Notice

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`http://www.agilent.com/find/assist`

If you do not have access to the Internet, contact your field engineer. In any correspondence or telephone conversation, refer to your instrument by its model number and full serial number.

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User's Guide

HP ESG-D Series Signal Generators

Serial Number Prefixes:

HP ESG-D1000A, US3704 through US3723
HP ESG-D2000A, US3704 through US3723
HP ESG-D3000A, US3704 through US3723
HP ESG-D4000A, US3704 through US3723

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1 Preparing for Use

This chapter contains procedures that show you how to install your signal generator, and how to perform a functional check to verify signal generator operation.

Installing the Signal Generator

This section contains procedures for properly installing your signal generator:

- checking the shipment
- installing front handles and rack flange kits
- meeting electrical and environmental requirements
- adjusting the display
- selecting the signal generator's HP-IB address
- selecting the programming language

Checking the Shipment

1. Inspect the shipping container for damage.

   Look for signs of damage such as a dented or torn shipping container or cushioning material that shows signs of unusual stress or compacting.

2. Carefully remove the contents from the shipping container and verify that your order is complete. Refer to Table 1-1 for a list of items that are shipped standard with the signal generator and for a list of options that you may also have ordered.

Table 1-1. Shipment Verification List

Part Number	Item Description	Option
Unique to Country	AC Power Cable	Standard
5063-9227	Front Handle Kit	1CN
5063-9214	Rack Flange Kit (without handles)	1CM
5063-9221	Rack Flange Kit (with handles)	1CP
E4400-90081	User's Guide (part of manual set E4400-90080)	Standard
E4400-90082	Programming Guide (part of manual set E4400-90080)	Standard
E4400-90083	Quick Reference Guide (part of manual set E4400-90080)	Standard
E4400-90084	Calibration Guide (part of manual set E4400-90080)	Standard
E4400-90080	Additional Manual Set	OB1
E4400-90014	Service Guide	0BW, 0BX
E4400-90015	Component Level Information Guide	0BV, 0BX
E4400-90030	User's Guide, Chinese for Taiwan	AB0
E4400-90029	User's Guide, Korean	AB1
E4400-90028	User's Guide, Chinese	AB2
E4400-90033	User's Guide, German	ABD
E4400-90032	User's Guide, Spanish	ABE
E4400-90031	User's Guide, Japanese	ABJ

Installing Front Handles and Rack Mount Flanges

You can attach handles to the front of the signal generator to facilitate transportation of the instrument. Handles are available in a kit which can be ordered when the signal generator is purchased (Option 1CN), or at any time afterward. Assembly instructions are included with the kit. The kit part number is listed in Table 1-2.

You can also rack mount the signal generator. Hardware is available in kits to install rack mount flanges on the signal generator without or with handles. These kits can be ordered when the signal generator is purchased (Options 1CM and 1CP), or at any time afterward. Assembly instructions are included with the kits. The kit part numbers are listed in Table 1-2.

Table 1-2. Front Handle and Rack Mount Flange Kits

Option	Description	HP Part Number
Option 1CN	Front Handle Kit	5063-9227
Option 1CM	Rack Mount Kit without Handles	5063-9214
Option 1CP	Rack Mount Kit with Handles	5063-9221

Providing Adequate Ventilation

CAUTION Ventilation Requirements: When installing the product in a cabinet, the convection into and out of the product must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the product by 4° C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, then forced convection must be used.

Cooling holes are located on the sides and bottom of the instrument cover and the rear panel of the instrument. Do not allow these holes to be obstructed as they allow air flow through the signal generator.

Meeting Electrical and Environmental Requirements

Line Settings

CAUTION: This product has an autoranging line voltage input. Be sure that the supply voltage is within the specified range.

The available AC power source must meet the following requirements:

Voltage:
- 100/115 volts nominal (90-132 volt range)
- 230/240 volts nominal (198-254 volt range)

Frequency:
- for 100/115 volts: 50/60/400 Hz nominal
- for 230/240 volts: 50/60 Hz nominal

Power:
- 200 watts maximum

Verify that the power cable is not damaged and that the power source socket outlet provides a protective earth contact.

WARNING **This is a Safety Class 1 Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.**

CAUTION Always use the three-prong AC power cord supplied with this product. Failure to ensure adequate earth grounding by not using this cord may cause product damage.

Environment

This product is designed for use in the following environmental conditions:

- indoor use
- < 15,000 feet (4,572 meters) altitude
- 0° to 55° C temperature, unless specified differently
- maximum relative humidity 80% for temperatures up to 31° C, decreasing linearly to 50% relative humidity at 40° C

CAUTION: This product is designed for use in INSTALLATION CATEGORY II and POLLUTION DEGREE 2, per IEC 1010 and 664 respectively.

WARNING **If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition only (in which all means for protection are intact).**

Cleaning the Signal Generator

Clean the instrument cabinet using a damp cloth only.

Adjusting the Display Contrast

You can adjust the contrast of the display by pressing the decrease contrast key [◑⇩] or the increase contrast key [◑⇧]. These keys are located on the front panel below the display.

Pressing the decrease contrast key and holding it down causes the display background to gradually darken in comparison to the text on the display. The minimum contrast setting is not a completely black display. Some contrast between the background and the text will still be visible.

Pressing the increase contrast key and holding it down causes the display background to gradually brighten in comparison to the text on the display. If the background does not appear to change, it is probably set to the maximum contrast.

Selecting Inverse Video

The normal display mode for the signal generator is dark text on a light background. To change to inverse video (light text on a dark background), press **Utility**, **Display** and set **Inverse Video Off On** to **On**. Inverse video is a persistent state; it is not affected by an instrument preset or by a power cycle.

Adjusting the Screen Saver

You can increase the life expectancy of the signal generator's display light by turning on the screen saver. Leaving the display lit for long periods of time or turning the display on and off frequently decreases the life of the bulb. With the screen saver on, the display light is turned off after a defined period of time with no input to the front panel. The display light turns on again when any front panel key is pressed or when a remote command is sent.

The screen saver is set to off at the factory. You can turn it on by pressing **Utility**, **Display**, **Screen Saver Off On**. Each time you press **Screen Saver Off On** the selection toggles between **Off** and **On**.

You can adjust the screen saver mode to turn the light on and off or to turn both the light and text on and off. Press **Utility**, **Display**, **Screen Saver Mode**. You can toggle between **Light Only** and **Light&Text**. Setting the mode to **Light Only** turns the display light off but leaves the text visible at a low intensity. To prevent the text from burning the display if you are leaving the display unchanged for long periods of time, set the mode to **Light&Text.** This mode turns off the display light and the text.

The screen saver delay is set to 1 hour at the factory. You can view and change the delay by pressing **Screen Saver Delay** in the same menu. The current screen saver delay is displayed in the softkey label and also in the active entry area. To change the delay, enter a new value using the numeric keypad and then press **Enter**, or rotate the front panel knob. The acceptable range of delay values is 1 through 12 hours in 1 hour increments.

The screen saver settings do not change when **Preset** is pressed, nor when power to the instrument is cycled.

Selecting the Signal Generator's HP-IB Address

The signal generator's HP-IB address is set to 19 at the factory. You can view and change the address by pressing **Utility**, **HP-IB/RS-232**, **HP-IB Address**. The current HP-IB address is displayed in the softkey label and also in the active entry area. To change the address, enter a new value using the numeric keypad and then press **Enter**, or rotate the front panel knob. The acceptable range of addresses is 0 through 30.

The HP-IB address is a persistent state; it is not affected by an instrument preset or by a power cycle.

Selecting the Signal Generator's Programming Language

The default programming language for the signal generator is Standard Commands for Programmable Instruments (SCPI). You can change this language selection by pressing **Utility**, **HP-IB/RS-232**, **Remote Language**. The Remote Language menu allows you to select between HP 8656/57-compatible language, HP 8657D language (NADC digital modulation capability), HP 8657D language (PDC digital modulation capability), HP 8657J (PHS digital modulation capability), HP 8648-compatible language, and SCPI language. Press the softkey for the selection that you desire.

You can also change the language selection by sending the appropriate command over HP-IB. Refer to the programming guide for instructions for changing the language over HP-IB.

You can set the signal generator to default to a selected language as a persistent state (remains unchanged after an instrument preset or power cycle). Press **Utility**, **Power On/Preset**, **Preset Language**. The Preset Language menu allow you to select between SCPI, the four HP 8656/57-compatible programming languages, and HP 8648-compatible language. Press the softkey for the selection that you desire.

Verifying Signal Generator Operation

The operator's check is appropriate as a daily functional check by users, or whenever the integrity of the signal generator is in question. Use the operator's check to verify proper operation of the signal generator. The operator's check does not ensure performance to specifications. To verify specifications, refer to the calibration guide.

Operator's Check

Perform the following tasks in order:

1. Power On the Signal Generator and Check for Error Messages

This procedure verifies that the signal generator powers up and that the internal instrument check identifies no errors.

1. Turn power on to the signal generator by pressing the power switch. The green LED will light. Let the instrument warm up for one hour.
2. Cycle the power to the signal generator. The green LED should again be lit and the instrument will perform a check.
3. When the display is lit, check to see if the **ERR** annunciator is turned on.
4. If the **ERR** annunciator is turned on, review the error messages in the queue by pressing **Utility**, **Error Info**. The first error message in the queue will be shown in the text area of the display. Refer to Chapter 3, "Troubleshooting", for information about the error message.

   If there is more than one error message (each message will be designated as 1 of *n*), press the **View Next Error Message** softkey until you have seen all of the messages.
5. When you have resolved all of the error messages, press **Clear Error Queue(s)** to delete the messages. Then restart this procedure at step two.

   Note: For instruments with Option 1E5, **`ERROR 514, Reference Oven Cold`** will occur whenever the signal generator is first connected to AC line power. The **`OVEN COLD`** annunciator and the **ERR** annunciator will both turn on. The **`OVEN COLD`** annunciator will automatically clear after approximately 5 minutes. The error queue *cannot* be cleared, however, until the **`OVEN COLD`** annunciator has turned off.

2. Verify Maximum Specified Power is Available at the Maximum Frequency

This procedure verifies that there are no unleveled power indications or error messages at the maximum specified frequency and power level.

1. Calibrate the power meter with the power sensor. (Refer to the power meter's manual for assistance.)
2. Connect the power sensor to the signal generator's RF OUTPUT connector as shown in Figure 1-1.

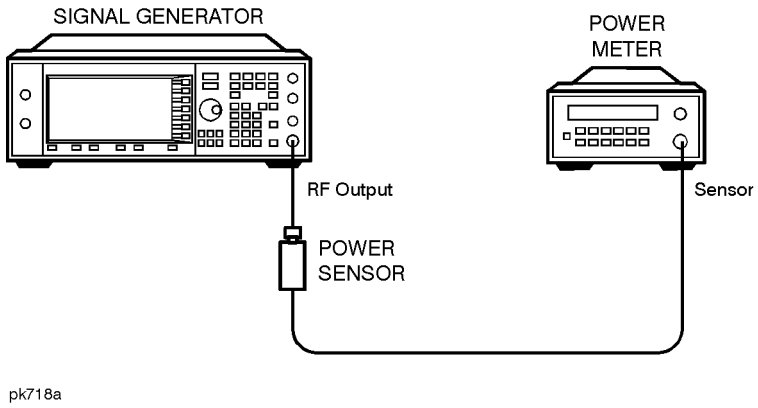


Figure 1-1. Operator's Check Equipment Setup

3. Preset the signal generator to the factory-defined conditions:
   a. Press **Utility**, **Power On/Preset** and toggle **Preset** until **Normal** is highlighted.
   b. Press the front panel **Preset** key.
4. Set the signal generator to its maximum specified frequency:
   a. Press **Frequency**.
   b. Use the numeric keypad to enter the signal generator's maximum specified frequency as shown in Table 1-3.
   c. Terminate your entry by pressing the **GHz** softkey.
5. Set the signal generator to its maximum specified power level:
   a. Press **Amplitude**.
   b. Use the numeric keypad to enter the signal generator's maximum specified power level as shown in Table 1-3.
   c. Terminate your entry by pressing the **dBm** softkey.

6. Toggle the front panel **RF On/Off** key to turn on RF power to the RF OUTPUT connector. The display **RF ON** annunciator will turn on.
7. Verify that the power meter reads the maximum specified output power including the power level accuracy limits.
8. Check to see if the **UNLEVEL** or **ERR** display annunciators have turned on. If these annunciators are on, refer to the service guide for troubleshooting information.

Table 1-3. Frequency and Power Level Limits

Instrument Model	Maximum Specified Frequency	Maximum Specified Power	Power Level Accuracy Limits[1]
HP ESG-D1000A	1 GHz	+13 dBm	±0.7 dB
HP ESG-D2000A	2 GHz	+10 dBm	±0.7 dB
HP ESG-D3000A	3 GHz	+10 dBm	±1.0 dB
HP ESG-D4000A	4 GHz	+7 dBm	±1.0 dB

1. The values provided are confidence levels only; they are not specifications.

2 Using Functions

This chapter contains procedures that show you how to use some of the major functions of your signal generator including setting frequency and power levels, setting up modulations, creating step and list sweeps, and saving and recalling instrument states.

Setting Frequency and Power Levels

Using these procedures, you will learn how to:

- set the RF frequency
- set a frequency reference and a frequency offset
- set the RF output power level
- set an amplitude reference and an amplitude offset

To Set the RF Frequency

1. Turn power on to the signal generator: press the power switch, , so that the green LED is on. The signal generator will perform an internal check.
2. Press the green **Preset** key. The signal generator will return to a set of factory-defined conditions.

NOTE: You can change the preset conditions to a user-defined instrument state. However, for the purpose of these examples, use the factory-defined preset state (the **Preset Normal User** softkey in the **Utility** menu must be set to **Normal**).

3. Observe the frequency area of the display (in the upper left-hand corner). It should display the maximum specified frequency of your signal generator.
4. The signal generator is set to output an RF signal, however the **RF On/Off** key must be set to **On** before the RF signal is available at the RF OUTPUT connector. Press **RF On/Off**. Notice that the display annunciator changes from **RF OFF** to **RF ON**. The maximum specified frequency is now being output at the RF OUTPUT connector.
5. Change the frequency to 700 MHz by pressing **Frequency**. The current RF frequency is now displayed in the active entry area of the display. Using the numeric keypad, enter **700** and then press the **MHz** terminator softkey. The new 700 MHz RF frequency is now displayed in the frequency area of the display and also in the active entry area.
6. Frequency is still the active function until you press another front panel function key. Change the frequency again by pressing the up arrow key once. Each press of the up arrow key increases the frequency by the value set for the **Incr Set** key. The increment value is displayed in the active entry area.

   The down arrow works like the up arrow. Practice stepping the frequency up and down in 1 MHz increments. Use the **Incr Set** key to change the increment value to 1 MHz, if necessary.

7. You can also adjust the RF frequency using the front panel knob. As long as frequency is the active function (the frequency is displayed in the active entry area), the front panel knob will increase and decrease the RF frequency. Use the front panel knob to adjust the frequency back to 700 MHz.

To Set a Frequency Reference and a Frequency Offset

The following procedure sets the RF output frequency as a reference frequency to which all other frequency parameters are relative. The frequency initially shown on the display will be 0 Hz (the frequency output by the hardware minus the reference frequency.) Although the display changes, the frequency output does not change. Any subsequent frequency changes are shown as incremental or decremental to 0 Hz.

1. Press **Preset** to return the signal generator to the factory-defined instrument state.
2. Set the RF frequency to 700 MHz.
3. Turn on frequency reference mode and set the current output frequency (700 MHz) as the reference value. Press **Freq**, **Freq Ref Set**. The frequency displayed is 0 Hz (the frequency output by the hardware, 700 MHz, minus the reference value, 700 MHz). Notice that the **REF** indicator is turned on and the **Freq Ref** softkey has toggled to **On**.
4. Set the **RF On/Off** key to **On**. Notice that the display annunciator has changed from **RF OFF** to **RF ON**. The RF frequency at the RF OUTPUT connector is 700 MHz.
5. Increment the output frequency by 1 MHz. Press the up arrow key. The frequency display changes to show 1 MHz (the frequency output by the hardware, 700 MHz + 1 MHz, minus the reference frequency, 700 MHz) and the output frequency changes to 701 MHz.
6. Enter a 1 MHz offset. Press the **Freq Offset** softkey and enter 1 MHz using the numeric keypad and pressing the **MHz** terminator softkey. The frequency display shows 2 MHz (the frequency output by the hardware, 701 MHz, minus the reference frequency, 700 MHz, plus the offset, 1 MHz.) Notice that the **OFFSET** indicator is turned on. The frequency at the RF OUTPUT connector is still 701 MHz.

To Set the RF Output Power Level

1. Press **Preset** to return the signal generator to the factory-defined instrument state.
2. Observe the amplitude area of the display (in the upper middle of the display). It should display –135 dBm. This is the normal preset RF output power level.
3. The signal generator is set to output an RF signal, however the **RF On/Off** key must be set to **On** before the RF signal is available at the RF OUTPUT connector. Press **RF On/Off**. Notice that the display annunciator changes from **RF OFF** to **RF ON**. The RF signal is now being output at a –135 dBm level at the RF OUTPUT connector.
4. Change the power level to –20 dBm. Press **Amplitude**. The current power level is now displayed in the active entry area of the display. Using the numeric keypad and the +/– key, enter **–20** and then press the **dBm** softkey. The new –20 dBm RF output power is now displayed in the amplitude area of the display and also in the active entry area.
5. Amplitude is still the active function until you press another front panel function key. You can also change the amplitude using the up and down arrow keys and the front panel knob. Practice changing the amplitude using these methods also.

To Set an Amplitude Reference and an Amplitude Offset

The following procedure sets the RF output power as an amplitude reference to which all other amplitude parameters are relative. The amplitude initially shown on the display will be 0 dB (the power output by the hardware minus the reference power). Although the display changes, the output power does not change. Any subsequent power changes are shown as incremental or decremental to 0 dB.

1. Press **Preset** to return the signal generator to the factory-defined instrument state.
2. Set the RF output power to –20 dBm.
3. Turn on amplitude reference mode and set the current output power (–20 dBm) as the reference value. Press **Ampl**, **More (1 of 2)**, **Ampl Ref Set**. The amplitude displayed is 0 dB (the power output by the hardware, –20 dBm, minus the reference value, –20 dBm.) Notice that the **REF** indicator is turned on and the **Ampl Ref** softkey has toggled to **On**.
4. Set the **RF On/Off** key to **On**. Notice that the display annunciator has changed from **RF OFF** to **RF ON**. The power at the RF OUTPUT connector is –20 dBm.
5. Use the up arrow key to increase the output power by 10 dB. The amplitude display changes to show 10 dB (the power output by the hardware, –20 dBm + 10 dBm, minus the reference power, –20 dBm) and the output power changes to –10 dBm.

6. Enter a 10 dB offset. Press the **Ampl Offset** softkey and enter 10 dB using the numeric keypad. The amplitude display shows 20 dB (the power output by the hardware, –10 dBm, minus the reference power, –20 dBm, plus the offset, 10 dB). Notice that the **OFFS** indicator is turned on. The power at the RF OUTPUT connector is still –10 dBm.

Setting Up Internally-Generated Amplitude Modulation

Using this procedure, you will learn how to generate an amplitude-modulated signal with the following characteristics:

- carrier frequency set to 1340 kHz
- power level set to 0 dBm
- AM depth set to 90%
- AM rate set to 10 kHz

Setting the Carrier Frequency

1. Press **Preset** to return the signal generator to the factory-defined instrument state.
2. Press the front panel **Frequency** key. Frequency becomes the active function and the normal preset value for frequency is displayed in the active entry area.
3. Enter 1340 kHz using the numeric keypad and pressing the **kHz** terminator softkey. The new carrier frequency is shown in the frequency area of the display. You should see **`1.340 000 00 MHz`**.

Setting the Power Level

1. Press the front panel **Amplitude** key. Amplitude becomes the active function and the normal preset value for amplitude is displayed in the active entry area.
2. Enter 0 dBm using the numeric keypad and pressing the **dBm** terminator softkey. The new power level is shown in the amplitude area of the display. You should see **`0.00 dBm`**.

Setting the AM Depth

1. Press the front panel **AM** key. The first level menu of softkeys is displayed.
2. Press the **AM Depth** softkey. AM depth becomes the active function and the normal preset value for AM depth is displayed in the active entry area.
3. Enter 90% using the numeric keypad and pressing the **%** terminator softkey. The new AM depth is displayed below the **AM Depth** softkey. You should see **90.0 %** in the second line of the softkey.

Setting the AM Rate

1. In the same AM menu, press the **AM Rate** softkey. AM rate becomes the active function and the normal preset value for AM rate is displayed in the active entry area.
2. Enter 10 kHz using the numeric keypad and pressing the **kHz** terminator softkey. The new AM rate is displayed below the **AM Rate** softkey. You should see **10.0000 kHz** in the second line of the softkey.

Turning On Amplitude Modulation

The signal generator is now configured to output a 0 dBm, amplitude-modulated carrier at 1340 kHz with the AM depth set to 90% and the AM rate set to 10 kHz. The shape of the waveform is a sinewave (notice that sine is the default for the **AM Waveform** softkey). Follow these remaining steps to output the amplitude-modulated signal.

1. In the same AM menu, press the **AM Off On** softkey. AM toggles from **Off** to **On**. Notice, also, that the **AM** display annunciator is turned on indicating that you have enabled amplitude modulation.
2. Press the front panel **RF On/Off** key to toggle RF on. Notice that the display annunciator changes from **RF OFF** to **RF ON**. The modulated signal is now available at the RF OUTPUT connector.

Setting Up Internally-Generated Frequency Modulation

Using this procedure you will configure the signal generator to output a frequency-modulated signal with the following characteristics:

- carrier frequency set to 104.9 MHz
- power level set to 0 dBm
- FM deviation set to 75 kHz
- FM rate set to 10 kHz

Setting the Carrier Frequency

1. Preset the signal generator to normal preset conditions.
2. Press the front panel **Frequency** key. Frequency becomes the active function and the normal preset value for frequency is displayed in the active entry area.
3. Enter 104.9 MHz using the numeric keypad and pressing the **MHz** terminator softkey. The new carrier frequency is shown in the frequency area of the display. You should see **`104.900 000 00 MHz`**.

Setting the Power Level

1. Press the front panel **Amplitude** key. Amplitude becomes the active function and the normal preset value for amplitude is displayed in the active entry area.
2. Enter 0 dBm using the numeric keypad and pressing the **dBm** terminator softkey. The new power level is shown in the amplitude area of the display. You should see **`0.00 dBm`**.

Setting the FM Deviation

1. Press the front panel **FM/ΦM** key. The first level menu of FM softkeys is displayed.
2. Press the **FM Dev** softkey. FM deviation becomes the active function and the normal preset value for FM deviation is displayed in the active entry area.
3. Enter 75 kHz using the numeric keypad and pressing the **kHz** terminator softkey. The new FM deviation is displayed below the **FM Dev** softkey. You should see **75.0000 kHz** in the second line of the softkey.

Setting the FM Rate

1. In the same FM menu, press the **FM Rate** softkey. FM rate becomes the active function and the normal preset value for FM rate is displayed in the active entry area.
2. Enter 10 kHz using the numeric keypad and pressing the **kHz** terminator softkey. The new FM rate is displayed below the **FM Rate** softkey. You should see **10.0000 kHz** in the second line of the softkey.

Turning On Frequency Modulation

The signal generator is now configured to output a 0 dBm, frequency-modulated carrier at 104.9 MHz with the FM deviation set to 75 kHz and the FM rate set to 10 kHz. The shape of the waveform is a sinewave (notice that sine is the default for the **FM Waveform** softkey - press **More (1 of 2)** to see the softkey). Follow these remaining steps to output the frequency-modulated signal.

1. In the same FM menu, press the **FM Off On** softkey. FM toggles from **Off** to **On**. Notice, also, that the **FM** display annunciator is turned on indicating that you have enabled frequency modulation.
2. Press the front panel **RF On/Off** key to toggle RF on. Notice that the display annunciator changes from **RF OFF** to **RF ON**. The modulated signal is now available at the RF OUTPUT connector.

Setting Up Internally-Generated Digital Modulation in a PHS Format (Options UN3 and UN4 Only)

Using this procedure you will configure the signal generator to output a π/4DQPSK digitally-modulated signal in a PHS format with the following characteristics:

- carrier frequency set to 1.89515 GHz
- power level set to 0 dBm
- control channel set to uplink
- Timeslot 1 turned on and configured as a custom timeslot
- a fixed 4-bit repeating sequence selected as the data pattern for timeslot 1
- Timeslot 3 turned on and configured as a traffic channel
- PN15 selected as the data pattern for timeslot 3

Setting the Carrier Frequency

1. Press **Preset** to return the signal generator to the factory-defined instrument state.
2. Press the front panel **Frequency** key. Frequency becomes the active function and the normal preset value for frequency is displayed in the active entry area.
3. Enter 1.89515 GHz using the numeric keypad and pressing the **GHz** terminator softkey. The new carrier frequency is shown in the frequency area of the display. You should see **`1.895 150 000 00 GHz`**.

Setting the Power Level

1. Press the front panel **Amplitude** key. Amplitude becomes the active function and the normal preset value for amplitude is displayed in the active entry area.
2. Enter 0 dBm using the numeric keypad and pressing the **dBm** terminator softkey. The new power level is shown in the amplitude area of the display. You should see **`0.00 dBm`**.

Setting the PHS Control Channel to Uplink

1. Press the front panel **Mode** key and then press the **PHS** softkey to select the PHS communications standard.
2. Toggle the **Data Format Pattern Framed** softkey to **Framed**. When you select **Framed** for bursting the frame envelope, you will be transmitting framed data. This means that you will be bursting the timeslots that you have turned on and there will be no RF carrier during the off timeslots. Notice that **Configure Timeslot** has become an active softkey.
3. Press **Configure Timeslot** and another menu of softkeys is displayed. Press the **Control Channel Dnlink Uplink** softkey to toggle from **Dnlink** to **Uplink**. Notice that the display shows the uplink timeslots as active.

Setting Up Timeslot 1

1. Observe the display and notice that the normal preset condition for timeslot #1 has the timeslot turned on and configured as a traffic channel (TCH). Next, look at the softkeys. The **Timeslot #** softkey shows that timeslot #1 is selected as the active timeslot. The **Timeslot Off On** softkey shows that timeslot #1 is turned on. Finally, the **Timeslot Type** softkey shows that timeslot #1 is configured as a traffic channel.
2. Change the timeslot type to custom by pressing the **Timeslot Type** softkey. Another menus of softkeys is displayed. Press the **Custom** softkey. You are automatically returned to the previous menu of softkeys. Notice that the **Timeslot Type** softkey has changed from **TCH** to **Custom**. Also notice that the display shows timeslot #1 configured as a custom timeslot.
3. Configure the data pattern for the timeslot by pressing **Configure Custom**. Another menu of softkeys is displayed showing you choices for internal data generation or externally-supplied data patterns either via the DATA connector or by downloading a binary file. Notice that the display has changed showing you a visual representation of the timeslot.

   Press **FIX4** to select a fixed 4-bit repeating sequence. The 4-bit data pattern becomes the active function and the normal preset value for FIX4 is displayed in the active entry area. Enter any binary sequence, such as 1010, using the numeric keypad and pressing the **Enter** terminator softkey. The new data pattern is displayed in the Data field near the bottom of the text area of the display. You should see **`Data: 1010`**. The data pattern is also displayed below the **FIX4** softkey.

Setting Up Timeslot 3

1. Press the front panel **Return** key to move to the preceding menu.
2. Select timeslot #3 as the active timeslot by pressing the **Timeslot #** softkey. Timeslot # becomes the active function and the current active timeslot (#1) is displayed in the active entry area. Press the up arrow key twice to increment the timeslot # to 3.
3. Turn on timeslot #3 by pressing toggling the **Timeslot Off On** softkey from **Off** to **On**.
4. Change the timeslot type to traffic channel by pressing the **Timeslot Type** softkey. Another menu of softkeys is displayed. Press the **TCH** softkey. You are automatically returned to the previous menu of softkeys. Notice that the **Timeslot Type** softkey has changed from **Custom** to **TCH**. Also notice that the display now shows timeslot #3 configured as a traffic channel.
5. Configure the data pattern for the timeslot by pressing **Configure TCH**. Another menu of softkeys is displayed that allow you to change the hexadecimal values for the unique word (UW) and the slow associated control channel (SA). For this example, we will not change the defaults.

   Press the **Data** softkey. Another menu is displayed showing you choices for internal data generation or externally-supplied data patterns either via the DATA connector or by downloading a binary file. Notice that the display has changed showing you a visual representation of the timeslot.

   Press **PN15** to select a pseudorandom bit pattern. The new data pattern is displayed in the **TCH** field near the bottom of the text area of the display. You should see **TCH: PN15**. The data pattern is also displayed below the **Data** softkey.

Turning On the PHS Format and the Modulation

The signal generator is now configured to burst two uplink timeslots with a 0 dBm, π/4DQPSK digitally-modulated carrier at 1.89515 GHz. Follow these remaining steps to output the framed data.

1. Press **Return** twice to move up two levels of softkey menus until the first PHS menu is displayed. (The first softkey in this menu is **PHS Off On**.) Press the **PHS Off On** softkey. The PHS format toggles from **Off** to **On**. At this time the internal baseband generator will generate the internal data patterns that you have configured for timeslots 1 and 3. A message is displayed while this process is taking place. Notice, also, that the following display annunciators are turned on: **PHS** indicates that you have enabled the PHS standard, **I/Q** indicates that I/Q modulation is being generated, and **ENVLP** indicates that burst is turned on for transmitting framed data.
2. Press the front panel **RF On/Off** key to toggle RF on. Notice that the display annunciator changes from **RF OFF** to **RF ON**. The modulated signal is now available at the RF OUTPUT connector.

Creating a Step Sweep and a List Sweep

Using this procedure, you will learn two ways to set up the signal generator to sweep a defined set of points. You will create a step sweep and then you will use these points as the basis for a new list sweep.

In the first procedure, you will create a step sweep with the following ten equally spaced points:

- frequency range from 525 MHz to 600 MHz
- power level from –20 dBm to 0 dBm
- dwell time 500 ms at each point

In the second procedure, you will take the step sweep points and edit several points to change the sweep information.

Configuring a Step Sweep

1. Press **Preset** to return the signal generator to the factory-defined instrument state.
2. Press the front panel **Sweep/List** key. The first level of sweep softkeys is displayed. Toggle the **Sweep Type List Step** softkey to **Step**.
3. Press the **Configure Step Sweep** softkey. Another menu is displayed with softkeys that you will use to create the sweep points.
4. Change the start frequency of the step sweep. Press the **Freq Start** softkey. Enter 525 MHz using the numeric keypad and pressing the **MHz** terminator softkey.
5. Change the stop frequency of the step sweep. Press the **Freq Stop** softkey. Enter 600 MHz using the numeric keypad and pressing the **MHz** terminator softkey.
6. Set the power level for the start of the step sweep. Press the **Ampl Start** softkey. Enter **-**20 dBm using the numeric keypad and pressing the **dBm** terminator softkey.
7. Set the power level for the end of the step sweep. Press the **Ampl Stop** softkey. Enter 0 dBm using the numeric keypad and pressing the **dBm** terminator softkey.
8. Set the number of sweep points. Press the **# Points** softkey. Enter 10 by rotating the front panel knob until the number 10 is displayed.
9. Set the dwell time at each point. Press the **Step Dwell** softkey. Enter 500 ms using the numeric keypad and pressing the **msec** terminator softkey.

Turning On Continuous Step Sweep

1. Press **Return** to move up one menu level.
2. Press the **Sweep** softkey. Another menu is displayed showing you choices for sweeping either the frequency, amplitude, or frequency and amplitude data. Press the **Freq&Ampl** softkey. Selecting this softkey returns you to the previous menu and turns the sweep function on.
3. Press the **Sweep Repeat Single Cont** softkey to toggle from **Single** to **Cont**. Notice that the **SWEEP** display annunciator is turned on indicating that the signal generator is sweeping.
4. Press the front panel **RF On/Off** key to toggle RF on. Notice that the display annunciator changes from **RF OFF** to **RF ON**. The swept RF signal is now available at the RF OUTPUT connector.

Configuring a List Sweep Using Step Sweep Data

1. Press the **Sweep Type List Step** softkey to toggle from **Step** to **List**.
2. Press the **Configure List Sweep** softkey. Another menu is displayed with softkeys that you will use to create the sweep points. Notice that the display shows the current list data (when no list has been previously created, the default is one point, set to the signal generator's maximum frequency, –135 dBm, with a dwell time of 2 ms).
3. Press **More (1 of 2)**, **Load List From Step Sweep**, **Confirm Load From Step Sweep**. The points you defined in the step sweep are automatically loaded into the list.

Editing List Sweep Points

1. Change the dwell time for point 1 to 100 ms. Press the right arrow key twice until the dwell time is highlighted. Press **More (2 of 2)**, **Edit Item**. The dwell time for point 1 becomes the active function. Enter 100 ms using the numeric keypad and pressing the **msec** terminator softkey. Notice that the next item in the table (in this case the frequency value for point 2) becomes highlighted after pressing the terminator softkey.
2. Change the frequency for point 4 to 560 MHz. Press the down arrow key two times until the frequency is highlighted. Press the **Edit Item** softkey. The frequency for point 4 becomes the active function. Enter 560 MHz using the numeric keypad and pressing the **MHz** terminator softkey.
3. Add a new point between points 7 and 8. Press the down arrow until any column in the point 8 row is highlighted. Press the **Insert Row** softkey. A copy of point 8 has been placed between points 7 and 8, creating a new point 8, and renumbering the successive points.

4. Create a new point between points 10 and 11. Use the arrow keys to highlight the frequency for point 11. Press the **Insert Item** softkey. Notice that a new frequency item is placed at point 11 and the frequency item previously occupying that position has shifted down to point 12. The power and dwell time items do not shift down. Press the **Edit Item** softkey. Enter 700 MHz using the numeric keypad and pressing the **MHz** terminator softkey.

NOTE: An informational **ERR** annunciator is turned on at this time indicating that the frequency and power lists are of unequal size. You will correct that problem in the following steps. The annunciator will not turn off until you clear the error queue in the **Utility** menu.

The power for point 11 should now be highlighted. Press the **Insert Item** softkey, then press the **Edit Item** softkey and enter 1 dBm using the numeric keypad and pressing the **dBm** terminator softkey. A new power item is placed at point 11 and the power item previously occupying that position has shifted down to point 12.

The dwell time for point 11 should now be highlighted. Press the **Insert Item** softkey. The dwell time from the previous point 11 has been copied into the new point 11. A new dwell time item is placed at point 11 and the dwell time item previously occupying that position has shifted down to point 12.

Turning On List Sweep for a Single Sweep

1. Press **Return** to move up one menu level.
2. Notice that the **Sweep** softkey is still set to sweep both frequency and amplitude data. You do not need to change it.
3. Press the **Sweep Repeat Single Cont** softkey to toggle from **Cont** to **Single**. Notice that the **SWEEP** display annunciator is turned off. The sweep will not occur until it is triggered.
4. Press **Single Sweep**. The signal generator will sweep the points in your list once. Notice that the **SWEEP** display annunciator is turned on during the sweep.
5. Change the sweep trigger to occur when you press the front panel **Trigger** key. Press **More (1 of 2)**, **Sweep Trigger**. Another menu is displayed showing you choices for triggering a sweep. Press the **Trigger Key** softkey.
6. Press **More (2 of 2)**, **Single Sweep** to arm the sweep. Notice that the **ARMED** display annunciator has turned on.
7. Press the front panel **Trigger** key. The signal generator will sweep the points in your list once and the **SWEEP** display annunciator is turned on during the sweep.

Saving and Recalling an Instrument State

Using this procedure, you will learn how to save instrument settings to a memory register and to recall the settings.

1. Press **Preset** to return the signal generator to the factory-defined instrument state.
2. Set up the signal generator with the following changes:
   a. Set the frequency to 800 MHz.
   b. Set the amplitude to 0 dBm.
   c. Enable amplitude modulation (**AM** display annunciator is on).
3. Save this instrument state in the signal generator memory in sequence 1, memory register 01. Press the front panel **Save** key and then press the **Select Seq** softkey. The sequence number becomes the active function. The signal generator will display the last sequence that you have used. Set the sequence to 1 using the arrow keys.

   Press the **Select Reg** softkey. The register number in sequence 1 becomes the active function. The signal generator will either display the last register used [accompanied by the text: **(in use)**] or, if no registers are in use, will display register 00 [accompanied by the text: **(available)**]. Use the arrow keys to select register 01.
4. Press the **Save Seq[1] Reg[01]** softkey. The current instrument settings including the frequency, amplitude, and modulation changes you made have been stored in signal generator memory.
5. Press **Preset** to return the signal generator to the factory-defined instrument state.
6. Recall your instrument state. Press the front panel **Recall** key. Notice that the **Select Seq** softkey shows sequence 1. (This is the last sequence that you have used.) You do not need to change the sequence. Press **RECALL Reg**. The register to be recalled in sequence 1 becomes the active function. Press the up arrow key once to select register 1. Notice that your stored instrument settings have been immediately recalled.

3 Troubleshooting

This chapter contains instructions for troubleshooting problems you may encounter during operation of the signal generator, it explains error messages you might see, and it explains how to return your signal generator to HP for service.

If You Encounter a Problem

If the signal generator is not operating as you expected, look for help in the following list of symptoms and possible solutions. If you do not find a solution here, refer to the service guide.

• No RF Output?

The front panel **RF On/Off** key must be set to **On** before the RF signal is available at the RF OUTPUT connector. Check the annunciator on the display. If it reads **RF OFF**, press the **RF On/Off** key once to toggle the RF output on.

• RF Output Power too Low?

If the RF output power seems too low, look for an **OFFSET** or **REF** indicator in the amplitude area of the display.

OFFSET tells you that an amplitude offset has been set. An amplitude offset changes the value shown in the amplitude area of the display but does not affect the output power. The amplitude displayed is equal to the current power output by the signal generator hardware plus the value for the offset. To eliminate the offset, press **Ampl**, **Ampl Offset**. Enter **0** using the numeric keypad and press the **dB** terminator softkey.

REF tells you that the amplitude reference mode is turned on. When this mode is on, the displayed amplitude value is *not* the output power level; rather, it is the current power output by the signal generator hardware minus the reference value set by the **Ampl Ref Set** softkey. To exit the reference mode, press **Ampl** and toggle the **Ampl Ref** softkey to **Off**. You can then reset the output power to the desired level.

• No Modulation at the RF Output?

Although you can set up and enable various modulations, the RF carrier is modulated by the enabled modulation only when you have also set **Mod On/Off** to **On**. Check the annunciator on the display. If it reads **MOD OFF**, press the **Mod On/Off** key once to toggle the modulation on.

• Can’t Turn Off Sweep Mode?

In the sweep mode menu you can choose to set the sweep to various sweep types or to turn sweep off. Press **Sweep/List**, **Sweep** and choose **Off** from the sweep mode selections.

• Recalled a Register and Sweep List is Missing?

Sweep information is not stored as part of the instrument state in a storage register. Only the current step and list sweep is available to the signal generator and it cannot be stored nor will it survive a factory preset.

• All of the Registers Where You Previously Stored Instrument States are Empty?

The save/recall registers are backed-up by a battery when AC power to the signal generator is not connected. The battery may need to be replaced. To verify that the battery has failed, turn power off line power to the signal generator and unplug it. Then plug in the instrument and cycle power on. If either error message –311 or –700 is stored in the error message queue, your battery has failed. Refer to the service guide for battery replacement instructions.

• Saved an Instrument State in a Register but the Register is Empty or Contains the Wrong State?

If you have intentionally, or unintentionally, selected a register number that is greater than 99, the signal generator will automatically select register 99 to save your instrument state. If the register number you intended to use is empty or contains the wrong instrument state, recall register 99 as the instrument state may be saved there.

• The Power Supply has Shut Down

If the power supply is not working, it requires repair or replacement. There is no user-replaceable power supply fuse. Refer to the service guide for instructions.

• Incorrect List Sweep Dwell Time?

If the signal generator does not dwell for the correct period of time at each sweep list point, first check the sweep list dwell values for accuracy. Press **Sweep/List**, **Configure List Sweep** and the sweep list values will be displayed. Edit the dwell values if they are incorrect.

If the list dwell values are correct, check to see if the **Dwell Type List Step** softkey is set to **Step**. When **Step** is selected, the signal generator will sweep the list points using the dwell time set for step sweep rather than the sweep list dwell values. To view the step sweep dwell time, press **Configure Step Sweep** and observe the value set for the **Step Dwell** softkey.

• Can’t Turn Off Help Mode?

There are two help modes (single and continuous) available on the signal generator. In single mode (the factory preset condition) when you press the **Help** key, help text is provided for your next key press. Now press any key and you will exit the help function and the function of the key you pressed is also executed. When you are in continuous help mode, when you press the **Help** key, help text is provided for your next key press and that key’s function is also executed (except for the **Preset** key). You will stay in this help mode until you press the **Help** key again. To change from continuous to single mode, press **Utility**, **Instrument Info/Help Mode** and toggle the **Help Mode Single Cont** softkey to **Single**.

• LF OUTPUT Signal is a Sinewave but the RF OUTPUT Signal is a Pulse Squarewave?

The LF OUTPUT connector will output a signal where the frequency and shape is set by the internal source as it is being used by a modulation. However, if you are generating a pulse squarewave, the LF OUTPUT signal is correctly output as a sinewave. That sinewave is later squared by the modulator to generate the pulse modulation.

Error Messages

If an error condition occurs in the signal generator, it will always be reported to both the front panel display error queue and the SCPI (remote interface) error queue. These two queues are viewed and managed separately.

The Front Panel Error Queue

This queue is designed in a circular (rotating) fashion. It can hold up to 30 error messages. If the queue is full, and additional error messages arrive, the oldest errors are lost. The previously read messages are not cleared from the queue; they remain in the queue until they are overwritten by a new error message.

The front panel error queue information can be accessed by pressing **Utility**, **Error Info**. From the Error Info menu, you may choose from **View Previous Error Message**, **View Next Error Message**, or **Clear Error Queue(s)**. You can also use the RPG and the arrow keys to review the messages/

If there are any unviewed messages in the front panel error queue, the **ERR** annunciator will be activated on the signal generator's display. you can optionally rotate the RPG or use the arrow keys to view the error messages. To empty the queue, press **Utility**, **Error Info, Clear Error Queue(s).**

There are some special error types called permanent errors. These include **`unlock`**, **`ovencold`**, **`hi/lo`**, etc. Permanent errors remain in the error queues until the error condition is cleared. Pressing **Utility**, **Error Info, Clear Error Queue(s)** will empty the front panel error queue, but the permanent errors will be re-reported if the error condition(s) still exist.

The SCPI Remote Interface Error Queue

This queue is constructed in a linear first-in/first-out fashion. It can hold up to 30 error messages. As errors and events are detected, they are placed in the queue. Unlike the front panel error queue, errors in this queue are not overwritten by the latest incoming error messages. If the queue overflows, the last error in the queue is replaced with the error:

-350,Queue overflow

When the queue overflows, the least recent errors remain in the queue, and the most recent error is discarded. Reading an error from the head of the queue removes that error from the queue, and opens a position in the tail of the queue for a new error, if one is subsequently detected.

When all the errors have been read from the queue, further error queries will return:

0,No error

The SCPI query **SYSTem:ERRor?** is used to view messages in the SCPI error queue. The error queue will be cleared when any of the following occur (IEEE 488.2, section 11.4.3.4):

- Upon power up
- Upon receipt of a ***CLS** command
- Upon reading the last item from the queue

In the SCPI error queue, the permanent errors are re-reported after the message **0, No error** is read using the **SYSTem:ERRor?** query and after the ***CLS** command is executed.

Querying the Error Queue

The queue query message is a request for the next entry from the instrument's error queue. This queue contains an integer that can range from -32768 to 32767. Negative error numbers are reserved by the SCPI standard and are defined in this section. Positive error numbers are instrument-dependent. An error value of zero indicates that no error or event has occurred.

The signal generator responds to the **SYSTem:ERRor?** (or **STATus:QUEue?**) query using the following form:

<error number>, <error description>

The <error number> is a unique error descriptor. Certain standard error numbers are described in this section. The <error description> is a short description of the error, (optionally) followed by additional information regarding the error. Short descriptions of the standard error numbers are described in this section. The information that follows the error message may contain corrective actions that should be followed to correct the error condition.

The <device-dependent info> section of the response may contain information which will allow you to determine the exact error and context. For example:

```
-131, Invalid suffix;FREQuency:CENT 2.0E+5 dBmV
```

The maximum string length of <error description> plus <device-dependent info> is 255 characters. The <error description> will be sent exactly as indicated in this document, including case.

If there has been no error, that is, if the queue is empty, the signal generator will respond with:

```
0, No error
```

If there has been more than one error, the instrument will respond with the first one in its queue. Subsequent responses to **SYSTem:ERRor?** will continue with the queue until it is empty.

Error Numbers

The system-defined error numbers are chosen on an enumerated (“1 of N”) basis. The SCPI-defined error numbers and the <error_description> portions of the error query response are listed here. The first error described in each class (for example, -100, -200, -300, -400) is a “generic” error. In selecting the proper error number to report, more specific error codes are preferred.

No Error

This message indicates that the error queue contains no errors.

Error Number	Error Description [description/explanation/examples]
0	`No error` The queue is empty. Every error in the queue has been read or the queue was purposely cleared by power-on or **`*CLS`**.

SCPI Standard Error Messages

Error Message Description

The list of error messages in this chapter describes all of the SCPI error messages associated with signal generator operation. A sample error message description is provided below to help you understand how information will be presented in this section.

-222 **`Data out of range;value clipped to lower limit.`**

Indicates that the user has entered a deviation, depth or internal source frequency that is beyond the specified limits.

The following list explains each element of the sample error message listing shown above.

- SCPI Error Number - The standard SCPI error number (-222 in this example). Standard SCPI error numbers are always negative, with the exception of **`0, No error`**.
- SCPI Error Message - The SCPI error message is **`Data out of range;`** in this example.
- Detailed Description - The information that appears after the semicolon (**`;`**) provides more detail as to the exact nature of the error. In this example, **`value clipped to lower limit`** tells you that you have entered a value outside the allowable range and the signal generator has changed the value so that it falls within the allowable limits. If no detailed description exists, it will be omitted from the error message.
- Explanation/Action Required - The text that appears below each error message listing contains an explanation of the error message and, in some cases, corrective actions that should be followed in order to correct the error condition. Though this information is not shown on the signal generator's display, it can be found in the following section.

Command Error

An error number in the range [-199 to -100] indicates that an IEEE 488.2 syntax error has been detected by the instrument's parser. The occurrence of any error in this class will cause the command error bit (bit 5) in the event status register (IEEE 488.2, section 11.5.1) to be set. If this bit is set, one of the following events has occurred:

- An IEEE 488.2 syntax error has been detected by the parser. That is, a control-to-device message was received which is in violation of the IEEE 488.2 standard. Possible violations include a data element which violates device listening formats or whose type is unacceptable to the device.
- An unrecognized header was received. Unrecognized headers include incorrect device-specific headers and incorrect or unimplemented IEEE 488.2 common commands.

Events that generate command errors will not generate execution errors, device-specific errors, or query errors; see the error definitions in this chapter.

Command Error Message Descriptions

This section lists the signal generator's command error messages and their associated descriptions.

Error Number	Error Description [description/explanation/examples]
-100	**`Command error`** This is a generic syntax error for devices that cannot detect more specific errors. The code indicates only that a command error as defined in IEE 488.2, 11.5.1.1.4 has occurred.
-101	**`Invalid character`** A syntactic command contains a character which is invalid for that type. For example, a header containing an ampersand, SETUP&. This error might be used in place of error numbers -114, -121, -141 and some others.
-102	**`Syntax error`** An unrecognized command or data type was encountered. For example, a string was received when the device does not accept strings.

-103 **`Invalid separator`**

The parser was expecting a separator and encountered an illegal character. For example, the semicolon was omitted after a program message unit.

-104 **`Data type error`**

The parser recognized a data element that is not allowed. For example, numeric or string data was expected, but block data was encountered.

-105 **`GET not allowed`**

A Group Execute Trigger was received within a program message (see IEEE 488.2, 7.7). Correct the HP-IB controller program so that the **`GET`** does not occur within a line of HP-IB program code.

-108 **`Parameter not allowed`**

More parameters were received than expected for the header. For example, the **`*ESE`** common command only accepts one parameter, so receiving **`*ESE 0,1`** is not allowed.

-109 **`Missing parameter`**

Fewer parameters were received than required for the header. For example, the **`*ESE`** common command requires one parameter, so receiving **`*ESE`** is not allowed.

-110 **`Command header error`**

An error was detected in the header. This message is used when the device cannot detect the more specific errors described for errors -111 through -119.

-111 **`Header separator error`**

A character which is not a legal header separator was encountered while parsing the header.

-112 **`Program mnemonic too long`**

The header contains more than twelve characters (see IEEE 488.2, 7.6.1.4.1).

-113 **`Undefined header`**

The header is syntactically correct, but it is undefined for this specific device. For example, **`*XYZ`** is not defined for any device.

-114 **`Header suffix out of range`**

The value of a header suffix attached to a program mnemonic makes the header invalid.

-120 **`Numeric data error`**

This error, as well as errors -121 through -129, are generated when parsing a data element which appears to be numeric, including non-decimal numeric types. This particular error message is used if the device cannot detect a more specific error.

-121 **`Invalid character in number`**

An invalid character for the data type being parsed was encountered. For example, an alpha in a decimal numeric or a “9” in octal data.

-123 **`Exponent too large`**

The magnitude of an exponent was greater than 32000 (see IEEE 488.2, 7.7.2.4.1).

-124 **`Too many digits`**

The mantissa of a decimal-numeric data element contained more than 255 digits excluding leading zeros (see IEEE 488.2, 7.7.2.4.1).

-128 **`Numeric data not allowed`**

A legal numeric data element was received, but the device does not accept one in this position for the header.

-130 **`Suffix error`**

This error, as well as errors -131 through -139, are generated when parsing a suffix. This particular error message is used if the device cannot detect a more specific error.

-131 **`Invalid suffix`**

The suffix does not follow the syntax described in IEEE 488.2, 7.7.3.2, or the suffix is inappropriate for this device.

-134 **`Suffix too long`**

The suffix contained more than twelve characters (see IEEE 488.2, 7.7.3.4).

-138 **`Suffix not allowed`**

A suffix was encountered after a numeric element which does not allow suffixes.

-140 **`Character data error`**

This error, as well as errors -141 through -149, are generated when parsing a character data element. This particular error message is used if the device cannot detect a more specific error.

-141 **`Invalid character data`**

Either the character data element contains an invalid character or the particular element received is not valid for the header.

-144 **`Character data too long`**

The character data element contains more that twelve characters (see IEEE 488.2, 7.7.1.4).

-148 **`Character data not allowed`**

A legal character data element was encountered where prohibited by the device.

-150 **`String data error`**

This error, as well as errors -151 through -159, are generated when parsing a string data element. This particular error message is used if the device cannot detect a more specific error.

-151 **`Invalid string data`**

A string data element was expected, but was invalid (see IEEE 488.2, 7.7.5.2). For example, an **`END`** message was received before the terminal quote character.

-158 **`String data not allowed`**

A string data element was encountered, but not allowed by the device at this point in the parsing.

-160 **`Block data error`**

This error, as well as errors -161 through -169, are generated when parsing a block data element. This particular error message is used if the device cannot detect a more specific error.

-161 **`Invalid block data`**

A block data element was expected, but was invalid (see IEEE 488.2, 7.7.6.2). For example, an **`END`** message was received before the end length was satisfied.

-168 **`Block data not allowed`**

A legal block data element was encountered, but not allowed by the device at this point in the parsing.

-170 **`Expression data error`**

This error, as well as errors -171 through -179, are generated when parsing an expression data element. This particular error message is used if the device cannot detect a more specific error.

-171 **`Invalid expression`**

The expression data element was invalid (see IEEE 488.2, 7.7.7.2). For example, unmatched parentheses or an illegal character.

-178 **`Expression data not allowed`**

A legal expression data was encountered, but was not allowed by the device at this point in parsing.

-180 **`Macro error`**

This error, as well as errors -181 through -189, are generated when defining a macro or executing a macro. This particular error message is used if the device cannot detect a more specific error.

-181 **`Invalid outside macro definition`**

Indicates that a macro parameter placeholder (**`$<number`**) was encountered outside of a macro definition.

-183 **`Invalid inside macro definition`**

Indicates that the program message unit sequence, sent with a **`*DDT`** or a **`*DMC`** command, is syntactically invalid (see IEEE 488.2, 10.7.6.3).

-184 **`Macro parameter error`**

Indicates that a command inside the macro definition had the wrong number or type of parameters.

Execution Error

An error number in the range [-299 to -200] indicates that an error has been detected by the instrument's execution control block. The occurrence of any error in this class will cause the execution error bit (bit 4) in the event status register (IEEE 488.2, section 11.5.1) to be set. If this bit is set, one of the following events has occurred:

- A <PROGRAM DATA> element following a header was evaluated by the device as outside of its legal input range or is otherwise inconsistent with the device's capabilities.
- A valid program message could not be properly executed due to some device condition.

Execution errors will be reported by the device after rounding and expression evaluation operations have been completed. Rounding a numeric data element, for example, will not be reported as an execution error. Events that generate execution errors will not generate command errors, device-specific errors, or query errors; see the error definitions in this chapter.

Execution Error Message Descriptions

This section lists the signal generator's execution error messages and their associated descriptions.

Error Number	Error Description [description/explanation/examples]
-200	**`Execution Error`** This is a generic syntax error for devices that cannot detect more specific errors. The code indicates only that an execution error as defined in IEEE 488.2, 11.5.1.1.5 has occurred.
-201	**`Invalid while in local`** Indicates that a command is not executable while the device is in local mode due to a hard local control (see IEEE 488.2, 5.6.1.5). For example, a device with a rotary switch receives a message which would change the switch's state, but the device is in local so the message cannot be executed.

-202 **`Settings lost due to rtl`**

Indicates that a setting associated with a hard local control (see IEEE 488.2, 5.6.15) was lost when the device changed to LOCS from REMS or to LWLS from RWLS.

-210 **`Trigger error`**

Indicates that a **`GET, *TRG,`** or a triggering signal could not be executed due to an error.

-211 **`Trigger ignored`**

Indicates that a **`GET`**, **`*TRG`**, or triggering signal was received and recognized by the device, but was ignored because of device timing considerations. For example, the device was not ready to respond.

-212 **`Arm ignored`**

Indicates that an arming signal was received and recognized by the device but was ignored.

-213 **`Init ignored`**

Indicates that a request for a measurement initiation was ignored as another measurement was already in progress.

-214 **`Trigger deadlock`**

Indicates that a trigger source for the initiation of a measurement is set to **`GET`** and a subsequent measurement query is received. The measurement cannot begin until a **`GET`** is received, but the **`GET`** would cause an INTERRUPTED error.

-215 **`Arm deadlock`**

Indicates that the arm source for the initiation of a measurement is set to **`GET`** and a subsequent measurement query is received. The measurement cannot begin until a **`GET`** is received, but the **`GET`** would cause an INTERRUPTED error.

-220 **`Parameter error`**

Indicates that a program data element related error has occurred. This particular error message is used if the device cannot detect a more specific errors described for errors -221 through -229.

-221 **`Settings conflict`**

Indicates that a legal program data element was parsed but could not be executed due to the current device state (see IEEE 488.2 11.5.1.1.5).

-222 **`Data out of range`**

Indicates that a legal program data element was parsed but could not be executed because the interpreted value was outside the legal range defined by the device (see IEEE 488.2 11.5.1.1.5).

-223 **`Too much data`**

Indicates that a legal program data element of block, expression or string type was received that contained more data than the device could handle due to memory or related device-specific requirements.

-224 **`Illegal parameter value`**

Used where exact value, from a list of possibilities, was expected.

-225 **`Out of memory`**

The device has insufficient memory to perform the requested operation.

-226 **`Lists not same length`**

Attempted to use LIST structure having individual LISTs of unequal length.

-230 **`Data corrupt or stale`**

Possibly invalid data. A new reading was started but not completed since last access.

-231 **`Data questionable`**

Indicates that the measurement accuracy is questionable.

-232 **`Invalid format`**

Indicates that a legal program data element was parsed but could not be executed because the data format or structure is inappropriate. For example, when loading memory tables or when sending a **`SYSTem:SET`** parameter for an unknown instrument.

-233 **`Invalid version`**

Indicates that a legal program data element was parsed but could not be executed because the version of the data is incorrect to the device. This particular error is used when file or block data elements are recognized by the instrument, but cannot be executed for reasons of version incompatibility. For example, a non- supported file version or a non- supported instrument version.

-240 **`Hardware error`**

Indicates that a legal program command or query could not be executed because of a hardware problem in the device. The definition of what constitutes a hardware problem is completely device-specific. This error is used when the device cannot detect the more specific errors described for errors -241 through -249.

-241 **`Hardware missing`**

Indicates that a legal program command or query could not be executed because of missing device hardware. For example, an option was not installed.

-250 **`Mass storage error`**

Indicates that a mass storage error has occurred. This message is used when a device cannot detect the more specific errors described for errors -251 through -259.

-252 **`Missing media`**

Indicates that a legal program command or query could not be executed because of missing media, for instance no disk in the disk drive. The definition of what constitutes missing media is device-specific.

-253 **`Corrupt media`**

Indicates that a legal program command or query could not be executed because of corrupt media, for instance a bad disk or incorrect disk format. The definition of what constitutes corrupt media is device-specific.

-254 **`Media full`**

Indicates that a legal program command or query could not be executed because the media was full. For example, there is was no space left on the disk. The definition of what constitutes full media is device-specific.

-255 **`Directory full`**

Indicates that a legal program command or query could not be executed because the media directory was full. The definition of what constitutes a full media directory is device-specific.

-256 **`File name not found`**

Indicates that a legal program command or query could not be executed because the file name on the device media could not be found. For example, an attempt was made to read or copy a nonexistent file. The definition of what constitutes a file not being found is device-specific.

-257 **`File name error`**

Indicates that a legal program command or query could not be executed because a file name on the device media was in error. For example, an attempt was made to copy to a duplicate filename. The definition of what constitutes a file name error is device-specific.

-258 **`Media protected`**

Indicates that the device or user has attempted to write to a read-only memory subsystem (msus). The definition of a protected media is device-specific.

-260 **`Expression error`**

Indicates that an expression data element-related error occurred. This error message is used when the device cannot detect the more specific errors described for errors -261 through -269.

-261 **`Math error in expression`**

Indicates that a syntactically legal expression program data element could not be executed due to a math error. For example, a divide-by-zero was attempted. The definition of a math error is device-specific.

-270 **`Macro error`**

Indicates that a macro-related execution error occurred. This error message is used when the device cannot detect the more specific errors described for errors -271 through -279.

-271 **`Macro syntax error`**

Indicates that a syntactically legal macro program data sequence, written in accordance with IEEE 488.2, 10.7.2, could not be executed due to a syntax error within the macro definition (see IEEE 488.2, 10.7.6.3).

-272 **`Macro execution error`**

Indicates that a syntactically legal macro program data sequence could not be executed due to an error within the macro definition (see IEEE 488.2, 10.7.6.3).

-273 **`Illegal macro label`**

Indicates that the macro label defined in the **`*DMC`** command was a legal string syntax, but could not be accepted by the device (see IEEE 488.2, 10.7.3 and 10.7.6.2). For example, the label was too long, the same as a common command header, or contained invalid header syntax.

-274 **`Macro parameter error`**

Indicates that the macro definition improperly used a macro parameter placeholder (see IEEE 488.2, 10.7.3).

-275 **`Macro definition too long`**

Indicates that a syntactically legal macro program data sequence could not be executed because the string or block contents were too long for the device to handle (see IEEE 488.2, 10.7.6.1).

-276 **`Macro recursion error`**

Indicates that a syntactically legal macro program data sequence could not be executed because the device found it to be recursive (see IEEE 488.2, 10.7.6.4).

-277 **`Macro redefinition not allowed`**

Indicates that the macro label defined in the **`*DMC`** command could not be executed because the macro label was already defined (see IEEE 488.2, 10.7.6.4).

-278 **`Macro header not found`**

Indicates that a syntactically legal macro label in the **`*GMC?`** query could not be executed because the header was not previously defined.

-280 **`Program error`**

Indicates that a downloaded program-related execution error occurred. This error message is used when the device cannot detect the more specific errors described for errors -281 through -289. The syntax used in a program and the mechanism for downloading a program is device-specific.

-281 **`Cannot create program`**

Indicates that an attempt to create a program was unsuccessful. This may be due to insufficient memory.

-282 **`Illegal program name`**

Indicates that the name used to reference a program was invalid. For example, redefining an existing program, deleting a nonexistent program, or in general, referencing a nonexistent program.

-283 **`Illegal variable name`**

Indicates that an attempt was made to reference a nonexistent variable.

-284 **`Program currently running`**

Indicates that certain operation related to programs may be illegal while the program is running. For example, deleting a running program may be illegal.

-285 **`Program syntax error`**

Indicates that a syntax error appears within a downloaded program. The syntax used when parsing a downloaded program is device-specific.

-286 **`Program runtime error`**

Indicates that a runtime error was detected in a downloaded program.

-290 **`Memory use error`**

Indicates that a user request has directly or indirectly caused an error related to memory or <data_handles>. This is not the same as “bad” memory.

-291 **`Out of memory`**

A downloaded program required more memory than was available in the instrument.

-292 **`Referenced name does not exist`**

A downloaded program attempted to access an undefined element (a variable, constant, filename, etc.).

-293 **`Referenced name already exists`**

A downloaded program attempted to define an element (a variable, constant, filename, etc.) that had already been defined.

-294 **`Incompatible type`**

Indicates that the type or structure of a memory item is inadequate.

Device-Specific Error

An error number in the range [-399 to -300] or [1 to 32767] indicates that the instrument has detected an error which is not a command error, a query error, or an execution error; some device operations did not properly complete, possibly due to an abnormal hardware or firmware condition. These codes are also used for self-test response errors. The occurrence of any error in this class will cause the device-specific error bit (bit 3) in the event status register (IEEE 488.2, section 11.5.1) to be set.

NOTE: For positive error number descriptions see the section titled “ESG-D Series Signal Generator Instrument-Specific Error Messages.”

The meaning of positive error codes is device-dependent and may be enumerated or bit mapped. The <error_message> string for positive error codes is not defined by SCPI. The occurrence of any error in this class will cause the device-specific error bit (bit 3) in the event status register (IEEE 488.2, section 11.5.1) to be set. Events that generate device-specific errors will not generate command errors, or query errors; see the other error definitions in this section.

Device-Specific Error Message Descriptions

This section lists the signal generator’s device-specific error messages and their associated descriptions.

Error Number	Error Description [description/explanation/examples]
-300	**`Device-specific error`** This is a generic device-dependent error for devices that cannot detect more specific errors. The code indicates only that a device-dependent error as defined in IEEE 488.2, 11.5.1.1.6 has occurred.
-310	**`System error`** Indicates that an error, termed “system error” by the device, has occurred.
-311	**`Memory error`** Indicates that an error was detected in the device’s memory.

-312 **`PUD memory lost`**

Indicates that the protected user data saved by the **`*PUD`** command has been lost.

-313 **`Calibration memory lost`**

Indicates that non-volatile calibration data has been lost.

-314 **`Save/recall memory loss`**

Indicates that the non-volatile data saved by the **`*SAV?`** command has been lost.

-315 **`Configuration memory lost`**

Indicates that non-volatile configuration data saved by the device has been lost. The meaning of this error is device-dependent.

-320 **`Storage fault`**

Indicates that the firmware detected a fault when using data storage. This error is not an indication of physical damage or failure of any mass storage element.

-321 **`Out of memory`**

Indicates that an internal operation needed more memory than was available.

-330 **`Self-test failed`**

Indicates that the device has detected a failure during its self-test procedure.

-340 **`Calibration failed`**

Indicates that the device has detected a failure during its calibration procedure.

-350 **`Queue overflow`**

This is a specific code entered into the queue in lieu of the code that caused the error. This message indicates that there is no more room in the queue and an error occurred but was not recorded.

-360 **`Communication error`**

This is the generic communication error for devices that cannot detect the more specific errors described for errors -361 through -363.

-361 **`Parity error in program message`**

Indicates that the parity bit was not correct when data was received (for example, an incorrect parity bit on a serial port).

-362 **`Framing error in program message`**

Indicates that a stop bit was not detected when data was received (for example, a baud rate mismatch).

Query Error

An error number in the range [-499 to -400] indicates that the output queue control of the instrument has detected a problem with the message exchange protocol described in IEEE 4888.2, chapter 6. The occurrence of any error in this class will cause the query error bit (bit 2) to be set in the event status register (IEEE 488.2, section 11.5.1). These errors correspond to message exchange protocol errors described in IEEE 488.2, 6.5. If a query error occurs one of the following is true:

- An attempt is being made to read data from the output queue when no output is either present or pending.
- Data in the output queue has been lost.

Events that generate query errors will not generate command errors, execution errors, or device-specific errors; see the other error definitions in this section.

Query Error Message Descriptions

This section lists the signal generator's query error messages and their associated descriptions.

Error Number	Error Description [description/explanation/examples]
-400	**`Query Error`** This is a generic query error for devices that cannot detect more specific errors. The code indicates only that a query error as defined in IEE 488.2, 11.5.1.1.7 and 6.3 has occurred.
-410	**`Query INTERRUPTED`** Indicates that a condition causing an INTERRUPTED query error occurred (see IEEE 488.2, 6.3.2.7). For example, a query was followed by **`DAB`** or **`GET`** before a response was completely sent.
-420	**`Query UNTERMINATED`** Indicates that a condition causing an UNTERMINATED query error occurred (see IEEE 488.2, 6.3.2.2). For example, the device was addressed to talk and an incomplete program message was received.
-430	**`Query DEADLOCKED`**

Indicates that a condition causing a DEADLOCKED query error occurred (see IEEE 488.2, 6.3.1.7). For example, both the input buffer and the output buffer are full and the device cannot continue.

-440 **`Query UNTERMINATED after indefinite response`**

Indicates that a query was received in the same program message after a query requesting an indefinite response was executed (see IEEE 488.2, 6.3.7.5).

ESG-D Series Signal Generator Instrument-Specific Error Messages

Some instrument-specific error messages incorporate the negative or "generic" SCPI error number with the addition of device-dependent/instrument-specific (ESG-D Series signal generator-specific) information following the semicolon in the error message.

A positive error number indicates that the instrument has detected an error within the HP-IB system, within the instrument's firmware or hardware, during the transfer of block data, or during calibration.

Error Number	Error Description [description/explanation/examples]
-100	**`Command error;R0:No standby mode allowed.`** Indicates that, in HP 8656/57 compatibility mode, **`R0`** was received via HP-IB. This command is not supported by the compatibility mode. **`Command error;Remote active function DN/UP not available.`** Indicates that, in HP 8656/57 compatibility mode, either **`DN`** or **`UP`** was received via HP-IB. These commands are not supported by the compatibility mode. **`Command error;LO: No low bandwidth ALC mode allowed.`** Indicates that, in HP 8656/57 compatibility mode, **`LO`** was received via HP-IB. This command is not supported by the compatibility mode.
-102	**`Syntax error;Bad HP compatibility language character <character>.`** Indicates that, in HP 8656/57 compatibility mode, illegal language input was received.

Syntax error;Bad HP compatibility language token <token>.

Indicates that, in HP 8656/57 compatibility mode, a known command or termination specifier was received when it was not expected. For example, a termination specifier was received with no currently active function.

-213 **Init ignored;Unable to sweep due to sweep being in an error state. The sweep error should be fixed.**

Indicates that the number of list, power, and/or dwell points are in conflict, or a serious system error has occurred in list/sweep. A previous error report should have described the error that is stalling list/sweep.

Init ignored;Cannot initiate sweep in manual mode.

Indicates that the manual mode is on and therefore the instrument cannot sweep.

Init ignored;Sweep is already initiated.

Indicates that the list/sweep is currently initiated and sweeping, therefore the command is not legal according to SCPI.

Init ignored;Sweep is already continuously initiated.

Indicates that the list/sweep is continuously initiated and sweeping, therefore the command is not legal according to SCPI.

-221 **Settings conflict;Cannot have uplink protocols while the control frame is on. Frames 1-17 timeslots changed to downlink.**

Indicates that, in TETRA mode, some of the timeslots are set to uplink. When the control frame is turned on in TETRA, all timeslots in all frames must use downlink protocols. The instrument enforces this by reconfiguring the timeslots that are not using downlink protocols when the control frame is switched on.

Settings conflict;Cannot select uplink protocols while the control frame is on. Selection changed to custom.

Indicates that in TETRA mode, an attempt has been made to select uplink protocols while the control frame is switched on. TETRA requires that the control frame be switched off in order to select uplink protocols.

Settings conflict;Continuous protocol timeslots cannot be turned off.

Indicates that a continuous protocol timeslot is switched off while in TETRA mode. When a continuous protocol has been selected for a timeslot in TETRA mode, all of the timeslots must be switched on.

Settings conflict;Continuous & Discontinuous setting conflict. All selected Continuous timeslots are now switched to Discontinuous.

Indicates that while in TETRA mode, an attempt has been made to simultaneously assign continuous and discontinuous protocols to the timeslots. Continuous and discontinuous protocols cannot coexist in TETRA mode. If a discontinuous protocol is selected for any timeslot, all timeslots' protocols are changed to discontinuous protocols.

Settings conflict;Discontinuous & Continuous setting conflict. All selected Discontinuous timeslots are now switched to Continuous.

Indicates that while in TETRA mode, an attempt has been made to simultaneously assign discontinuous and continuous protocols to the timeslots. Discontinuous and continuous protocols cannot coexist in TETRA mode. If a continuous protocol is selected for any timeslot, all timeslots' protocols are changed to continuous protocols.

Settings conflict;Frequency list and dwell list are of unequal size. Set one list equal to size one, or make their sizes equal.

Indicates that the frequency list has more than one element and the dwell list has more than one element, and they are not of equal size. If any of the frequency, power, or dwell lists have more than one element, they must all have the same number of elements. A list of a single element is the same as a list of equal size with the single element repeated the necessary number of times.

Settings conflict;Frequency list and power list are of unequal size. Turn one list off, set one to size one, or make their sizes equal.

Indicates that the frequency list has more than one element and the power list has more than one element, and they are not of equal size. If any of the frequency, power, or dwell lists have more than one element, they must all have the same number of elements. A list of a single element is the same as a list of equal size with the single element repeated the necessary number of times.

Settings conflict;Power list and dwell list are of unequal size. Set one to size one, or make their sizes equal.

Indicates that the dwell list has more than one element and the power list has more than one element, and they are not of equal size. If any of the frequency, power, or dwell lists have more than one element, they must all have the same number of elements. A list of a single element is the same as a list of equal size with the single element repeated the necessary number of times.

Settings conflict;The selected external trigger setting conflicts with the previous setting.

Indicates that the external trigger has been set to positive edge for one trigger source and negative edge for another trigger source.

Settings conflict;I/Q & AM WB cannot be on at the same time.

The modulation types I/Q and AM WB cannot be used at the same time. This error is reported when the user attempts to activate one type of modulation while the other is activated. The modulation type that was most recently requested will be turned on and the modulation that was on at the time will be turned off.

Settings conflict;FM2/PM2 value set greater than FM1/PM1 value. FM1/PM1 changed to match FM2/PM2 value.

The deviation of FM2/PM2 must always be less than or equal to the deviation settings for FM1/PM1. This error will be reported to the queue when FM1/PM1 is enabled and FM2/PM2 is also enabled and an adjustment to either FM2/PM2 deviation causes the FM2 or PM2 deviation to be greater than the FM1 or PM1 deviation. It will also be reported when FM2/PM2 is being turned on, and the last FM1/PM1 deviation setting is less than the current FM2/PM2 deviation setting. In both cases the FM1/PM1 deviation will be adjusted to match the FM2/PM2 deviation.

Settings conflict;FM1/PM1 value set less than FM2/PM2 value. FM2/PM2 changed to match FM1/PM1 value.

The deviation of FM2/PM2 must always be less than or equal to the deviation settings for FM1/PM1. This error will be reported to the queue when FM2/PM2 is enabled and FM1/PM1 is also enabled and an adjustment to either FM1/PM1 deviation causes the FM1 or PM1 deviation to be less than the FM2 or PM2 deviation. It will also be reported when FM1/PM1 is being turned on, and the last FM2/PM2 deviation setting is greater than the current FM1/PM1 deviation setting. In both cases the FM2/PM2 deviation will be adjusted to match the FM1/PM1 deviation.

Settings conflict;Enabled mod source conflicts with previously enabled mod source. Previous mod disabled.

The signal generator has three sources: INT, EXT1, and EXT2 that are shared by the FM1/PM1, AM1/AM2, FM2/PM2, pulse (INT and EXT2), and burst envelope (EXT1 only). Each source can only be used by one of the modulations at a time. If a source is being used by an active modulation, and a request for the source is made by another modulation, the first modulation will be turned off, the second modulation will be turned on.

Settings conflict;External burst cannot be on while using AM.

Indicates that there is a hardware conflict for the burst envelope using the EXT1 source (I/Q menu) and AM1/AM2. The most recently requested modulation will be turned on, the previous modulation will be turned off.

Settings conflict;FM & PM not allowed.

Indicates that there is a hardware conflict between FM and PM. The most recently requested modulation will be turned on, the previous modulation will be turned off.

Settings conflict;Pulse modulation cannot be on with internal burst.

Indicates that there is a hardware conflict between pulse modulation and internal burst. The most recently requested modulation will be turned on, the previous modulation will be turned off.

Settings conflict;Internal burst cannot be on with pulse modulation.

Indicates that there is a hardware conflict between internal burst and pulse modulation. The most recently requested modulation will be turned on, the previous modulation will be turned off.

Settings conflict;Pattern repeat is changed to continuous because data source is external.

Indicates that, while in non-bursted data generation, Pattern Repeat was in Single mode and data source was selected to be External. For non-bursted data generation using an external data source, Pattern Repeat must be in Continuous mode. To continue data transmission, Pattern repeat has been changed to Continuous mode.

Settings conflict;Uplink & Downlink setting conflict. All selected Uplink timeslots are now set to Downlink.

Indicates that an Uplink timeslot type has been selected while another timeslot(s) has Downlink selected. In NADC and PDC digital modulation for bursted data, only either Uplink (base to mobile) or Downlink (mobile to base) Traffic Channel type can be selected for all timeslots at any one moment.To continue data transmission, all Uplink timeslots have been changed to the Downlink configuration.

Settings conflict; Downlink & Uplink setting conflict. All selected Downlink timeslots are now set to Uplink.

Indicates that an Downlink timeslot type has been selected while another timeslot(s) has Uplink selected. In NADC and PDC digital modulation for bursted data, only either Uplink (base to mobile) or Downlink (mobile to base) Traffic Channel type can be selected for all timeslots at any one moment.To continue data transmission, all Downlink timeslots have been changed to the Uplink configuration.

Settings conflict; Pulse period set less than pulse width. Pulse width changed to match period value.

Indicates that a pulse period has been entered which is smaller than the pulse width. The instrument automatically adjusts the pulse period to match the pulse width.

Settings conflict; PDC and NADC Custom protocols are now uplink protocols, so the timeslots with Custom selected were changed to Downlink Custom.

Indicates that, because PDC or NADC has downlink protocols selected and also has Custom in one or more timeslots, the timeslots with Custom are set to Downlink Custom. Otherwise, the timeslots with Custom are set to Uplink Custom. Downlink Custom has its own instrument state information for the Data type and Fix 4 value.

-222 **Data out of range;value clipped to lower limit.**

Indicates that an input value is below the minimum value allowed. Examples are: frequency setting, reference, or offset; output power; power reference and offset; modulation depth, deviation, or modulation source frequency; number of points and start/stop values for list mode; start/stop values for internal I/Q calibration; sequence or register values (save/recall); dwell time.

Data out of range;value clipped to upper limit.

Indicates that an input value is above the maximum value allowed. Examples are: frequency setting, reference, or offset; output power; power reference and offset; modulation depth, deviation, or modulation source frequency; number of points and start/stop values for list mode; start/stop values for internal I/Q calibration; sequence or register values (save/recall); dwell time.

Data out of range;Synthesizer: Frequency out of bounds.

Indicates that the instrument received an internal request for a frequency outside of its supported frequency range. Report the circumstances to the factory.

Data out of range;Manual point exceeds list sizes. Limiting to maximum point.

Indicates that the sweep/list manual point has been reassigned to a smaller number value due to the longest list decreasing in size or being turned off. Its new value is the length of the longest enabled list (frequency or power).

Data out of range;Manual point exceeds frequency list size. Limiting to maximum point.

Indicates that the sweep/list manual point has been reassigned to a smaller number value due to the longest list decreasing in size or being turned off. Its new value is the length of the frequency list which is the longest enabled list.

Data out of range;Manual point exceeds power list size. Limiting to maximum point.

Indicates that the sweep/list manual point has been reassigned to a smaller number value due to the longest list shrinking, or being turned off. Its new value is the length of the power list, which is the longest enabled list.

-223 **Too Much Data;The number of list points exceeds the maximum allowed.**

Indicates that a SCPI list has been entered that is longer than the maximum allowed length, which is also the maximum number of step points; too many points were given for a frequency, amplitude, or dwell time list. This error can also be caused by attempting to copy items in the list editor when the list is already at its maximum length.

-230 **Data corrupt or stale;RAM copy of <filename>.**

The non-volatile RAM copy of a file is either corrupt or is out of date with the EEPROM master copy (if one exists). The system automatically re-initializes the file from EEPROM (if appropriate) or from a default algorithm. A potential cause is a failing backup battery.

Data corrupt or stale;EEPROM copy of <filename>.

The EEPROM copy of a file is either corrupt or otherwise unusable. The system automatically updates the non-volatile RAM copy of the EEPROM copy using a default initialization. The actual EEPROM file is left as it is. Report this problem to the factory.

-231 **Data questionable;RAM copy of <filename>.**

Indicates that the non-volatile RAM copy of a file has a correctable error. The system automatically performs the correction. A potential cause is a failing backup battery.

Data questionable;EEPROM copy of <filename>.

Indicates that the EEPROM copy of a file has a correctable error. The system automatically performs the correction. A potential cause is a failing EERPOM. Report this problem to the factory.

-241 **Hardware missing; <card_name>**

Indicates that a test communication to a hardware card failed. The instrument is most likely not functional. Contact the nearest HP Sales and Service office.

Hardware missing; Installed option boards do not match configuration information.

Indicates that a set of option boards have been installed that do not match the information that was given to the instrument as part of the installation. If this is the result of a customer installed option, the wrong option was specified during installation. If this is seen at any other time, the likely cause is an EEPROM failure on the option card.

-250 **Mass storage error; EEPROM write timeout on <filename>.**

Indicates that the system was not able to program new data to an EEPROM. The system is still functional, but files written to EEPROM (such as updated calibration data) may be lost when the instrument's line power is cycled. Contact the nearest HP Sales and Service office.

-253 **Corrupt media;User File System**

Indicates that the main memory area used for storing instrument states and sequences as well as other data files is corrupt. The system will automatically clear and reconfigure this memory area. A potential cause is a failing backup battery. Another potential cause could be the loss of line power to the instrument in the middle of a write operation.

Corrupt media;<media_name>

Indicates that a source media (possibly EEPROM) for a data file is corrupt. This error is usually seen in conjunction with errors concerning a certain file.

-254 **Media full; Unable to delete saved state from non-volatile memory. No instrument state change.**

Indicates that the state memory subsystem **STATE:** was unable to delete a register. You must free some memory by deleting a file or register using Catalog. Afterwards, try again.

Media full; Save a state register ignored.

Indicates that the state memory subsystem **STATE:** did not have enough room to save a register. You must free some memory by deleting a file or register using Catalog. Afterwards, try again.

Media full; Save a state register failed. State marked available.

Indicates that the state memory subsystem **STATE:** did not have enough room to save a register, so the register was lost and is now marked available. You must free some memory by deleting a file or register using Catalog. Afterwards, try again.

-256 **File name not found;The internal list file was not found. There is no list data to return**

Indicates that the **DWEL_FILE**, **FREQ_FILE**, or **POW_FILE** has been lost, so a new one will have to be created. These files are the persistent information for list/sweep mode. They contain the dwell list, the frequency list, or the power list. Invoking the list editor will recreate the missing file to a length of one element.

-257 **File name error;Delete empty sequence <sequence_name>. Delete sequence ignored.**

Indicates that the user has attempted to delete a sequence which is empty (all registers unused). This is informational only. Typically this error is reported (several times) when the “Delete All Sequences” command is executed.

File name error;Delete a non-saved state register. Delete register ignored.

Indicates that the user has attempted to delete a state which is empty (unused). This is informational only.

File name error;Directory does not support extenders.

Indicates that an extender, which is specified by an **@** sign followed by a memory subsystem name, has been specified for an explicit memory subsystem which does not allow the **@** notation. Only the default **(:)** memory subsystem allows extenders.

File name error;Empty filename

Indicates that a filename of **" "** was specified. This is not a legal filename.

File name error;Illegal extender

Indicates that an illegal memory subsystem name was used after the **@**. Supported values are **@STATE** and **@LIST**.

File name error;Illegal filename character

Indicates that an illegal character was used within a filename. ****, **:**, **@** and all non-printable ASCII characters are illegal in filenames.

File name error;Only one ":" is allowed.

Indicates that only one colon is allowed in any filename specification. The text before the colon is a user memory subsystem. The valid user choices are **:**, **DEFAULT:**, **STATE:**, and **LIST:**.

File name error;Only one "@" is allowed.

Indicates that only one **@** is allowed in any filename specification. It specifies the memory subsystem that a user file actually resides in.

-286 **Program runtime error;Floating-Point Exception**

Indicates that a floating-point math error (such as a divide by zero) has been detected. The system will attempt to recover automatically. Report the circumstances to the nearest HP Sales and Service office.

-310 **System error;RS232 buffer overflow: character lost.**

Indicates that the RS232 buffer has been exceeded. The most recent character has been dropped.

System error;Cannot change manual point until list mode error condition cleared.

An error is keeping the sweep/list from being able to set the frequency and/or power. Until the problem is addressed, the manual point cannot be changed.

System error;Unable to determine which attenuator is installed.

Indicates that an invalid attenuator identification code has been detected. Possible causes include a loose attenuator control cable. The instrument will likely not produce the proper output power levels. Report this error to the factory.

-311 **Memory error;Unable to configure Save Recall registers from non-volatile memory. Save Recall registers re-initialized.**

Indicates that saved states are no longer usable. Delete explicitly using Catalog.

-315 **Configuration memory lost;Persistent state preset. Using factory defaults.**

Indicates that the persistent state has been forced to return to factory preset values.

Configuration memory lost;Persistent state version is bad. Using factory defaults.

Indicates that the persistent state version is not recognized as valid and is assumed to be corrupt. The persistent state is reinitialized with the factory preset values.

Configuration memory lost;Persistent state checksum is bad. Using factory defaults.

Indicates that the persistent state is corrupt and had to be reinitialized with the factory preset values.

-321 **Out of memory;Unable to verify instrument state file.**

Indicates that an instrument state file could not be accessed and verified because of insufficient memory. Reduce the size of any sweep lists and try again.

Out of memory;Memory catalog failed.

Indicates that there is not enough memory to complete a catalog listing. Reduce the size of any sweep lists and try again.

Out of memory;Unable to display timeslot window.

Indicates that the instrument was unable to create part of the graphical user interface due to an inability to allocate memory (possibly due to fragmentation). Please report the circumstances to the factory. The instrument is still functional.

Out of memory;Unable to display protocol window.

Indicates that the instrument was unable to create part of the graphical user interface due to an inability to allocate memory (possibly due to fragmentation). Please report the circumstances to the factory. The instrument is still functional.

Out of memory;Unable to display format window.

Indicates that the instrument was unable to create part of the graphical user interface due to an inability to allocate memory (possibly due to fragmentation). Please report the circumstances to the factory. The instrument is still functional.

Out of memory;Cannot uncompress file.

Indicates that a **STATE:** file cannot be uncompressed because there is not enough memory to run the decompression algorithm. Recall will fail and there will be no instrument state change. Reduce the size of any sweep lists and try again.

Out of memory;Cannot precalculate frequencies. Try fewer frequencies.

Indicates that memory was exhausted during frequency precalculation (used to speed the process of sweep/list mode). List mode cannot run until either fewer frequencies have been supplied or more memory becomes available and the same set of frequencies are sent again, **FREQ:MODE CW** is executed, or **:FREQ:MODE LIST** is executed.

Out of memory;Object Memory Area

Indicates that memory was exhausted during instrument power-on. Report the circumstances to the factory.

Out of memory;List formation

The device was unable to allocate space for a lookup table, such as for list mode precalculation. List mode cannot run until either fewer frequencies have been supplied or more memory becomes available and the same set of frequencies are sent again, **FREQ:MODE CW** is executed, or **:FREQ:MODE LIST** is executed.

Out of memory;PRBS xx/xx

There was not enough memory to apply a scramble to data for the baseband generator. In this case, the scramble is not applied to the generator.

Out of memory;Display system out of memory. An abnormal display may result. Memory consumption should be reduced.

There was not enough memory in the system to properly update the display. Some inconsistencies may be seen. The size of any list/sweep should be reduced, and the source should be preset to clear up any inconsistencies. Report the circumstances to the nearest HP Sales and Service office.

Out of memory;Unable to check Data Generator memory.

There was not enough memory in the system to properly complete the data generator memory test. This does NOT imply a data generator memory failure. Check all other error messages to identify possible causes, discontinue list/sweep mode to free some memory, and repeat the test.

-330 **Self-test failed;Power supply self-test failure**

Indicates that the self-test for a particular power supply voltage has failed. The instrument is likely not functional. Contact the nearest HP Sales and Service office.

Self-test failed;EEPROM header checksum error <card_name>.

Indicates that the card identification header for a hardware card is incorrect. If the card is not properly identified, the instrument is likely to be non-functional. Contact the nearest HP Sales and Service office.

Self-test failed;Data Generator Memory Test @ 0x____

Indicates that the data generator memory failed. Modulation data produced by the data generator may not be correct. However, if an **Unable to check Data Generator Memory** error was also seen, this result is not conclusive. The address of the first location that failed is reported. Contact the nearest HP Sales and Service office.

Self-test failed;Burst Generator Memory Test @ 0x____

Indicates that the burst generator memory failed. Modulation data produced by the burst generator may not be correct. However, if an **Unable to check Burst Generator Memory** error was also seen, this result is not conclusive. The address of the first location that failed is reported. Contact the nearest HP Sales and Service office.

Self-test failed;Bad address position @ 0x____

Indicates that the data generator memory failed. Modulation data produced by the data generator may not be correct. An address that appeared to have a failed address line was reported. Contact the nearest HP Sales and Service office.

Self-test failed;Chips ___, ___ aliased @ 0x____

Indicates that the data generator memory failed. Modulation data produced by the data generator may not be correct. An address that appeared to be aliased across multiple memory chips has been reported. Contact the nearest HP Sales and Service office.

-430 **`Query DEADLOCKED`**

Indicates that a SCPI output queue has filled preventing further SCPI command execution, and there is no more room left in the corresponding SCPI input queue to accept a query to read from the output queue. The system automatically discards output to correct the deadlock.

201 **`Bad file number;Unable to check Data Generator memory.`**

Indicates that the instrument was not able to generate the pattern necessary to perform the data generator memory test. This does NOT imply a data generator memory failure. Report the problem to the factory.

208 **`I/O error;Unable to delete saved state from non-volatile memory. No instrument state change.`**

Indicates that a **`STATe:`** file could not be deleted due to the file not being found, file corruption, or another file-related problem. If the file is displayed by a memory catalog, delete it explicitly.

`I/O error;Save a state register ignored.`

Indicates that a **`STATe:`** file could not be saved due to insufficient space, file corruption, or another related problem.

`I/O error;Delete empty sequence <sequence_name>. Delete sequence ignored.`

Indicates that the user has attempted to delete a sequence that is empty. This error message is informational only. Typically, this error is reported several times when the “Delete All Sequences” command is executed. If the file is displayed by Catalog, delete explicitly.

I/O error;Delete a non-saved state register. Delete register ignored.

Indicates that the user has attempted to delete an unused (empty) state. This error message is informational only.

I/O error;Trailing zero found in <filename>. Fixing...

Indicates that a compressed state file has a zero at its end. This is a sign of file corruption. The device fixes the problem by concealing the zero such that it no longer triggers an error message. The file may be corrupt or unusable.

I/O error;Unable to recall from non-volatile memory. No instrument state change.

Indicates that the state file is not readable and the recall was aborted.

214 **Not owner;Unable to delete saved state from non-volatile memory. No instrument state change.**

Indicates that the user has attempted to write to a read-only memory subsystem.

501 **Attenuator hold setting over range;Frequency change forced attenuator adjust.**

Indicates that the firmware has changed the attenuator setting because, while in attenuator hold mode, a change in frequency setting has forced the ALC beyond its range.

Attenuator hold setting over range;Power set to lower limit.

Indicates that the firmware has changed the power setting to a value other than the requested value due to the fact that, while in attenuator hold mode, the user has requested a power setting that is below the ALC range for the attenuator setting. The power has been set to the lower limit.

Attenuator hold setting over range;Power set to upper limit.

Indicates that the firmware has changed the power setting to a value other than the requested value due to the fact that, while in attenuator hold mode, the user has requested a power setting that is above the ALC range for the attenuator setting.

508 **Synthesizer unlocked**

Indicates that the synthesizer is unlocked. Service may be needed.

509 **Output Section input overdrive**

Internal error: report to factory.

510 **I/Q Modulator overdrive**

Internal error: report to factory.

511 **Output unleveled**

Indicates that the instrument's output is unleveled.

512 **Reference unlocked**

Indicates that the instrument's reference is unlocked. If an external reference is connected, check the frequency and power. It is possible for this to occur during a poor connection/disconnection of an external reference. If this error reoccurs when no external reference is connected, the instrument may require service.

513 **Het VCO unlocked**

Indicates that the VCO used to generate output frequencies below 250 MHz is unlocked. The instrument may require service.

514 **Reference Oven cold**

Indicates that the reference oven is not at the required operating temperature. This is normal if the instrument has been powered down for a while. If the error persists, the instrument may require service.

515 **`Reference board: 10 Mhz reference signal bad or missing`**

Indicates that the instrument's reference is unlocked. If an external reference is connected, check the frequency and power. It is possible for this to occur during a poor connection/disconnection of an external reference. If this error reoccurs when no external reference is connected, the instrument may require service.

516 **`Baseband Generator unlocked; refer to manual.`**

Indicates that the digital modulation board is unlocked. If this error occurs and the status indicator on the front panel is not on, the board is operational. There are legitimate reasons for the front panel indicator to be on: if External Data mode was selected and no clock was provided for the data clock input, or if there was an incorrect setting selected for data clock/symbol clock.

517 **`Calibration failure;DCFM DC overrange`**

Indicates that the instrument was unable to perform a DCFM or DCΦM calibration due to the input signal being outside of the offset range that can be calibrated for.

`Calibration failure;Upgrade calibration failed. Data not stored.`

Indicates that the calibration stage of the instrument upgrade was not executed successfully. The calibration data has not been stored. The upgrade is not functional. Contact the nearest HP Sales and Service office.

`Calibration failure;Cal aborted by user.`

Indicates that, while executing the internal I/Q calibration, the user sent a DCAS over the HP-IB or pressed the **Abort** key on the front panel.

`Calibration failure;I/Q cal failed to allocate memory.`

Indicates that, while executing the internal I/Q calibration, the attempt to allocate memory for the calibration failed.

Calibration failure;'Marble Cal', 'Offset Cal', 'Other Cal', 'Gain Cal', 'BBG Cal'

Indicates that, while executing the internal I/Q calibration, a failure occurred during the section indicated.

600 **RPP has tripped.**

Indicates that the reverse power protection circuit has been triggered. Repeated tripping of this circuit can cause damage to the instrument.

601 **Power search failed.**

Indicates that, while executing power search, the level meter circuit failed to return a meaningful value. This event indicates that the power is in a range that the leveling loop cannot properly level. The power will be set to the last properly leveled power.

605 **DSP FW download failed.**

Indicates that the instrument's firmware was unable to successfully initialize the internal DSP. Report the circumstances to the nearest HP Sales and Service office.

606 **DSP times out.**

Indicates that the DSP failed to respond within the appropriate amount of time. Report the circumstances to the nearest HP Sales and Service office.

607 **DSP returns error.**

Indicates that the DSP is in an indeterminate state. Report the circumstances to the nearest HP Sales and Service office.

608 **DSP in use by other process.**

Indicates that the DSP is in an indeterminate state. Report the circumstances to the nearest HP Sales and Service office.

615 **New wave shape changes limit for internal frequency;frequency changed to new limit.**

When using the internal modulation source, the upper limit varies for the different waveforms. If the user changes the waveform when the internal source frequency is higher than that allowed for the new waveform, the frequency for the source will be changed, and the user informed of that change with this message.

617 **Configuration error; Data Generator Memory configuration does not match installed board.**

This indicates that the memory configuration for an option board does not match the known memory limits of the board. If this error has occurred as the result of a customer-installed option, uninstall all options and then reinstall the correct options. If the error persists, contact the factory.

Configuration error; Installed option boards do not match configuration information.

This indicates that the option boards have not been properly installed in the instrument. Verify that the correct option boards have been installed in the correct slots. Reinstall the correct option. If the error persists, contact the factory.

Configuration error; Invalid Data Generator memory configuration.

This indicates that the memory configuration for an option board does not match the known memory limits of any supported option board. If this error has occurred as the result of a customer-installed option, uninstall all options and then reinstall the correct options. If the error persists, contact the factory.

Configuration error; Invalid option board configuration.

This indicates that an invalid combination of option boards has been configured. If this error has occurred as the result of a customer-installed option, uninstall all options and then reinstall the correct options. If the error persists, contact the factory.

700 **State Save Recall Error;Recall aborted. Unable to recall the state from non-volatile memory.**

This indicates that the state file was not readable, so the recall was aborted. If state file exists, delete explicitly using the memory catalog.

State Save Recall Error;Recalled state has a bad checksum. No instrument state change.

This indicates that the state file was corrupt or out-of-date, so the recall was ignored. If state file exists, delete explicitly using the memory catalog.

State Save Recall Error;Recall data different from FW revision. No instrument state change.

Indicates that an attempt was made to recall a state that was saved with an incompatible version of the instrument firmware. This typically occurs when a state file is copied from an instrument with a newer version of firmware to an instrument with an older version of firmware. Newer versions of instrument firmware can read older state files.

State Save Recall Error;Recall non-saved state register. Recall ignored.

Indicates that a recall was attempted for a state register that is unused. If state file exists, delete explicitly using catalog.

State Save Recall Error;Delete sequence <sequence_name> ignored.

Indicates that a **STATE:** file in a sequence that is being deleted could not be deleted due to the file not being found, data corruption, etc. If state file exists, delete explicitly using the memory catalog.

State Save Recall Error;The state file is from a different firmware revision that does not support comments.

Indicates that an attempt was made to write a comment to a state file revision that does not support comments. Comments in saved state files are not supported by the A.01.00 and A.01.01 releases of the instrument firmware.

Returning Your Signal Generator to HP

If you are returning your signal generator to HP for servicing, fill out and attach a blue repair tag to the instrument. Repair tags are located at the end of this chapter.

Include as much information as possible about the problem: record any error messages that appeared on the display, and include performance test results or any other specific data on the performance of the signal generator.

Ship the instrument in the original factory packaging materials, if they are available. If not, use similar packaging to properly protect the instrument.

Return the instrument to the nearest HP sales and service office. A list of sales and service offices follows on the next page.

HP Sales and Service Offices

US FIELD OPERATIONS

Headquarters
Hewlett-Packard Company
19320 Pruneridge Avenue
Cupertino, CA 95014, USA
(800) 752-0900

California, Northern
Hewlett-Packard Co.
301 E. Evelyn
Mountain View, CA 94041
(415) 694-2000

California, Southern
Hewlett-Packard Co.
1421 South Manhattan Ave.
Fullerton, CA 92631
(714) 999-6700

Colorado
Hewlett-Packard Co.
24 Inverness Place, East
Englewood, CO 80112
(303) 649-5512

Atlanta Annex
Hewlett-Packard Co.
2124 Barrett Park Drive
Kennesaw, GA 30144
(404) 648-0000

Illinois
Hewlett-Packard Co.
545 E. Algonquin Rd.
Arlington Heights, IL 60005
(847) 342-2000

New Jersey
Hewlett-Packard Co.
150 Green Pond Road
Rockaway, NJ 07866
(201) 586-5400

Texas
Hewlett-Packard Co.
930 E. Campbell Rd.
Richardson, TX 75081
(214) 231-6101

EUROPEAN FIELD OPERATIONS

Headquarters
Hewlett-Packard S.A.
150, Route du Nant-d'Avril
1217 Meyrin 2/Geneva
Switzerland
(41 22) 780.8111

France
Hewlett-Packard France
1 Avenue Du Canada
Zone D'Activite De Courtaboeuf
F-91947 Les Ulis Cedex
France
(33 1) 69 82 60 60

Germany
Hewlett-Packard GmbH
Hewlett-Packard Strasse
61352 Bad Homburg v.d.H
Germany
(49 6172) 16-0

Great Britain
Hewlett-Packard Ltd.
Eskdale Road, Winnersh Triangle
Wokingham, Berkshire RG41 5DZ
England
(44 734) 696622

INTERCON FIELD OPERATIONS

Headquarters
Hewlett-Packard Company
3495 Deer Creek Rd.
Palo Alto, CA 94304-1316
(415) 857-5027

Australia
Hewlett-Packard Australia Ltd.
31-41 Joseph Street
Blackburn, Victoria 3130
(61 3) 895-2895

Canada
Hewlett-Packard (Canada) Ltd.
17500 South Service Road
Trans-Canada Highway
Kirkland, Quebec H9J 2X8
Canada
(514) 697-4232

China
China Hewlett-Packard Co.
38 Bei San Huan X1 Road
Shuang Yu Shu
Hai Dian District
Beijing, China
(86 1) 256-6888

Japan
Hewlett-Packard Japan, Ltd.
9-1 Takakura-Cho, Hachioji
Tokyo 192, Japan
(81 426) 60-2111

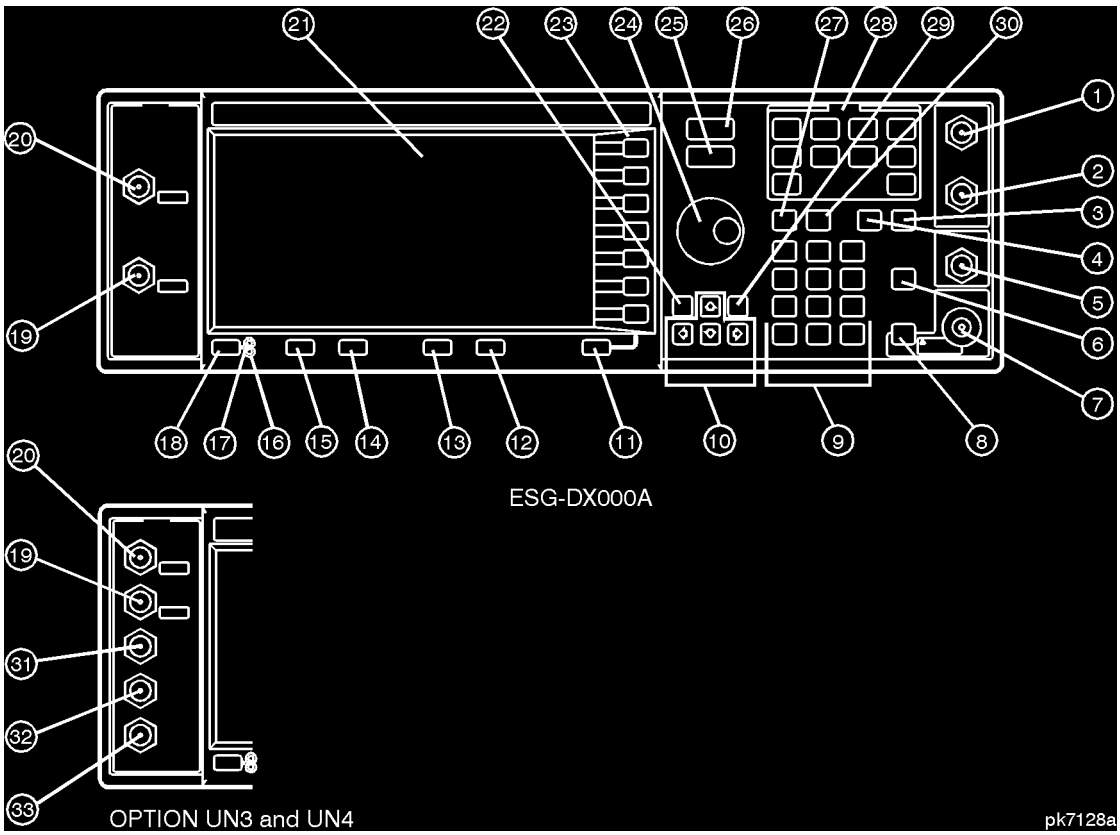
Singapore
Hewlett-Packard Singapore (Pte.) Ltd.
150 Beach Road
#29-00 Gateway West
Singapore 0718
(65) 291-9088

Taiwan
Hewlett-Packard Taiwan
8th Floor, H-P Building
337 Fu Hsing North Road
Taipei, Taiwan
(886 2) 712-0404

4 Front and Rear Panel

This chapter contains descriptions of the keys and connectors and other hardware on the front and rear panels. It also describes which information is displayed in the various parts of the display.

Front Panel Overview



1. EXT 1 INPUT Connector

This female BNC input connector accepts a 1 Vpeak signal for FM, ΦM, AM, and burst modulation. With FM, ΦM, or AM, ±1 Vpk produces the indicated deviation or depth. With burst modulation, 0 V is on and −1 V is off, with linear control between 0 V and −1 V. When AC-coupled inputs are selected for FM, ΦM, or AM, HI/LO annunciators will light if the peak input voltage differs from 1.0 V by more than 3%. The input impedance is 50Ω. The damage levels are 5 V_{rms} and 10 Vpk. If you configure your signal generator with Option 1EM, this input is relocated to a rear panel, female BNC connector.

2. EXT 2 INPUT Connector

This female BNC input connector accepts a 1 Vpeak signal for FM, ΦM, AM, and pulse modulation. With FM, ΦM, or AM, ±1 Vpk produces the indicated deviation or depth. With pulse modulation, +1 V is on and 0 V is off. When AC-coupled inputs are selected for FM, ΦM, or AM, HI/LO annunciators will light if the peak input voltage differs from 1.0 V by more than 3%. The input impedance is 50Ω. The damage levels are 5 V_{rms} and 10 Vpk. If you configure your signal generator with Option 1EM, this input is relocated to a rear panel, female BNC connector.

3. Help Key

Press this hardkey for a short textual description of the function of the front panel hardkeys and softkeys. Press any other key and you will be returned to normal instrument operation.

4. Trigger Key

Press this hardkey to trigger a specified event or series of events. You can trigger a step or list sweep or initiate a burst to output a frame or a data sequence in a digital modulation format.

5. LF OUTPUT Connector

This female BNC connector is the output connector for modulation signals generated by the LF source function generator. You can also output signals where the frequency and shape are set by the internal source as it is being used by a modulation. For pulse modulation, however, the internal source is a sinewave which is later squared by the modulator to generate the pulse squarewave. This output is capable of driving 3.5 Vpk into a 50Ω load. If you configure your instrument with Option 1EM, this input is relocated to a rear panel, female BNC connector.

6. Mod On/Off Key

This hardkey toggles all modulation signals on and off. Although you can set up and enable various modulation states, the RF carrier is not modulated until **Mod On/Off** is set to **On**. An annunciator is always turned on in the display to indicate whether modulation is turned on or off.

7. RF OUTPUT Connector

This female Type-N connector is the output connector for RF signals. The source impedance is 50Ω. The damage levels are 50 Vdc, 50 W at ≤ 2 GHz, and 25 W at > 2 GHz maximum. The reverse power protection circuit will trip, however, at nominally 1 watt. If you configure your signal generator with Option 1EM, this output is relocated to a rear panel female Type-N connector.

8. RF On/Off Key

This hardkey toggles the RF signal on and off at the RF OUTPUT connector. An annunciator is always turned on in the display to indicate whether RF is turned on or off.

9. Numeric Keypad

The numeric keypad consists of the digit keys (0 through 9), a decimal point key, and a backspace key, [+/−←] . The backspace key has dual functions for both backspacing and for changing the sign of a value to positive or negative. Use these keys at any time when the active function requires a value input.

10. Arrow Keys

The up and down arrow keys increase or decrease a numeric value. You can also use these keys to scroll through displayed lists to select items. The left and right arrow keys choose the highlighted digit in the active function display, which is modified by the up and down arrow keys. You can also use these keys in a list to select items in a row.

11. Return Key

The **Return** key moves you from your current softkey menu to the softkey menu that precedes it. It will back up through the menus of the current hardkey until you reach the first menu of that key.

12. Display Contrast Decrease Key

Pressing the decrease contrast key and holding it down causes the display background to gradually darken in comparison to the text on the display.

13. Display Contrast Increase Key

Pressing the increase contrast key and holding it down causes the display background to gradually brighten in comparison to the text on the display.

14. Local Key

Press this key to return the signal generator to local (front panel) control from remote operation.

15. Preset Key

Press this key to set the signal generator to a known state (either the factory-defined state or a user-defined state).

16. Standby LED

This yellow LED lights when the instrument is in standby condition. In standby, the power switch is off but the instrument is still connected to the mains circuit by way of the power cord.

17. Line Power LED

This green LED lights when power is cycled on to the signal generator.

18. Power Switch

Pressing this hardkey turns power to the signal generator either on (green LED on) or to standby (yellow LED on).

19. Q INPUT Connector

This female BNC connector accepts an externally-supplied, analog, quadrature-phase component of I/Q modulation. The signal level is $\sqrt{I^2+Q^2}$ = 0.5 V_{rms}. The input impedance is 50Ω. The damage level is 1 V_{rms}. If you configure your instrument with Option 1EM, this input is relocated to a rear panel, female BNC connector.

20. I INPUT Connector

This female BNC connector accepts an externally-supplied, analog, in-phase component of I/Q modulation. The signal level is $\sqrt{I^2+Q^2}$ = 0.5 V. The input impedance is 50Ω. The damage level is 1 V_{rms}. If you configure your instrument with Option 1EM, this input is relocated to a rear panel, female BNC connector.

21. Display

The LCD display provides information on the current instrument state such as modulation status, frequency and amplitude settings, status indicators, and error messages. Softkey labels corresponding to their adjacent keys are located on the right-hand side of the display.

22. Hold Key

Press this hardkey to de-activate the current active function and blank the softkey menu. Once **Hold** is pressed, the front panel knob, the arrow keys, and the numeric keypad have no effect. To return to normal operation, press any front panel hardkey.

23. Softkeys

Press a softkey to activate the function indicated by the label on the display directly to the left of the softkey.

24. Knob

The knob increases or decreases a numeric value. Any of the values that can be set through the numeric keypad or the step keys can also be set using the knob.

25. Amplitude Key

Press this hardkey to activate the power level amplitude function so that you can change the amplitude of the RF output.

26. Frequency Key

Press this hardkey to activate the frequency function so that you can change the frequency of the RF output.

27. Save Key

This hardkey lets you save up to 100 different instrument states in a combination of 100 memory registers and 10 register sequences.

28. Menu Keys

These hardkeys provide access to the signal generator’s primary functionality. Press these keys for access to softkey menus where you can configure modulations, step and list sweeps, and various frequency and power capabilities.

29. Incr Set Key

Press this hardkey to cancel the highlighted digit in the active function display which allows you to enter an arbitrary increment size.

30. Recall Key

This hardkey lets you restore any instrument state that you previously saved in a memory register. You can save up to 100 different instrument states in a combination of 100 memory registers and 10 register sequences.

31. DATA Input Connector

This female BNC connector is only available on instruments with Option UN3 or UN4. The DATA connector accepts an externally-supplied data input for digital modulation applications. The expected input is a CMOS signal where a CMOS high is equivalent to a data 1 and a CMOS low is equivalent to a data 0. The maximum input data rate is 1.152 Mb/s. The leading edges must be synchronous with the DATA CLOCK rising edges. The data must be valid on the DATA CLOCK falling edges. The damage levels are > +8 and < –4 V. If you configure your instrument with Option 1EM, this input is relocated to a rear panel SMB connector.

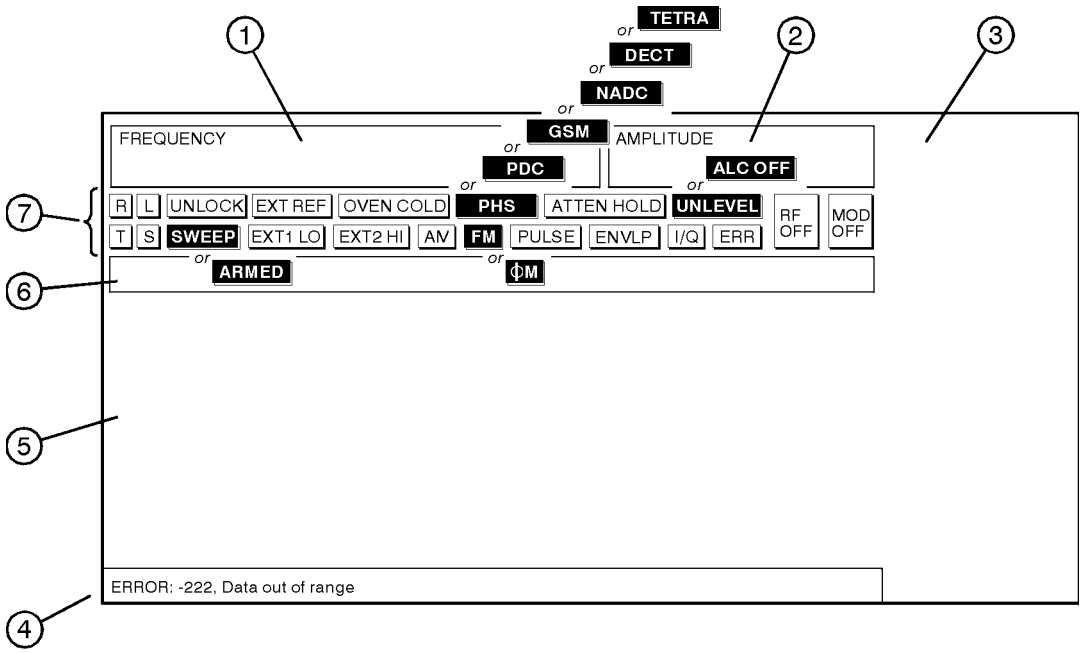
32. DATA CLOCK Input Connector

This front panel, female BNC connector is only available on instruments with Option UN3 or UN4. The DATA CLOCK connector accepts an externally-supplied data clock input for digital modulation applications. The expected input is a CMOS signal (either bit or symbol) where the rising edge is aligned with the beginning data bit. The CMOS falling edge is used to clock the DATA and SYMBOL SYNC signals. The maximum clock rate is 1.152 MHz. The damage levels are > +8 and < –4 V. If you configure your instrument with Option 1EM, this input is relocated to a rear panel SMB connector.

33. SYMBOL SYNC Input Connector

This front panel, female BNC connector is only available on instruments with Option UN3 or UN4. The SYMBOL SYNC connector accepts the digital modulation symbol synchronization signal from an external source. This signal synchronizes the serial multi-bit symbol transmission. The expected signal may be continuous or a single, one-bit wide pulse to synchronize the first bit of the first symbol. The CMOS rising edge must be synchronous with the DATA CLOCK rising edges. The synchronization signal must be valid on the DATA CLOCK falling edges. The damage levels are > +8 V and < –4 V. If you configure your instrument with Option 1EM, this input is relocated to a rear panel SMB connector.

Display Annotation



pk723a

1. Frequency Area

The current CW frequency setting is shown in this portion of the display. Indicators are also displayed in this area when a frequency offset or multiplier is set or if frequency reference mode is turned on.

2. Amplitude Area

The current output power level setting is shown in this portion of the display. Indicators are also displayed in this area when an amplitude offset is set or if amplitude reference mode is turned on.

3. Softkey Labels

These labels define the function of the corresponding softkeys immediately to the right of the label.

4. Error Messages Area

Error messages are reported in this space. When multiple error messages occur, only the most recent message remains displayed. All of the reported error messages can be viewed by pressing **Utility**, **Error Info**, **View Next Error Message**.

5. Text Area

This area is used to display status information about the signal generator such as the modulation status, to enter information such as creating sweep lists, and to manage information such as displaying the catalog of files and deleting unwanted files.

6. Active Entry Area

The current active function is shown in this area. For example, if frequency is the active function, the current setting will be displayed in the active entry area and that setting will change as you enter a new value. If the active function has an increment value associated with it, that value is displayed here also.

7. Annunciators

The display annunciators show the status of some of the signal generator functions and indicate error conditions of the instrument. The following annunciators are available:

ΦM This annunciator is turned on when phase modulation is turned on. A second annunciator, **FM**, will appear in the same position if frequency modulation is turned on. Frequency modulation and phase modulation cannot be turned on at the same time so the two annunciators will never conflict.

ALC OFF This annunciator is turned on when the automatic leveling control circuit is disabled. A second annunciator, **UNLEVEL**, will appear in the same position if the signal generator's automatic level control is unable to maintain the output level. When the ALC is disabled, the unleveled annunciator has no meaning so these annunciators will never conflict.

AM This annunciator is turned on when amplitude modulation is turned on.

ARMED This annunciator is turned on when a sweep has been initiated and the signal generator is waiting for the sweep trigger event.

ATTEN HOLD This annunciator is turned on when the attenuator hold function is turned on. When this function is on, the attenuator is frozen at its current setting.

DECT This annunciator is only present on instruments with Option UN3 or UN4. It is turned on when DECT modulation is turned on. Annunciators for other digital modulations are displayed in the same position as this annunciator. The modulations can never be turned on at the same time so the annunciators will never conflict.

ENVLP This annunciator is turned on if the burst envelope modulation turned on.

ERR This annunciator is turned on when an error message is placed in the error queue. This annunciator will not turn off until you clear the error queue of all error messages. You can view and delete error messages using the **Utility** menu.

EXT1 LO/HI This annunciator toggles between **EXT1 LO** and **EXT1 HI**. This annunciator is turned on if the AC-coupled signal to the EXT 1 input is less than 0.97 Vpk or greater than 1.03 Vpk.

EXT2 LO/HI This annunciator toggles between **EXT2 LO** and **EXT2 HI**. This annunciator is turned on if the AC-coupled signal to the EXT 2 input is less than 0.97 Vpk or greater than 1.03 Vpk.

EXT REF This annunciator is turned on when an external 1, 2, 5, or 10 MHz frequency reference is in use.

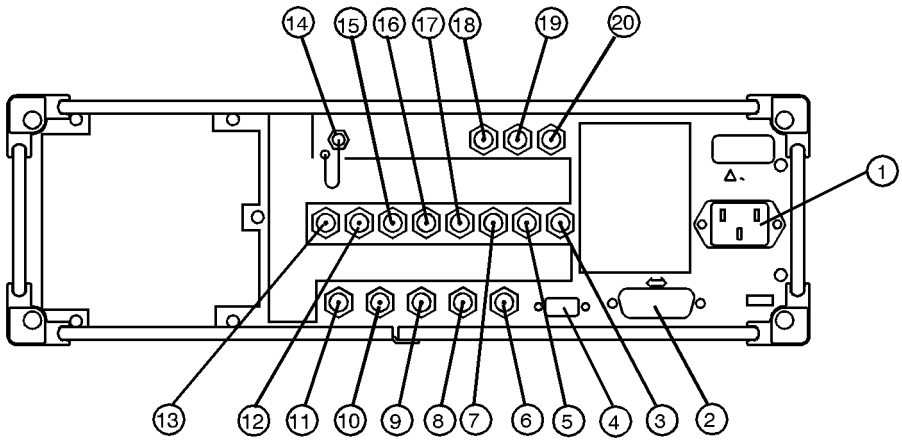
FM This annunciator is turned on when frequency modulation is turned on. A second annunciator, **ΦM**, will appear in the same position if phase modulation is turned on. Frequency modulation and phase modulation cannot be turned on at the same time so the two annunciators will never conflict.

GSM This annunciator is only present on instruments with Option UN3 or UN4. It is turned on when GSM modulation is turned on. Annunciators for other digital modulations are displayed in the same position as this annunciator. The modulations can never be turned on at the same time so the annunciators will never conflict.

I/Q	This annunciator is turned on when I/Q modulation is turned on.
L	The **L** annunciator is turned on when the signal generator is in the listen mode and receiving information or commands over the HP-IB.
MOD OFF	This annunciator toggles between **MOD OFF** and **MOD ON** and is always visible in the display. This annunciator indicates whether the modulations which you have enabled are modulating the RF carrier.
NADC	This annunciator is only present on instruments with Option UN3 or UN4. It is turned on when NADC modulation is turned on. Annunciators for other digital modulations are displayed in the same position as this annunciator. The modulations can never be turned on at the same time so the annunciators will never conflict.
OVEN COLD	This annunciator is turned on when the temperature of the internal ovenized reference oscillator (Option 1E5) has dropped below an acceptable level. When this annunciator is turned on, frequency accuracy will be degraded. This condition should only occur if the signal generator is disconnected from line power. The annunciator is timed and automatically turns off after a specified period of time.
PDC	This annunciator is only present on instruments with Option UN3 or UN4. It is turned on when PDC modulation is turned on. Annunciators for other digital modulations are displayed in the same position as this annunciator. The modulations can never be turned on at the same time so the annunciators will never conflict.
PHS	This annunciator is only present on instruments with Option UN3 or UN4. It is turned on when PHS modulation is turned on. Annunciators for other digital modulations are displayed in the same position as this annunciator. The modulations can never be turned on at the same time so the annunciators will never conflict.
PULSE	This annunciator is turned on when pulse modulation is turned on.
R	The **R** annunciator is turned on when the signal generator is in remote HP-IB operation.

RF OFF	This annunciator toggles between **RF OFF** and **RF ON** and is always visible in the display. This annunciator indicates whether the RF signal is present at the RF OUTPUT connector.
S	The **S** annunciator is turned on when the signal generator has generated a service request (SRQ) over the HP-IB.
SWEEP	This annunciator is turned on when the signal generator is sweeping in list or step mode.
T	The **T** annunciator is turned on when the signal generator is in the talk mode and is transmitting information over the HP-IB.
TETRA	This annunciator is only present on instruments with Option UN3 or UN4. It is turned on when TETRA modulation is turned on. Annunciators for other digital modulations are displayed in the same position as this annunciator. The modulations can never be turned on at the same time so the annunciators will never conflict.
UNLEVEL	This annunciator is turned on when the signal generator is unable to maintain the correct output level. The **UNLEVEL** annunciator is not necessarily an indication of instrument failure. Unleveled conditions can occur during normal operation, for example if I/Q modulation is turned on and no I/Q signals are connected. A second annunciator, **ALC OFF**, will appear in the same position when the automatic leveling control circuit is disabled. When the ALC is disabled, the **UNLEVEL** annunciator has no meaning so these annunciators will never conflict.
UNLOCK	This annunciator is turned on when any of the signal generator's phase locked loops are unable to maintain phase lock. You can determine which loop is unlocked by interrogating the error messages.

Rear Panel Overview



1. AC Power Receptacle

The power cord receptacle accepts a three-pronged cable that is shipped with the instrument. The line voltage is connected here.

2. HP-IB Connector

The HP-IB connector allows communications with compatible devices such as power meters and external controllers.

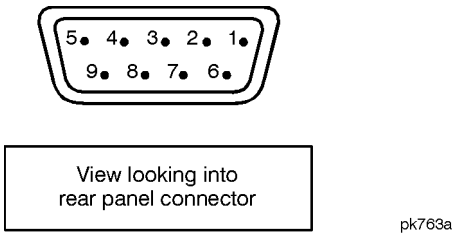
3. SYMBOL SYNC OUT Connector

This female BNC connector is only available on instruments with Option UN3 or UN4. The SYMBOL SYNC OUT connector outputs a symbol synchronization pulse, one data clock period wide, for use in digital modulation applications. The pulse output is synchronized with the first symbol in the internal pattern generator sequence. The damage levels are > +8 and < –4 V. If you configure your instrument with Option 1EM, this output is changed from a BNC to an SMB connector.

4. AUXILIARY INTERFACE Connector

This male DB-9 connector is an RS-232 serial port which can be used for remotely controlling the signal generator. The following table shows the description of the pinouts.

Pin Number	Signal Description	Signal Name
1	No Connection	
2	Receive Data	RECV
3	Transmit Data	XMIT
4	+5 V	
5	Ground, 0 V	
6	No Connection	
7	Request to Send	RTS
8	Clear to Send	CTS
9	No Connection	



5. DATA CLK OUT Connector

This female BNC connector is only available on instruments with Option UN3 or UN4. The DATA CLK OUT connector outputs a clock signal for digital modulation data. The output signal level is CMOS with the rising edge aligned with the beginning of the data bit and the falling edge occurring when the data and symbol synchronization signal are valid. The damage levels are > +8 and < –4 V. If you configure your instrument with Option 1EM, this output is changed from a BNC to an SMB connector.

6. SWEEP OUT Connector

This female BNC connector provides a voltage range of 0 to +10 V. When the signal generator is sweeping, the SWEEP OUT signal ranges from 0 V at the beginning of the sweep to +10 V at the end of the sweep regardless of the sweep width. In CW mode this connector has no output. The output impedance is less than 1Ω and can drive 2 kΩ.

7. DATA OUT Connector

This female BNC connector is only available on instruments with Option UN3 or UN4. The DATA OUT connector outputs digital modulation data sourced from an externally-supplied signal at the DATA input or from the internal pattern generator. The output signal level is a CMOS signal where a CMOS high is equivalent to a data 1 and a CMOS low is equivalent to a data 0. If you configure your instrument with Option 1EM, this output is changed from a BNC to an SMB connector.

8. TRIGGER OUT Connector

This female BNC connector outputs a TTL signal that is asserted high at the start of a dwell sequence, or at the start of waiting for the point trigger in manual sweep mode, and low when the dwell is over, or when the point trigger is received. The logic polarity can be reversed.

9. TRIGGER IN Connector

This female BNC connector accepts a TTL signal for triggering point-to-point in manual sweep mode. Triggering can occur on either the positive or negative edge. The damage level is ≥ +10 V or ≤ –4 V.

10. 10 MHz IN Connector

This female BNC connector accepts a –3.5 to +20 dBm signal from an external timebase reference which is within ±10 ppm (standard timebase) or ±1 ppm (high stability timebase). The nominal input impedance is 50Ω. The signal generator detects when a valid reference signal is present at this connector and automatically switches from internal to external reference operation.

11. 10 MHz OUT Connector

This female BNC connector provides a nominal signal level of +7 dBm ±2 dB, and output impedance of 50Ω. The accuracy is determined by the timebase used.

12. PATTERN TRIG IN Connector

This female BNC connector is only available on instruments with Option UN3 or UN4. This input accepts a CMOS low to CMOS high edge trigger. (Instruments with Option 1EH, the precursor to Options UN3 and UN4, require a TTL input). The minimum trigger input pulse width, high or low, is 100 ns. The input to the PATTERN TRIG IN connector is used to trigger the internal digital modulation pattern generator to start a single pattern output or to stop and re-synchronize a pattern that is being continuously output. The trigger edge is latched and then sampled by the falling edge of the internal data bit clock to synchronize the trigger with the data bit clock timing. The minimum delay from the trigger edge to the first bit of the frame is 1.5 to 2.5 bit clock periods. The damage levels are > +8 and < –4 V. If you configure your instrument with Option 1EM, this input is changed from a BNC to an SMB connector.

For more information on pattern triggering, refer to Chapter 7, “Operation”.

13. BURST GATE IN Connector

This female BNC connector is only available on instruments with Option UN3 or UN4. The BURST GATE IN connector accepts a CMOS signal for gating burst power in digital modulation applications. The burst gating is used when you are externally supplying data and clock information. The input signal must be synchronized with the external data input which will be output during the burst. The burst power envelope and modulated data are internally delayed and re-synchronized. The input signal must be CMOS high for normal burst RF power or CW RF output power and CMOS low for RF off. The leading edges must be synchronous with the DATA CLOCK rising edges. The signal level must be valid on the DATA CLOCK falling edge. The damage levels are > +8 and < –4 V. If you configure your instrument with Option 1EM, this output is changed from a BNC to an SMB connector.

14. COHERENT CARRIER OUT Connector

This SMA connector outputs RF which is not modulated with AM, pulse, or I/Q modulation, but is modulated with FM or ΦM. The output power is nominally 0 dBm ±5 dB. The output frequency range is from 249.99900001 MHz to the maximum specified frequency of your signal generator. If the RF output frequency is below this range, the COHERENT CARRIER OUT signal will have the following frequency: Frequency of coherent carrier = (1E9 – Frequency of RF output) in Hz. The damage levels are 20 Vdc and 13 dBm reverse RF power.

15. ALT PWR Connector

This connector is reserved for future use.

16. EVENT 1 Connector

This female BNC connector is only available on instruments with Option UN3 or UN4. The pulse output can be used to trigger the start of a data pattern, frame, or timeslot. It is adjustable to within plus or minus one timeslot with one bit of resolution. The damage levels are > +8 V and < –4 V. If you configure your instrument with Option 1EM, this output is changed from a BNC to an SMB connector.

17. EVENT 2 Connector

This female BNC connector is only available on instruments with Option UN3 or UN4. This connector outputs a data enable signal for gating external equipment. The output is applicable when the external data is clocked into internally-generated timeslots. Data is enabled when the signal is low. The damage levels are > +8 V and < –4 V. If you configure your instrument with Option 1EM, this output is changed from a BNC to an SMB connector.

18. 13 MHz IN Connector

This female BNC connector is only available on instruments with Option UN3 or UN4. The 13 MHz IN connector accepts a 0 to +20 dBm sinewave or TTL squarewave signal from an external 13 MHz timebase reference. This digital modulation reference clock is used by the internal pattern generator in GSM applications. (Only the internal digital data generator can be locked to this external reference; the RF frequency remains locked to the 10 MHz reference). The nominal input impedance is 50Ω at 13 MHz, AC-coupled. The damage levels are > +8 V and < –8 V. If you configure your instrument with Option 1EM, this output is changed from a BNC to an SMB connector.

19. I OUT Connector

This female BNC connector is only available on instruments with Option UN3 or UN4. The I OUT connector outputs the analog, calibrated, in-phase component of I/Q modulation from the internal baseband generator. The nominal output impedance of this connector is 50Ω, DC-coupled. The damage levels are > +2 V and < –2 V. The DC origin offset is typically < 10 mV. The output signal levels into a 50Ω load are as follows:

- 0.5 Vpk, typical, corresponds to one unit length of the I/Q vector.
- 0.69 Vpk (2.84 dB), typical, maximum crest factor for peaks for π/4 DQPSK with alpha = 0.5.
- 0.71 Vpk (3.08 dB), typical, maximum crest factor for peaks for π/4 DQPSK with alpha = 0.35.

If you configure your instrument with Option 1EM, this output is relocated from a BNC to an SMB connector.

20. Q OUT Connector

This female BNC connector is only available on instruments with Option UN3 or UN4. The Q OUT connector outputs the analog, calibrated, quadrature-phase component of I/Q modulation from the internal baseband generator. The nominal output impedance of this connector is 50Ω, DC-coupled. The damage levels are > +2 V and < –2 V. The DC origin offset is typically < 10 mV. The output signal levels into a 50Ω load are as follows:

- 0.5 Vpk, typical, corresponds to one unit length of the I/Q vector.
- 0.69 Vpk (2.84 dB), typical, maximum crest factor for peaks for π/4 DQPSK with alpha = 0.5.
- 0.71 Vpk (3.08 dB), typical, maximum crest factor for peaks for π/4 DQPSK with alpha = 0.35.

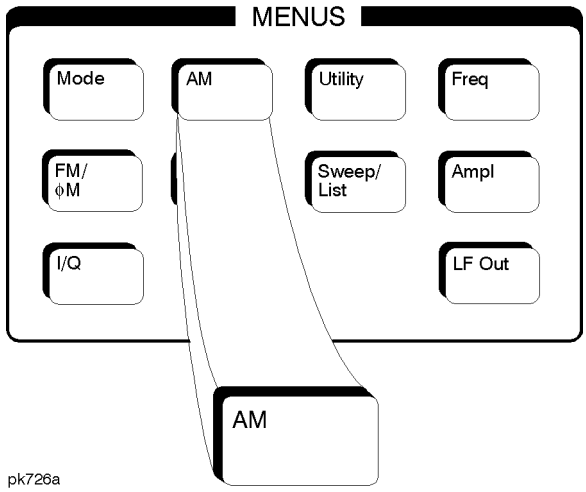
If you configure your instrument with Option 1EM, this output is relocated from a BNC to an SMB connector.

5 Hardkey and Softkey Reference

This chapter describes each front panel hardkey and each softkey associated with the hardkey. The SCPI programming commands are listed in addition to normal preset and power-on conditions. The chapter is organized alphabetically by front panel hardkey.

AM

Pressing the front panel **AM** key reveals a menu of softkeys. These softkeys are described in this section in alphabetical order.



AM Depth

This softkey sets the amplitude modulation depth, in percent, for the **AM Path 1** and **AM Path 2** configurations. To change the value of the AM depth, press the softkey once. The current value for AM depth is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **%** terminator softkey. The range of values allowed is 0.1 to 100%. The minimum increment allowed is 0.1%. Notice that the new value of AM depth applies only to whichever AM path configuration (**AM Path 1** or **AM Path 2**) you have currently selected.

Softkey Location: Press **AM**, **AM Depth**
or press **AM**, **AM Waveform**, **Dual-Sine**, **AM Depth**

Status after Normal Preset: 0.1%

SCPI Commands:

[:SOURce]:AM[1]|2[:DEPTh] <val><unit>

[:SOURce]:AM[1]|2[:DEPTh]?

AM Depth Couple Off On

This softkey toggles the AM depth coupling on and off. AM depth coupling links the AM depth values of **AM Path 1** and **AM Path 2**. When the values are coupled, any change you make to one AM depth value is applied to both AM depth values.

Softkey Location: Press **AM**, **AM Depth Couple Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:AM[1]|2[:DEPTh]:TRACk ON|OFF|1|0

[:SOURce]:AM[1]|2[:DEPTh]:TRACk?

AM Dual-Sine Ampl Ratio

Press this softkey to set the ratio of the depth of AM tone 2 to the depth of AM tone 1 as a percent. The range of values allowed is 0 to 100%. The minimum increment allowed is 0.1%. The sum of the two AM depths results in the total AM depth (set by the **AM Depth** softkey in the initial AM Menu.

For example, if the total AM depth is 30% and you set **AM Dual-Sine Ampl Ratio** to 50%, then the depth of AM tone 1 will be 20% and the depth of AM tone 2 will be 10% (50% of 20%) so that the depth of the two tones adds up to 30% (20% plus 10%).

Softkey Location: Press **AM**, **AM Waveform**, **Dual-Sine**, **AM Dual-Sine Ampl Ratio**

SCPI Commands:

[:SOURce]:AM[1]|2:INTernal[1]:FREQuency:ALTernate:AMPLitude:PERCent <val><unit>

[:SOURce]:AM[1]|2:INTernal[1]:FREQuency:ALTernate:AMPLitude:PERCent?

AM Off On

This softkey enables the amplitude modulation for whichever AM path configuration (**AM Path 1**, **AM Path 2**, or **AM Path WB**) you have selected. Notice, however, that although you can enable amplitude modulation with this softkey, the RF carrier is modulated by the enabled modulation only when you have also set **Mod On/Off** to **On**. Whenever amplitude modulation is enabled, the **AM** annunciator is turned on in the display.

There are two paths for AM modulation which can be simultaneously enabled as long as they use different sources (Int, Ext1, or Ext2). The modulation signals from both paths are summed internally for composite modulation.

Softkey Location: Press **AM**, **AM Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:AM[1]|2:STATe ON|OFF|1|0

[:SOURce]:AM[1]|2:STATe?

AM Path 1 2 WB

Use **AM Path 1** and **AM Path 2** to define two unique amplitude modulation configurations. For example, select **AM Path 1**. (**AM Path 1** is the default after a normal preset. If **AM Path 1** is not highlighted, press the **AM Path 1 2 WB** softkey until the selection toggles to **AM Path 1**.) Configure the modulation characteristics (such as depth, source, rate, and waveform) using the remaining softkeys in the AM menu. Then enable AM by setting **AM Off On** to **On**.

To configure a second amplitude modulation configuration, toggle to **AM Path 2**. Define the modulation characteristics for this second configuration and enable AM by setting **AM Off On** to **On**.

The RF carrier is available at the RF OUTPUT connector when you set **RF On/Off** to **On**. Set **Mod On/Off** to **On** to modulate the RF carrier with the modulations that you have enabled.

AM Path 1 and **AM Path 2** are summed internally for composite modulation. Either path can be switched to any one of the modulation sources: Int, Ext1, or Ext2. All modulation types can be simultaneously enabled, except FM with ΦM, AM with external burst source, and wideband AM with I/Q. AM, FM, and ΦM can sum simultaneous inputs from any two sources (Int, Ext1, and Ext2). Any given source (Int, Ext1, or Ext2) can only be routed to one activated modulation type.

The wideband AM selection (**AM Path WB**) eliminates the bandwidth limitations of the ALC loop thereby increasing the bandwidth beyond that of the standard amplitude modulation. Typical rates for wideband AM are listed in Chapter 9, "Specifications." When you select **AM Path WB** in the AM menu, you must apply your modulating signal to the I input. The sensitivity is 0.5 V = 100% AM depth. With **AM Path WB** selected, the modulated RF signal will be available at the RF OUTPUT connector when you turn on both **Mod On/Off** and **RF On/Off**.

Softkey Location: Press **AM**, **AM Path 1 2 WB**

Status after Normal Preset: AM Path 1

SCPI Commands:

[:SOURce]:AM:WIDeband:STATe ON|OFF|1|0

[:SOURce]:AM:WIDeband:STATe?

AM Rate

Use this softkey to change the internal modulation frequency for the **AM Path 1** and **AM Path 2** configurations. To change the value, press the softkey once. The current value for AM rate is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Hz** or **kHz** terminator softkey. The range of values allowed is 0.1 Hz to 10 kHz. (0.1 Hz to 50 kHz is the range allowed if sinewave is selected as the internal waveform.) The minimum increment allowed is 0.1 Hz. Notice that the new value of AM rate applies only to whichever AM configuration (**AM Path 1** or **AM Path 2**) you have currently selected.

Softkey Location: Press **AM**, **AM Rate**

Status after Normal Preset: 400 Hz

SCPI Commands:

[:SOURce]:AM[1]|2:INTernal[1]:FREQuency <val><unit>

[:SOURce]:AM[1]|2:INTernal[1]:FREQuency?

AM Source

Pressing this softkey reveals a menu of choices for amplitude modulation sources. You can choose internally-generated amplitude modulation or select an externally-applied signal from either the EXT 1 INPUT or EXT 2 INPUT connectors. The internal modulation is always AC-coupled. For the externally-applied signals, you can choose between AC- and DC-coupled modulation. A 1.0 Vpk input is required for calibrated AM depth settings. The **EXT 1 LO/HI** and **EXT 2 LO/HI** display annunciators will turn on if the peak input voltage differs from 1.0 Vpk by more than 3%. (The LO/HI annunciators only function for AC-coupled external inputs.)

The internal and external 1 and 2 sources have multiple uses. You can use them for amplitude, frequency, and phase modulation. For burst modulation, you can only use the external 1 source and you must use the external 2 source for pulse modulation. However, any given source can only be routed to one enabled modulation at a time. If, for example, you were using the external 1 source in a frequency modulation configuration for **FM Path 1**, and then you configured **AM Path 2** to also use the external 1 source, the signal generator would turn off **FM Path 1** and assign the external 1 source to your **AM Path 2** configuration. Notice that for these purposes the external 1 AC-coupled source is the same as the external 1 DC-coupled source and the external 2 AC-coupled source is the same as the external 2 DC-coupled source.

Softkey Location: Press **AM**, **AM Source**

Status after Normal Preset: INT

SCPI Commands:

[:SOURce]:AM[1]|2:SOURce?

AM Start Rate

Use this softkey to change the starting internal modulation frequency for swept-sine amplitude modulation. To change the value, press the softkey once. The current value for the AM start rate is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Hz** or **kHz** terminator softkey. The range of values allowed is 0.1 Hz to 50 kHz. The minimum increment allowed is 0.1 Hz.

This softkey is coupled to the **AM Rate** softkey in the initial AM Menu and the **AM Tone 1 Rate** softkey in the AM Dual-Sine Menu. Any value set for **AM Start Rate** is reflected in the **AM Rate** and **AM Tone 1 Rate** softkeys. Conversely, if you change the value for either the **AM Rate** softkey or the **AM Tone 1 Rate** softkey, the value for **AM Start Rate** is changed to match.

Softkey Location: Press **AM**, **AM Waveform**, **Swept-Sine**, **AM Start Rate**

Status after Normal Preset: 400.0 Hz

SCPI Commands:

[:SOURce]:AM[1]|2:INTernal[1]:FREQuency <val><unit>

[:SOURce]:AM[1]|2:INTernal[1]:FREQuency?

AM Stop Rate

Use this softkey to change the ending internal modulation frequency for swept-sine amplitude modulation. To change the value, press the softkey once. The current value for the AM stop rate is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Hz** or **kHz** terminator softkey. The range of values allowed is 0.1 Hz to 50 kHz. The minimum increment allowed is 0.1 Hz.

This softkey is coupled to the **AM Tone 2 Rate** softkey in the AM Dual-Sine Menu. Any value set for **AM Stop Rate** is reflected in the **AM Tone 2 Rate** softkey. Conversely, if you change the value for the **AM Tone 2 Rate** softkey, the value for **AM Stop Rate** is changed to match.

Softkey Location: Press **AM**, **AM Waveform**, **Swept-Sine**, **AM Stop Rate**

Status after Normal Preset: 400.0 Hz

SCPI Commands:

[:SOURce]:AM[1]|2:INTernal[1]:FREQuency:ALTernate <val><unit>

[:SOURce]:AM[1]|2:INTernal[1]:FREQuency:ALTernate?

AM Sweep Time

Press this softkey to set the sweep time for swept-sine amplitude modulation. The signal generator will vary the AM rate from the specified start rate to the stop rate in the time set with this softkey. Enter the desired sweep time using the up and down arrow keys, the front panel knob, or enter a value using the numeric keypad and press the **sec** or **msec** terminator softkey. The range of values allowed is 1 ms through 65.535 s. The minimum increment allowed is 1 ms.

Softkey Location: Press **AM**, **AM Waveform**, **Swept-Sine**, **AM Sweep Time**

Status after Normal Preset: 100.0 msec

SCPI Commands:

[:SOURce]:AM[1]|2:INTernal[1]:SWEep:TIME <val><unit>

[:SOURce]:AM[1]|2:INTernal[1]:SWEep:TIME?

AM Sweep Trigger

Pressing this softkey reveals a menu of choices for triggering swept-sine amplitude modulation. You can choose triggering that occurs immediately, triggering that is supplied by the HP-IB, triggering on either the positive or negative edge of a signal supplied to the TRIGGER IN connector, or triggering by the front panel **Trigger** key.

Softkey Location: Press **AM**, **AM Waveform**, **Swept-Sine**, **AM Sweep Trigger**

Status after Normal Preset: Immediate

SCPI Commands:

:TRIGger[:SEQuence]:SOURce?

AM Tone 1 Rate

Press this softkey to set the internal modulation frequency for the AM tone 1. Enter the desired rate using the up and down arrow keys, the front panel knob, or enter a value using the numeric keypad and press the **kHz** or **Hz** terminator softkey. The range of values allowed is 0.1 Hz through 50 kHz. The minimum increment allowed is 0.1 Hz.

This softkey is coupled to the **AM Rate** softkey in the initial AM Menu and the **AM Start Rate** softkey in the AM Swept-Sine Menu. Any value set for **AM Tone 1 Rate** is reflected in the **AM Rate** and **AM Start Rate** softkeys. Conversely, if you change the value for either the **AM Rate** softkey or the **AM Start Rate** softkey, the value for **AM Tone 1 Rate** is changed to match.

Softkey Location: Press **AM**, **AM Waveform**, **Dual-Sine**, **AM Tone 1 Rate**

Status after Normal Preset: 400.0 Hz

SCPI Commands:

[:SOURce]:AM[1]|2:INTernal[1]:FREQuency <val><unit>

[:SOURce]:AM[1]|2:INTernal[1]:FREQuency?

AM Tone 2 Rate

Press this softkey to set the internal modulation frequency for the AM tone 2. Enter the desired rate using the up and down arrow keys, the front panel knob, or enter a value using the numeric keypad and press the **kHz** or **Hz** terminator softkey. The range of values allowed is 0.1 Hz through 50 kHz. The minimum increment allowed is 0.1 Hz.

This softkey is coupled to the **AM Rate** softkey in the initial AM Menu and the **AM Stop Rate** softkey in the AM Swept-Sine Menu. Any value set for **AM Tone 2 Rate** is reflected in the **AM Rate** and **AM Stop Rate** softkeys. Conversely, if you change the value for either the **AM Rate** softkey or the **AM Stop Rate** softkey, the value for **AM Tone 2 Rate** is changed to match.

Softkey Location: Press **AM**, **AM Waveform**, **Dual-Sine**, **AM Tone 2 Rate**

Status after Normal Preset: 400.0 Hz

SCPI Commands:

[:SOURce]:AM[1]|2:INTernal[1]:FREQuency:ALTernate <val><unit>

[:SOURce]:AM[1]|2:INTernal[1]:FREQuency:ALTernate?

AM Waveform

Pressing this softkey reveals a menu of AM waveform choices for your **AM Path 1** and **AM Path 2** configurations. Select from sine, triangle, square, ramp, noise, dual-sine, and swept-sine waveforms. Notice that your waveform selection applies only to whichever AM path configuration you have currently selected.

Softkey Location: Press **AM**, **AM Waveform**

Status after Normal Preset: Sine

SCPI Commands:

[:SOURce]:AM[1]|2:INTernal[1]:FUNCTion:SHAPe?

Bus

This softkey is one of the choices in the AM Sweep Trigger menu. With **Bus** selected, you use the HP-IB to trigger single sweeps of swept-sine amplitude modulation.

Softkey Location: Press **AM**, **AM Waveform**, **Swept-Sine**, **AM Sweep Trigger**, **Bus**

Status after Normal Preset: AM sweep trigger is set to Immediate

SCPI Commands:

[:SOURce]:AM[1]|2:INTernal[1]:SWEep:TRIGger BUS

[:SOURce]:AM[1]|2:INTernal[1]:SWEep:TRIGger?

Dual-Sine

Pressing this softkey reveals a menu of choices for setting the dual-sine amplitude modulation parameters. In this menu you can set the AM rates for two separate tones. In addition, you can set the AM depth for **AM Path 1** and **AM Path 2** and also set a ratio of the tone 2 AM depth to the tone 1 AM depth.

Softkey Location: Press **AM**, **AM Waveform**, **Dual-Sine**

SCPI Commands:

[:SOURce]:AM[1]|2:INTernal[1]:FUNCtion:SHAPe DUALsine

[:SOURce]:AM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Ext

This softkey is one of the choices in the AM Sweep Trigger menu. Choosing **Ext** allows you to trigger swept-sine amplitude modulation using the signal applied to the TRIGGER IN rear panel connector. Set the polarity of the trigger signal using the **Trigger In Polarity Neg Pos** softkey.

Softkey Location: Press **AM**, **AM Waveform**, **Swept-Sine**, **AM Sweep Trigger**, **Ext**

Status after Normal Preset: AM sweep trigger is set to Immediate

SCPI Commands:

[:SOURce]:AM[1]|2:INTernal[1]:SWEep:TRIGger EXTernal

[:SOURce]:AM[1]|2:INTernal[1]:SWEep:TRIGger?

Ext 1 AC-Coupled

This softkey lets you input an external, AC-coupled, amplitude modulation signal to the EXT 1 INPUT connector. The modulation signal is tested for voltage and a display annunciator will report a high or low condition if the voltage is > ±3% of 1 Vpk.

The external 1 input has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 1 input in a frequency modulation configuration for **FM Path 1**, and then you configured **AM Path 2** to also use the external 1 input, the signal generator would turn off **FM Path 1** and assign the external 1 input to your **AM Path 2** configuration. (For the purpose of this discussion, the external 1 AC-coupled input is the same as the external 1 DC-coupled input.)

Softkey Location: Press **AM**, **AM Source**, **Ext 1 AC-Coupled**

Status after Normal Preset: AM Source is set to Internal

SCPI Commands:

[:SOURce]:AM[1]|2:SOURce EXTernal1

[:SOURce]:AM[1]|2:EXTernal[1]:COUPling AC

[:SOURce]:AM[1]|2:EXTernal[1]:COUPling?

Ext 1 DC-Coupled

This softkey lets you input an external, DC-coupled, amplitude modulation signal to the EXT 1 INPUT connector.

The external 1 input has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 1 input in a frequency modulation configuration for **FM Path 1**, and then you configured **AM Path 2** to also use the external 1 input, the signal generator would turn off **FM Path 1** and assign the external 1 input to your **AM Path 2** configuration. (For the purpose of this discussion, the external 1 AC-coupled input is the same as the external 1 DC-coupled input.)

Softkey Location: Press **AM**, **AM Source**, **Ext 1 DC-Coupled**

Status after Normal Preset: AM Source is set to Internal

SCPI Commands:

[:SOURce]:AM[1]|2:SOURce EXTernal1

[:SOURce]:AM[1]|2:EXTernal[1]:COUPling DC

[:SOURce]:AM[1]|2:EXTernal[1]:COUPling?

Ext 2 AC-Coupled

This softkey lets you input an external, AC-coupled, amplitude modulation signal to the EXT 2 INPUT connector. The modulation signal is tested for voltage and a display annunciator will report a high or low condition if the voltage is > ±3% of 1 Vpk.

The external 2 input has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 2 input in a frequency modulation configuration for **FM Path 1**, and then you configured **AM Path 2** to also use the external 2 input, the signal generator would turn off **FM Path 1** and assign the external 2 input to your **AM Path 2** configuration. (For the purpose of this discussion, the external 2 AC-coupled input is the same as the external 2 DC-coupled input.)

Softkey Location: Press **AM**, **AM Source**, **Ext 2 AC-Coupled**

Status after Normal Preset: AM Source is set to Internal

SCPI Commands:

[:SOURce]:AM[1]|2:SOURce EXTernal2

[:SOURce]:AM[1]|2:EXTernal2:COUPling AC

[:SOURce]:AM[1]|2:EXTernal2:COUPling?

Ext 2 DC-Coupled

This softkey lets you input an external, DC-coupled, amplitude modulation signal to the EXT 2 INPUT connector.

The external 2 input has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 2 input in a frequency modulation configuration for **FM Path 1**, and then you configured **AM Path 2** to also use the external 2 input, the signal generator would turn off **FM Path 1** and assign the external 2 input to your **AM Path 2** configuration. (For the purpose of this discussion, the external 2 AC-coupled input is the same as the external 2 DC-coupled input.)

Softkey Location: Press **AM**, **AM Source**, **Ext 2 DC-Coupled**

Status after Normal Preset: AM Source is set to Internal

SCPI Commands:

[:SOURce]:AM[1]|2:SOURce EXTernal2

[:SOURce]:AM[1]|2:EXTernal2:COUPling DC

[:SOURce]:AM[1]|2:EXTernal2:COUPling?

Immediate

This softkey is one of the choices in the AM Sweep Trigger menu. Choosing **Immediate** immediately triggers swept-sine amplitude modulation in a continuous mode. To stop the sweep, choose a different trigger such as **Ext**, or set the waveform to something other than **Swept-Sine**.

Softkey Location: Press **AM**, **AM Waveform**, **Swept-Sine**, **AM Sweep Trigger**, **Immediate**

Status after Normal Preset: AM sweep trigger is set to Immediate

SCPI Commands:

[:SOURce]:AM[1]|2:INTernal[1]:SWEep:TRIGger IMMediate

[:SOURce]:AM[1]|2:INTernal[1]:SWEep:TRIGger?

Internal

This softkey lets you connect an internally-generated, calibrated signal to the AM modulator. The default state of the internal waveform generator is a 400 Hz sinewave with 0.1% depth.

The internal source has multiple uses but can be used for only one modulation at a time. If, for example, you were using the internal source in a frequency modulation configuration for **FM Path 1**, and then you configured **AM Path 2** to also use the internal source, the signal generator would turn off **FM Path 1** and assign the internal source to your **AM Path 2** configuration.

Softkey Location: Press **AM**, **AM Source**, **Internal**

SCPI Commands:

[:SOURce]:AM[1]|2:SOURce INT[1]

[:SOURce]:AM[1]|2:SOURce?

Noise

This softkey lets you specify noise as the amplitude modulation waveform for the **AM Path 1** and **AM Path 2** configurations. Notice that the selected waveform applies only to whichever AM path configuration you have currently selected.

Softkey Location: Press **AM**, **AM Waveform**, **Noise**

SCPI Commands:

[:SOURce]:AM[1]|2:INTernal[1]:FUNCtion:SHAPe NOISe

[:SOURce]:AM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Ramp

This softkey lets you specify ramp as the amplitude modulation waveform for the **AM Path 1** and **AM Path 2** configurations. Notice that the selected waveform applies only to whichever AM path configuration you have currently selected.

Softkey Location: Press **AM**, **AM Waveform**, **Ramp**

SCPI Commands:

[:SOURce]:AM[1]|2:INTernal[1]:FUNCtion:SHAPe RAMP

[:SOURce]:AM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Sine

This softkey lets you specify sine as the amplitude modulation waveform for the **AM Path 1** and **AM Path 2** configurations. Notice that the selected waveform applies only to whichever AM path configuration you have currently selected.

Softkey Location: Press **AM**, **AM Waveform**, **Sine**

SCPI Commands:

[:SOURce]:AM[1]|2:INTernal[1]:FUNCtion:SHAPe SINE

[:SOURce]:AM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Square

This softkey lets you specify square as the amplitude modulation waveform for the **AM Path 1** and **AM Path 2** configurations. Notice that the selected waveform applies only to whichever AM path configuration you have currently selected.

Softkey Location: Press **AM**, **AM Waveform**, **Square**

SCPI Commands:

[:SOURce]:AM[1]|2:INTernal[1]:FUNCtion:SHAPe SQUare

[:SOURce]:AM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Swept-Sine

Pressing this softkey reveals a menu of choices for setting the swept-sine amplitude modulation parameters. In this menu you can set the start and stop AM rate and the sweep time. You can set the signal generator to a single, externally-triggered sweep on either a negative or positive TTL level or you can choose continuous sweep, triggered immediately. In this menu you can also select either a positive or negative polarity for the TRIGGER OUT signal.

Softkey Location: Press **AM**, **AM Waveform**, **Swept-Sine**

SCPI Commands:

[:SOURce]:AM[1]|2:INTernal[1]:FUNCtion:SHAPe SWEPtsine

[:SOURce]:AM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Triangle

This softkey lets you specify triangle as the amplitude modulation waveform for the **AM Path 1** and **AM Path 2** configurations. Notice that the selected waveform applies only to whichever AM path configuration you have currently selected.

Softkey Location: Press **AM**, **AM Waveform**, **Triangle**

SCPI Commands:

[:SOURce]:AM[1]|2:INTernal[1]:FUNCtion:SHAPe TRIangle

[:SOURce]:AM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Trigger In Polarity Neg Pos

Press this softkey to toggle between a negative TTL level trigger (0 V) and a positive TTL level trigger (+5 V) for externally triggering swept-sine amplitude modulation.

This softkey is coupled to the **Trigger In Polarity Neg Pos** softkey for swept-sine FM, ΦM, and LF Out, and to the **Ext Neg** and **Ext Pos** sweep trigger selections in the Sweep/List Menu. If you set the **Trigger In Polarity Neg Pos** softkey in the AM Swept-Sine Menu to **Neg**, the **Trigger In Polarity Neg Pos** softkey is also set to **Neg** for swept-sine FM, ΦM, and LF Out. In addition, if the step or list sweep is set to externally trigger, the selection will automatically be set to **Ext Neg**. The same softkeys will toggle to **Pos** or to **Ext Pos** if you select **Pos** in the Swept-Sine AM Menu.

Conversely, if the **Trigger In Slope Neg Pos** softkey is toggled in the swept-sine FM, ΦM, or LF Out menus, it will cause the swept-sine AM softkey to toggle also. This is also true for the **Ext Neg** and **Ext Pos** step or list sweep trigger selections.

Softkey Location: Press **AM**, **AM Waveform**, **Swept-Sine**, **Trigger In Polarity Neg Pos**

Status after Normal Preset: Pos

SCPI Commands:

:TRIGger[:SEQuence]:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:SLOPe?

Trigger Key

This softkey is one of the choices in the AM Sweep Trigger menu. With **Trigger Key** selected, when you press the **Trigger** front panel key you immediately trigger a single sweep of swept-sine amplitude modulation.

The **Trigger** key has autorepeat capability. Hold it down and you will repeatedly trigger sweeps until you release the key.

Softkey Location: Press **AM**, **AM Waveform**, **Swept-Sine**, **AM Sweep Trigger**, **Trigger Key**

Status after Normal Preset: AM sweep trigger is set to Immediate

SCPI Commands:

[:SOURce]:AM[1]|2:INTernal[1]:SWEep:TRIGger KEY

[:SOURce]:AM[1]|2:INTernal[1]:SWEep:TRIGger?

Trigger Out Polarity Neg Pos

This softkey toggles the polarity of the TTL signal that is output at the rear panel TRIGGER OUT connector. When **Trigger Out Polarity Neg Pos** is set to **Pos**, the output signal is asserted high (+5 V) at the start of the swept-sine amplitude modulation sweep and low (0 V) when the sweep is concluded. Setting **Trigger Out Polarity Neg Pos** to **Neg** reverses the polarity, where a high is 0 V and a low is +5 V.

This softkey is coupled to the **Trigger Out Polarity Neg Pos** softkey in the swept-sine FM, ΦM, and LF Out menus and the sweep/list menu. When the polarity is toggled for this softkey in any one of these menus, it affects all locations of the softkey.

Softkey Location: Press **AM**, **AM Waveform**, **Swept-Sine**, **Trigger Out Polarity Neg Pos**

Status after Normal Preset: Pos

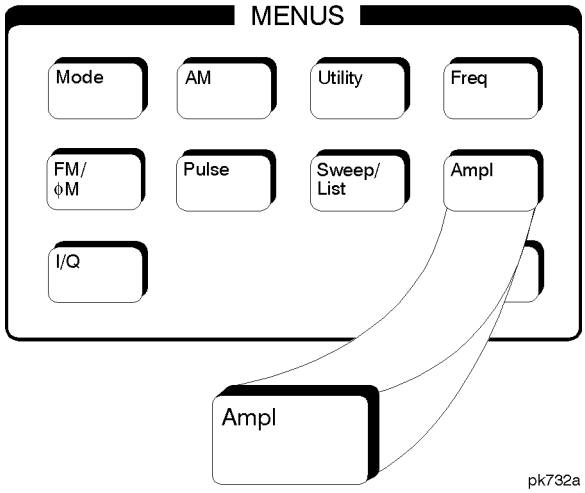
SCPI Commands:

:TRIGger:OUTPut:POLarity POSitive|NEGative

:TRIGger:OUTPut:POLarity?

Ampl

Pressing the front panel **Ampl** key reveals a menu of softkeys. These softkeys are described in this section in alphabetical order.



ALC BW Normal Narrow

Press this softkey to toggle between ALC normal and narrow bandwidth modes. The bandwidth is automatically set to narrow when external I/Q modulation is turned on, and automatically set to normal when I/Q modulation is turned off. Setting **ALC BW Normal Narrow** to **Narrow** limits the bandwidth to 100 Hz which can improve EVM. Narrow bandwidth mode may, however, also slow the settling time for frequency changes to as much as 40 ms. This softkey is inactive when internal I/Q modulation is turned on.

Softkey Location: Press **Ampl**, **ALC BW Normal Narrow**

Status after Normal Preset: Normal

SCPI Commands:

[:SOURce]:DM:EXTernal:ALC:BWIDth|BANDwidth NORMal|NARRow

[:SOURce]:DM:EXTernal:ALC:BWIDth|BANDwidth?

ALC Off On

This softkey toggles the automatic leveling control (ALC) circuit off and on.

The ALC is normally on. The RF output power of the signal generator is constantly monitored and controlled by the ALC circuit. Its purpose is to hold output power at its desired level in spite of drift due to temperature and time.

There are some modulation conditions which the ALC circuit cannot handle properly which lead to output level errors. In these conditions, better power level accuracy can be obtained by turning the ALC off and using power search. (Refer to the **Power Search Manual Auto** softkey documented in this section for more information about power search.) ALC Off is useful with pulse modulation with a pulse width narrower than 2 µs and with certain external I/Q modulation.

Pulse modulation is accomplished using a modulator which precedes the ALC detector. The ALC must, therefore, measure a pulsed signal, and it is able to do this if the pulse width exceeds 2 µs. For narrower pulses, set the **ALC** softkey to **Off**.

With external I/Q modulation, the ALC loop acts to hold the signal generator's average output power constant, in spite of variations in the I/Q input power ($I^2 + Q^2$). Rapid variations of ($I^2 + Q^2$) propagate to the output, while slow variations are removed by the ALC loop, with a high-pass corner of 1 kHz. If you do not want this high-pass filtering, set the **ALC Off On** softkey to **Off**. With ALC off, the I/Q modulation will be DC-coupled. Using power search, power level accuracy is preserved if $\sqrt{I^2+Q^2}$ = 0.5 V_{rms}.

When ALC is off, the **ALC OFF** display annunciator will turn on.

NOTE: An alternative to setting the ALC off is to set the ALC bandwidth to narrow. See the **ALC BW Normal Narrow** softkey in the this section.

Softkey Location: Press **Ampl**, **ALC Off On**

Status after Normal Preset: On

SCPI Commands:

[:SOURce]:POWer:ALC[:STATe] ON|OFF|1|0

[:SOURce]:POWer:ALC[:STATe]?

Ampl Offset

Press this softkey to set a value for amplitude offset. An amplitude offset changes the value shown in the amplitude area of the display but does not affect the output power. For example, if the current output power is 0 dBm and you enter an amplitude offset of –3 dBm, the output power will remain at 0 dBm but the display will show an amplitude of –3 dBm. This feature lets you simulate the power level at a test point beyond the RF OUTPUT connector.

An amplitude offset can be entered at any time during normal operation and also when you are operating in amplitude reference mode. To enter an offset, press **Ampl Offset** and enter the desired offset value using the up and down arrow keys, the front panel knob, or enter a value using the numeric keypad and press the **dB** terminator softkey. When a non-zero offset has been entered, the **OFFSET** indicator is turned on in the amplitude area of the display.

Softkey Location: Press **Ampl**, **More 1 of 2**, **Ampl Offset**

Status after Normal Preset: 0.00 dB

SCPI Commands:

[:SOURce]:POWer[:LEVel][:IMMediate]:OFFSet <val><unit>

[:SOURce]:POWer[:LEVel][:IMMediate]:OFFSet?

Ampl Ref Set

This softkey sets the current output power as an amplitude reference value. It also causes the **Ampl Ref Off On** softkey to toggle to the **On** position, turning on amplitude reference mode. All amplitude parameters are then set as relative to the reference value.

Softkey Location: **Ampl**, **More 1 of 2**, **Ampl Ref Set**

Status after Normal Preset: 0.0 dBm

SCPI Commands:

[:SOURce]:POWer:REFerence <val><unit>

[:SOURce]:POWer:REFerence?

Ampl Ref Off On

This softkey toggles the amplitude reference mode on and off. When amplitude reference mode is turned on, the amplitude value displayed is equal to the current hardware output power minus the reference value set by the **Ampl Ref Set** softkey. (The **Ampl Ref Set** softkey sets the reference value equal to the current output power. If you have not yet set the reference value, the normal preset value for amplitude reference is 0 dBm.) The **REF** indicator is turned on in the amplitude area of the display. All amplitude parameters will now be set as relative to the reference value.

Amplitude offsets can be used with amplitude reference mode. In this situation, the display will show the amplitude calculated as the current hardware output power minus the reference value plus the amplitude offset.

Amplitude reference mode only changes the display; it does not change the RF output power. For example, if you set your RF output power to –20 dBm, set your reference value, and then turn amplitude reference mode on, your display shows your amplitude as 0 dB but your output power remains at –20 dBm.

Softkey Location: Press **Ampl**, **More 1 of 2**, **Ampl Ref Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:POWer:REFerence:STATe ON|OFF|1|0

[:SOURce]:POWer:REFerence:STATe?

Atten Hold Off On

This softkey toggles the attenuator hold function on and off. Turn attenuator hold on to freeze the attenuator at it's current setting. The **ATTN HOLD** display annunciator will turn on. Use this function at any time you want to guarantee that there will be no power discontinuity normally associated with the attenuator switching during power adjustments. (When the attenuator is held, only a frequency change will change the attenuator setting. There will be no attenuator switching during power adjustments.) With attenuator hold on, the maximum power adjustment range will vary. However, you will have at least +4 dB and at least –13 dB range.

Softkey Location: Press **Ampl**, **Atten Hold Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:POWer:ATTenuation:AUTO ON|OFF|1|0

[:SOURce]:POWer:ATTenuation:AUTO?

Do Power Search

Press this softkey to execute the power search routine one time. Power search is an internal calibration routine used to achieve calibrated output power when the ALC is off. You can execute a power search at any time by pressing this softkey. You do not need to disconnect modulation inputs, however modulation is disabled during power search. If you are using external I/Q modulation, the power search routine assumes that the I/Q input level is $\sqrt{I^2+Q^2}$ = 0.5 V_{rms}. Actual output amplitude will scale directly with $\sqrt{I^2+Q^2}$.

The following conditions must be met in order to execute the power search routine:

- **ALC Off On** is set to **Off**
- **RF On/Off** is set to **On**

Softkey Location: Press **Ampl**, toggle **ALC Off On** softkey to **Off**, press **Do Power Search**

SCPI Commands:

[:SOURce]:POWer:ALC:SEARch ONCE

Power Search Manual Auto

This softkey toggles between the auto and manual modes of power search mode. Power search is an internal calibration routine used to achieve calibrated output power when the ALC is off. When you set **Power Search Manual Auto** to **Auto**, power search will execute automatically with each change to the RF frequency or power, and also with each change to the AM, burst, pulse, or I/Q modulation state. You do not need to disconnect modulation inputs, however modulation is disabled during power search. If you are using external I/Q modulation, the power search routine assumes that the I/Q input level is $\sqrt{I^2+Q^2}$ = 0.5 V_{rms}. Actual output amplitude will scale directly with $\sqrt{I^2+Q^2}$.

When you set **Power Search Manual Auto** to **Manual**, the power search routine is not run until the **Do Power Search** softkey is pressed. As with auto mode, you do not need to disconnect modulation inputs during power search, however modulation is disabled during the power search.

The following conditions must be met in order to engage either power search mode:

- **ALC Off On** is set to **Off**
- **RF On/Off** is set to **On**

Softkey Location: Press **Ampl**, toggle **ALC Off On** softkey to **Off**, press **Power Search Manual Auto**

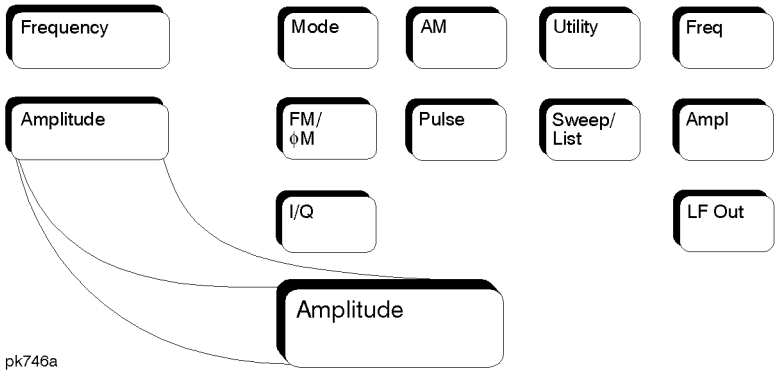
Status after Normal Preset: Manual

SCPI Commands:

[:SOURce]:POWer:ALC:SEARch ON|OFF|1|0|ONCE

[:SOURce]:POWer:ALC:SEARch?

Amplitude



Press this front panel hardkey to change the RF output power. Amplitude becomes the active function and the current value is shown in the active entry area of the display. To enter a new value for amplitude, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **dBm**, **dBuV**, **dBuVemf**, **mV**, **uV**, **mVemf**, or **uVemf** terminator softkey. The output power range allowed depends on your instrument model. Refer to Chapter 9, “Specifications.”

The current RF output power level is always shown in the amplitude area of the display except under the following conditions:

- Amplitude reference mode is turned on
- An offset is applied
- A step or list amplitude sweep is in process
- The RF Off On front panel key is off

The amplitude area of the display is blanked whenever an amplitude sweep is selected.

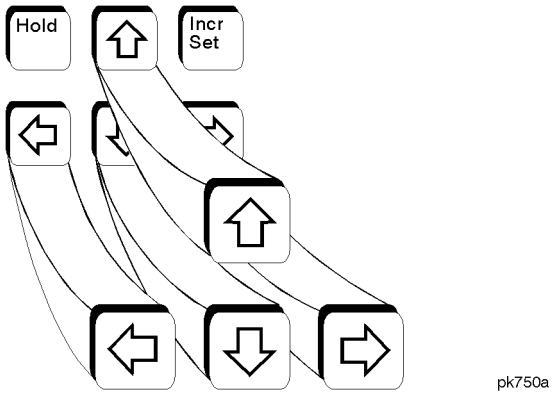
Status after Normal Preset: –135 dBm

SCPI Commands:

[:SOURce]:POWer[:LEVel][:IMMediate][:AMPLitude] <val><unit>

[:SOURce]:POWer[:LEVel][:IMMediate][:AMPLitude]?

Arrow Keys



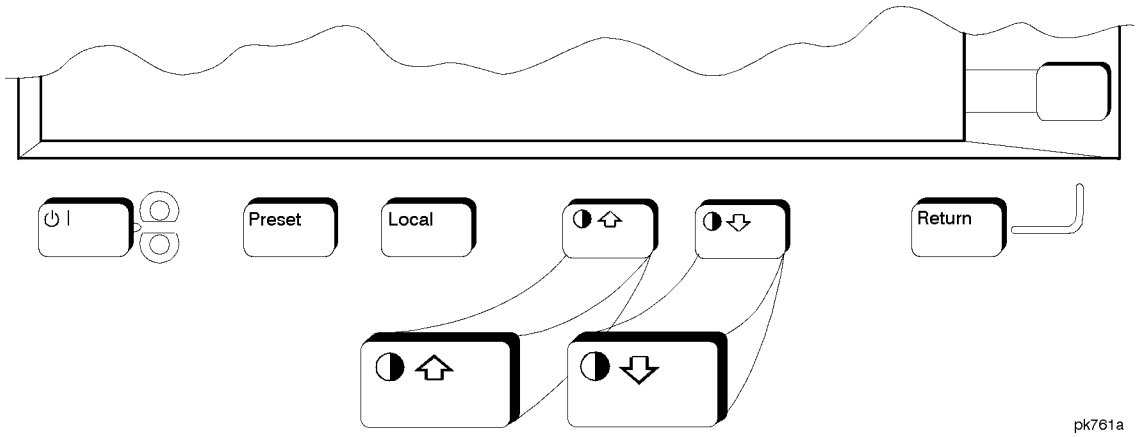
Use the up and down arrow keys to increase and decrease the value of a numeric parameter by the increment value. For example, when frequency is the active function, if the current frequency setting is 1 MHz and the increment value set is 1 kHz, pressing the up and down arrow keys will increase and decrease the 1 MHz frequency in 1 kHz steps.

In addition, you can use the up and down arrow keys to scroll through displayed lists to select items.

The left and right arrow keys choose the highlighted digit in the active entry area, which is modified by the up and down arrow keys. When a digit is highlighted it overrides the increment value used with the up and down arrow keys. This override remains in effect until the **Incr Set** key is pressed, an instrument preset occurs, or power is cycled. For example, if frequency is the active parameter and you press the right arrow key until the 1 kHz position is highlighted, the up and down arrow keys will increase and decrease the frequency in 1 kHz increments no matter where the **Incr Set** key has been set.

The arrow keys have autorepeat capability. Hold a key down and its function is continuously executed until you release it.

Display Contrast Keys



You can adjust the contrast of the display by pressing the decrease contrast key [◑⇩] or the increase contrast key [◑⇧] .

Pressing the decrease contrast key and holding it down causes the display background to gradually darken in comparison to the text on the display. The minimum contrast setting is not a completely black display. Some contrast between the background and the text will still be visible.

Pressing the increase contrast key and holding it down causes the display background to gradually brighten in comparison to the text on the display. If the background does not appear to change, it is probably set to the maximum contrast.

Display contrast is a persistent state; it is not affected by an instrument preset or by a power cycle.

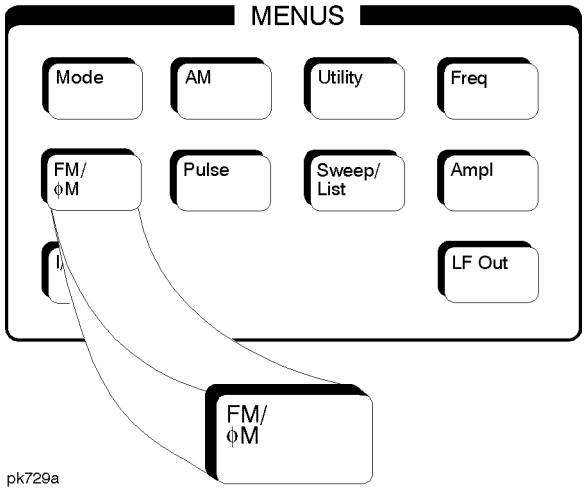
SCPI Commands:

:DISPlay:CONTrast <value>

:DISPlay:CONTrast?

FM

Pressing the front panel **FM/ΦM** key reveals a menu of softkeys. The softkeys for FM are described in this section in alphabetical order. For a description of the ΦM softkeys, refer to the “Phase Modulation” section in this chapter.



Bus

This softkey is one of the choices in the FM Sweep Trigger menu. With **Bus** selected, you use the HP-IB to trigger single sweeps of swept-sine frequency modulation.

Softkey Location: Press **FM/ΦM**, **More (1 of 2)**, **FM Waveform**, **Swept-Sine**, **FM Sweep Trigger**, **Bus**

Status after Normal Preset: FM sweep trigger is set to Immediate

SCPI Commands:

[:SOURce]:FM[1]|2:INTernal[1]:SWEep:TRIGger BUS

[:SOURce]:FM[1]|2:INTernal[1]:SWEep:TRIGger?

DCFM/DCΦM Cal

Pressing this softkey initiates a DCFM calibration. This calibration eliminates the offset in DC FM so that the carrier frequency remains the same with no modulation applied. External, DC-coupled FM must be active when this calibration is executed.

Softkey Location: Press **FM/ΦM**, **More (1 of 2)**, **DCFM/DCΦM Cal**

SCPI Commands:

:CALibration:DCFM

Dual-Sine

Pressing this softkey reveals a menu of choices for setting the dual-sine frequency modulation parameters. In this menu you can set the FM rates for two separate tones. In addition, you can set the FM deviation for **FM Path 1** and **FM Path 2** and also set a ratio of the tone 2 FM deviation to the tone 1 FM deviation.

Softkey Location: Press **FM/ΦM**, **More 1 of 2**, **FM Waveform**, **Dual-Sine**

SCPI Commands:

[:SOURce]:FM[1]|2:INTernal[1]:FUNCtion:SHAPe DUALsine

[:SOURce]:FM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Ext

This softkey is one of the choices in the FM Sweep Trigger menu. Choosing **Ext** allows you to trigger swept-sine frequency modulation using a signal applied to the TRIGGER IN rear panel connector. Set the polarity of the trigger signal using the **Trigger In Polarity Neg Pos** softkey.

Softkey Location: Press **FM/ΦM**, **More (1 of 2)**, **FM Waveform**, **Swept-Sine**, **FM Sweep Trigger**, **Ext**

Status after Normal Preset: FM sweep trigger is set to Immediate

SCPI Commands:

[:SOURce]:FM[1]|2:INTernal[1]:SWEep:TRIGger EXTernal

[:SOURce]:FM[1]|2:INTernal[1]:SWEep:TRIGger?

Ext 1 AC-Coupled

This softkey lets you input an external, AC-coupled, frequency modulation signal to the EXT 1 INPUT connector. The modulation signal is tested for voltage and a display annunciator will report a high or low condition if the voltage is > ±3% of 1 Vpk.

The external 1 input has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 1 input in an amplitude modulation configuration for **AM Path 1**, and then you configured **FM Path 2** to also use the external 1 input, the signal generator would turn off **AM Path 1** and assign the external 1 input to your **FM Path 2** configuration. For the purposes of this discussion, the external 1 AC-coupled input is the same as the external 1 DC-coupled source.

Softkey Location: Press **FM/ΦM**, **FM Source**, **Ext 1 AC-Coupled**

SCPI Commands:

[:SOURce]:FM[1]|2:SOURce EXTernal1

[:SOURce]:FM[1]|2:EXTernal[1]:COUPling AC

[:SOURce]:FM[1]|2:EXTernal[1]:COUPling?

Ext 1 DC-Coupled

This softkey lets you input an external, DC-coupled, frequency modulation signal to the EXT 1 INPUT connector.

The external 1 input has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 1 input in an amplitude modulation configuration for **AM Path 1**, and then you configured **FM Path 2** to also use the external 1 input, the signal generator would turn off **AM Path 1** and assign the external 1 input to your **FM Path 2** configuration. For the purposes of this discussion, the external 1 AC-coupled input is the same as the external 1 DC-coupled source.

Softkey Location: Press **FM/ΦM**, **FM Source**, **Ext 1 DC-Coupled**

SCPI Commands:

[:SOURce]:FM[1]|2:SOURce EXTernal1

[:SOURce]:FM[1]|2:EXTernal[1]:COUPling DC

[:SOURce]:FM[1]|2:EXTernal[1]:COUPling?

Ext 2 AC-Coupled

This softkey lets you input an external, AC-coupled, frequency modulation signal to the EXT 2 INPUT connector. The modulation signal is tested for voltage and a display annunciator will report a high or low condition if the voltage is > ±3% of 1 Vpk.

The external 2 input has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 2 input in an amplitude modulation configuration for **AM Path 1**, and then you configured **FM Path 2** to also use the external 2 input, the signal generator would turn off **AM Path 1** and assign the external 2 input to your **FM Path 2** configuration. For the purposes of this discussion, the external 2 AC-coupled input is the same as the external 2 DC-coupled source.

Softkey Location: Press **FM/ΦM**, **FM Source**, **Ext 2 AC-Coupled**

SCPI Commands:

[:SOURce]:FM[1]|2:SOURce EXTernal2

[:SOURce]:FM[1]|2:EXTernal[2]:COUPling AC

[:SOURce]:FM[1]|2:EXTernal[2]:COUPling?

Ext 2 DC-Coupled

This softkey lets you input an external, DC-coupled, frequency modulation signal to the EXT 2 INPUT connector.

The external 2 input has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 2 input in an amplitude modulation configuration for **AM Path 1**, and then you configured **FM Path 2** to also use the external 2 input, the signal generator would turn off **AM Path 1** and assign the external 2 input to your **FM Path 2** configuration. For the purposes of this discussion, the external 2 AC-coupled input is the same as the external 2C-coupled source.

Softkey Location: Press **FM/ΦM**, **FM Source**, **Ext 2 DC-Coupled**

SCPI Commands:

[:SOURce]:FM[1]|2:SOURce EXTernal2

[:SOURce]:FM[1]|2:EXTernal[2]:COUPling DC

[:SOURce]:FM[1]|2:EXTernal[2]:COUPling?

FM/ΦM

This softkey toggles between the menus for FM, normal ΦM, and wideband ΦM. Refer to the "Phase Modulation" section for a discussion of the differences between normal ΦM, and wideband ΦM.

Softkey Location: Press the **FM/ΦM** hardkey, then press the **FM/ΦM** softkey.

Status after Normal Preset: FM

FM Dev

Use this softkey to set the frequency modulation deviation for the **FM Path 1** and **FM Path 2** configurations. To change the value of the FM deviation, press the softkey once. The current value for FM deviation is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Hz**, **kHz**, **MHz**, or **GHz** terminator softkey. The range of values allowed depends on the carrier frequency. The maximum peak deviation for a frequency is calculated by multiplying N times 10 MHz. (The following table lists the values for N and the resulting maximum peak deviations.)

Carrier Frequency	N	Maximum Peak Deviation
250 kHz to ≤ 249.999 MHz	1	10 MHz
> 249.999 MHz to ≤ 500 MHz	0.5	5 MHz
> 500 MHz to ≤ 1 GHz	1	10 MHz
> 1 GHz to ≤ 2 GHz	2	20 MHz
> 2 GHz to 4 GHz	4	40 MHz

For example, if you choose a carrier frequency of 400 MHz, multiply 0.5 times 10 MHz resulting in a 5 MHz maximum peak deviation.

Notice that the new value of FM deviation applies only to whichever FM path configuration you have currently selected. Also, whenever **FM Path 1** is used with **FM Path 2**, the deviation for **FM Path 1** must be greater than or equal to the deviation for **FM Path 2**.

Softkey Location: Press **FM/ΦM**, **FM Dev**
or press **FM/ΦM**, **More 1 of 2**, **FM Waveform**, **Dual-Sine**, **FM Dev**

Status after Normal Preset: 1 kHz

SCPI Commands:

[:SOURce]:FM[1]|2[:DEViation] <val><unit>

[:SOURce]:FM[1]|2[:DEViation]?

FM Dev Couple Off On

This softkey toggles the FM deviation coupling on and off. Turning on FM deviation coupling links the FM deviation values of **FM Path 1** and **FM Path 2**. When the values are coupled, any change you make to one FM deviation value is applied to both FM deviation values.

Softkey Location: Press **FM/ΦM**, **More (1 of 2) FM Dev Couple Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:FM[1]|2:[DEViation]:TRACk ON|OFF|1|0

[:SOURce]:FM[1]|2:[DEViation]:TRACk?

FM Dual-Sine Ampl Ratio

Press this softkey to set the ratio of the deviation of FM tone 2 to the deviation of FM tone 1 as a percent. The range of values allowed is 0 to 100%. The minimum increment allowed is 0.1%. The sum of the two FM deviations results in the total FM deviation (set by the **FM Dev** softkey in the initial FM Menu).

For example, if the total FM deviation is 3.0 kHz and you set **FM Dual-Sine Ampl Ratio** to 50%, then the deviation of FM tone 1 will be 2.0 kHz and the deviation of FM tone 2 will be 1.0 kHz (50% of 2.0 kHz) so that the deviation of the two tones adds up to 3.0 kHz (2.0 kHz plus 1.0 kHz).

Softkey Location: Press **FM**, **More (1 of 2)**, **FM Waveform**, **Dual-Sine**, **FM Dual-Sine Ampl Ratio**

SCPI Commands:

[:SOURce]:FM[1]|2:INTernal[1]:FREQuency:ALTernate:AMPLitude:PERCent <val><unit>

[:SOURce]:FM[1]|2:INTernal[1]:FREQuency:ALTernate:AMPLitude:PERCent?

FM Off On

This softkey toggles the frequency modulation on or off for whichever FM path configuration (**FM Path 1** or **FM Path 2**) you have selected. Notice, however that although you can turn on frequency modulation with this softkey, the RF carrier is modulated by the enabled modulation only when you have also set **Mod On/Off** to **On**. Whenever frequency modulation is enabled, the **FM** annunciator is turned on in the display.

There are two paths for FM modulation which can be simultaneously enabled as long as they use different sources (Int, Ext1, or Ext2). **FM Path 2** is limited to a maximum rate of 1 MHz. **FM Path 2** must be set to a deviation less than or equal to **FM Path 1**. The modulation signals from both paths are summed internally for composite modulation.

Softkey Location: Press **FM/ΦM**, **FM Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:FM[1]|2:STATe ON|OFF|1|0

[:SOURce]:FM[1]|2:STATe?

FM Path 1 2

Use **FM Path 1** and **FM Path 2** to define two unique frequency modulation configurations. For example, select **FM Path 1**. (**FM Path 1** is the default after a normal preset. If **FM Path 1** is not highlighted, press the softkey until the selection toggles to **FM Path 1**.) Configure the modulation characteristics (such as deviation, source, rate, and waveform) using the remaining softkeys in the FM menu. Then enable FM by setting **FM Off On** to **On**.

To configure a second frequency modulation configuration, toggle to **FM Path 2**. Define the modulation characteristics for this second configuration and enable FM by setting **FM Off On** to **On**.

The RF carrier is available at the RF OUTPUT connector when you set **RF On/Off** to **On**. Set **Mod On/Off** to **On** to modulate the RF carrier with the modulations that you have enabled.

FM Path 1 and **FM Path 2** are summed internally for composite modulation. Either path can be switched to any one of the modulation sources: Int, Ext1, or Ext2. All modulation types can be simultaneously enabled, except FM with ΦM, AM with external burst source, and wideband AM with I/Q. AM, FM, and ΦM can sum simultaneous inputs from any two sources (Int, Ext1, and Ext2). Any given source (Int, Ext1, or Ext2) can only be routed to one activated modulation type.

Softkey Location: Press **FM/ΦM**, **FM Path 1 2**

Status after Normal Preset: FM Path 1

FM Rate

Use this softkey to change the internal modulation frequency for the **FM Path 1** and **FM Path 2** configurations. To change the value, press the softkey once. The current value for FM rate is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Hz** or **kHz** terminator softkey. The range of values allowed is 0.1 Hz to 10 kHz. (0.1 Hz to 50 kHz is the range allowed if sinewave is selected as the internal waveform.) The minimum increment allowed is 0.1 Hz. Notice that the new value of FM rate applies only to whichever FM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM**, **FM Rate**

Status after Normal Preset: 400 Hz

SCPI Commands:

[:SOURce]:FM[1]|2:INTernal[1]:FREQuency <val><unit>

[:SOURce]:FM[1]|2:INTernal[1]:FREQuency?

FM Source

Pressing this softkey reveals a menu of choices for frequency modulation sources. You can choose internally-generated frequency modulation or select an externally-applied signal from either the EXT 1 INPUT or EXT 2 INPUT connectors. The internal modulation is always AC-coupled. For the externally-applied signals, you can choose between AC- and DC-coupled modulation. A 1.0 Vpk input is required for calibrated FM deviation settings. The **EXT 1 LO/HI** and **EXT 2 LO/HI** display annunciators will turn on if the peak input voltage differs from 1.0 Vpk by more than 3%. (The LO/HI annunciators only function for AC-coupled external inputs.)

The internal and external 1 and 2 sources have multiple uses. You can use them for amplitude, frequency, and phase modulation. For burst modulation, you can only use the external 1 source. You must use the external 2 source for pulse modulation. However, any given source can only be routed to one enabled modulation at a time. If, for example, you were using the external 1 source in a frequency modulation configuration for **FM Path 1**, and then you configured **AM Path 2** to also use the external 1 source, the signal generator would turn off **FM Path 1** and assign the external 1 source to your **AM Path 2** configuration. Notice that for these purposes the external 1 AC-coupled source is the same as the external 1 DC-coupled source and the external 2 AC-coupled source is the same as the external 2 DC-coupled source.

Softkey Location: Press **FM/ΦM**, **FM Source**

Status after Normal Preset: Internal

SCPI Commands:

[:SOURce]:FM[1]|2:SOURce?

FM Start Rate

Use this softkey to change the starting internal modulation frequency for swept-sine frequency modulation. To change the value, press the softkey once. The current value for the FM start rate is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Hz** or **kHz** terminator softkey. The range of values allowed is 0.1 Hz to 50 kHz. The minimum increment allowed is 0.1 Hz.

This softkey is coupled to the **FM Rate** softkey in the initial FM Menu and the **FM Tone 1 Rate** softkey in the FM Dual-Sine Menu. Any value set for **FM Start Rate** is reflected in the **FM Rate** and **FM Tone 1 Rate** softkeys. Conversely, if you change the value for either the **FM Rate** softkey or the **FM Tone 1 Rate** softkey, the value for **FM Start Rate** is changed to match.

Softkey Location: Press **FM/ΦM**, **More (1 of 2)**, **FM Waveform**, **Swept-Sine**, **FM Start Rate**

Status after Normal Preset: 400.0 Hz

SCPI Commands:

[:SOURce]:FM[1]|2:INTernal[1]:FREQuency <val><unit>

[:SOURce]:FM[1]|2:INTernal[1]:FREQuency?

FM Stop Rate

Use this softkey to change the ending internal modulation frequency for swept-sine frequency modulation. To change the value, press the softkey once. The current value for the FM stop rate is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Hz** or **kHz** terminator softkey. The range of values allowed is 0.1 Hz to 50 kHz. The minimum increment allowed is 0.1 Hz.

This softkey is coupled to the **FM Tone 2 Rate** softkey in the FM Dual-Sine Menu. Any value set for **FM Stop Rate** is reflected in the **FM Tone 2 Rate** softkey. Conversely, if you change the value for the **FM Tone 2 Rate** softkey, the value for **FM Stop Rate** is changed to match.

Softkey Location: Press **FM/ΦM**, **More (1 of 2)**, **FM Waveform**, **Swept-Sine**, **FM Stop Rate**

Status after Normal Preset: 400.0 Hz

SCPI Commands:

[:SOURce]:FM[1]|2:INTernal[1]:FREQuency:ALTernate <val><unit>

[:SOURce]:FM[1]|2:INTernal[1]:FREQuency:ALTernate?

FM Sweep Time

Press this softkey to set the sweep time for swept-sine frequency modulation. The signal generator will vary the FM rate from the specified start rate to the stop rate in the time set with this softkey. Enter the desired sweep time using the up and down arrow keys, the front panel knob, or enter a value using the numeric keypad and press the **sec** or **msec** terminator softkey. The range of values allowed is 1 ms through 65.535 s. The minimum increment allowed is 1 ms.

Softkey Location: Press **FM/ΦM**, **More (1 of 2)**, **FM Waveform**, **Swept-Sine**, **FM Sweep Time**

Status after Normal Preset: 100.0 msec

SCPI Commands:

[:SOURce]:FM[1]|2:INTernal[1]:SWEep:TIME <val><unit>

[:SOURce]:FM[1]|2:INTernal[1]:SWEep:TIME?

FM Sweep Trigger

Pressing this softkey reveals a menu of choices for triggering swept-sine frequency modulation. You can choose triggering that occurs immediately, triggering that is supplied by the HP-IB, triggering on either the positive or negative edge of a signal supplied to the TRIGGER IN connector, or triggering by the front panel **Trigger** key.

Softkey Location: Press **FM/ΦM**, **More (1 of 2)**, **FM Waveform**, **Swept-Sine**, **FM Sweep Trigger**

Status after Normal Preset: Immediate

SCPI Commands:

:TRIGger[:SEQuence]:SOURce?

FM Tone 1 Rate

Press this softkey to set the internal modulation frequency for the FM tone 1. Enter the desired rate using the up and down arrow keys, the front panel knob, or enter a value using the numeric keypad and press the **kHz** or **Hz** terminator softkey. The range of values allowed is 0.1 Hz through 50 kHz. The minimum increment allowed is 0.1 Hz.

This softkey is coupled to the **FM Rate** softkey in the initial FM Menu and the **FM Start Rate** softkey in the FM Swept-Sine Menu. Any value set for **FM Tone 1 Rate** is reflected in the **FM Rate** and **FM Start Rate** softkeys. Conversely, if you change the value for either the **FM Rate** softkey or the **FM Start Rate** softkey, the value for **FM Tone 1 Rate** is changed to match.

Softkey Location: Press **FM/ΦM**, **More (1 of 2)**, **FM Waveform**, **Dual-Sine**, **FM Tone 1 Rate**

Status after Normal Preset: 400.0 Hz

SCPI Commands:

[:SOURce]:FM[1]|2:INTernal[1]:FREQuency <val><unit>

[:SOURce]:FM[1]|2:INTernal[1]:FREQuency?

FM Tone 2 Rate

Press this softkey to set the internal modulation frequency for the FM tone 2. Enter the desired rate using the up and down arrow keys, the front panel knob, or enter a value using the numeric keypad and press the **kHz** or **Hz** terminator softkey. The range of values allowed is 0.1 Hz through 50 kHz. The minimum increment allowed is 0.1 Hz.

This softkey is coupled to the **FM Stop Rate** softkey in the FM Swept-Sine Menu. Any value set for **FM Tone 2 Rate** is reflected in the **FM Stop Rate** softkey. Conversely, if you change the value for the **FM Stop Rate** softkey, the value for **FM Tone 2 Rate** is changed to match.

Softkey Location: Press **FM/ΦM**, **More (1 of 2)**, **FM Waveform**, **Dual-Sine**, **FM Tone 2 Rate**

Status after Normal Preset: 400.0 Hz

SCPI Commands:

[:SOURce]:FM[1]|2:INTernal[1]:FREQuency:ALTernate <val><unit>

[:SOURce]:FM[1]|2:INTernal[1]:FREQuency:ALTernate?

FM Waveform

Pressing this softkey reveals a menu of FM waveform choices for your **FM Path 1** and **FM Path 2** configurations. Select from sine, triangle, square, ramp, noise, dual-sine, and swept-sine waveforms. Notice that your waveform selection applies only to which ever FM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM**, **More (1 of 2)**, **FM Waveform**

Status after Normal Preset: Sine

SCPI Commands:

[:SOURce]:FM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Immediate

This softkey is one of the choices in the FM Sweep Trigger menu. Choosing **Immediate** immediately triggers swept-sine frequency modulation in a continuous mode. To stop the sweep, choose a different trigger such as **Ext**, or set the waveform to something other than **Swept-Sine**.

Softkey Location: Press **FM/ΦM**, **More (1 of 2)**, **FM Waveform**, **Swept-Sine**, **FM Sweep Trigger**, **Immediate**

Status after Normal Preset: FM sweep trigger is set to Immediate

SCPI Commands:

[:SOURce]:FM[1]|2:INTernal[1]:SWEep:TRIGger IMMediate

[:SOURce]:FM[1]|2:INTernal[1]:SWEep:TRIGger?

Internal

This softkey lets you internally generate an AC-coupled, frequency modulation signal.

The internal source has multiple uses but can be used for only one modulation at a time. If, for example you were using the internal source in an amplitude modulation configuration for **AM Path 1**, and then you configured **FM Path 2** to also use the internal source, the signal generator would turn off **AM Path 1** and assign the internal source to your **FM Path 2** configuration.

Softkey Location: Press **FM/ΦM**, **FM Source**, **Internal**

SCPI Commands:

[:SOURce]:FM[1]|2:SOURce INT[1]

[:SOURce]:FM[1]|2:SOURce?

Noise

This softkey lets you specify noise as the frequency modulation waveform for the **FM Path 1** and **FM Path 2** configurations. Notice that the selected waveform applies only to whichever FM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM**, **More (1 of 2)**, **FM Waveform**, **Noise**

SCPI Commands:

[:SOURce]:FM[1]|2:INTernal[1]:FUNCtion:SHAPe NOISe

[:SOURce]:FM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Ramp

This softkey lets you specify ramp as the frequency modulation waveform for the **FM Path 1** and **FM Path 2** configurations. Notice that the selected waveform applies only to whichever FM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM**, **More (1 of 2)**, **FM Waveform**, **Ramp**

SCPI Commands:

[:SOURce]:FM[1]|2:INTernal[1]:FUNCtion:SHAPe RAMP

[:SOURce]:FM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Sine

This softkey lets you specify sine as the frequency modulation waveform for the **FM Path 1** and **FM Path 2** configurations. Notice that the selected waveform applies only to whichever FM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM**, **More (1 of 2)**, **FM Waveform**, **Sine**

SCPI Commands:

[:SOURce]:FM[1]|2:INTernal[1]:FUNCtion:SHAPe SINE

[:SOURce]:FM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Square

This softkey lets you specify square as the frequency modulation waveform for the **FM Path 1** and **FM Path 2** configurations. Notice that the selected waveform applies only to whichever FM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM**, **More (1 of 2)**, **FM Waveform**, **Square**

SCPI Commands:

[:SOURce]:FM[1]|2:INTernal[1]:FUNCtion:SHAPe SQUare

[:SOURce]:FM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Swept-Sine

Pressing this softkey reveals a menu of choices for setting the swept-sine frequency modulation parameters. In this menu you can set the start and stop FM rate and the sweep time. You can set the signal generator to a single, externally-triggered sweep on either a negative or positive TTL level or you can choose continuous sweep, triggered immediately. In this menu you can also select either a positive or negative polarity for the TRIGGER OUT signal.

Softkey Location: Press **FM/ΦM**, **More (1 of 2)**, **FM Waveform**, **Swept-Sine**

SCPI Commands:

[:SOURce]:FM[1]|2:INTernal[1]:FUNCtion:SHAPe SWEPtsine

[:SOURce]:FM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Triangle

This softkey lets you specify triangle as the frequency modulation waveform for the **FM Path 1** and **FM Path 2** configurations. Notice that the selected waveform applies only to whichever FM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM**, **More (1 of 2)**, **FM Waveform**, **Triangle**

SCPI Commands:

[:SOURce]:FM[1]|2:INTernal[1]:FUNCtion:SHAPe TRIangle

[:SOURce]:FM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Trigger In Polarity Neg Pos

Press this softkey to toggle between a negative TTL level trigger (0 V) and a positive TTL level trigger (+5 V) for externally triggering swept-sine frequency modulation.

This softkey is coupled to the **Trigger In Polarity Neg Pos** softkey for swept-sine AM, ΦM, and LF Out, and to the **Ext Neg** and **Ext Pos** sweep trigger selections in the Sweep/List Menu. If you set the **Trigger In Polarity Neg Pos** softkey in the FM Swept-Sine Menu to **Neg**, the **Trigger In Polarity Neg Pos** softkey is also set to **Neg** for swept-sine AM, ΦM, and LF Out. And, in addition, if the step or list sweep trigger is set to **Ext Pos**, the trigger selection will automatically be changed to **Ext Pos**. The same softkeys will toggle to **Pos** or to **Ext Pos** if you select **Pos** in the Swept-Sine FM Menu.

Conversely, if the **Trigger In Slope Neg Pos** softkey is toggled in the swept-sine AM, ΦM, or LF Out menus, it will cause the swept-sine FM softkey to toggle also. This is also true for the **Ext Neg** and **Ext Pos** step or list sweep trigger selections.

Softkey Location: Press **FM/ΦM**, **More (1 of 2)**, **FM Waveform**, **Swept-Sine**, **Trigger In Polarity Neg Pos**

Status after Normal Preset: Pos

SCPI Commands:

:TRIGger[:SEQuence]:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:SLOPe?

Trigger Key

This softkey is one of the choices in the FM Sweep Trigger menu. With **Trigger Key** selected, when you press the **Trigger** front panel key you immediately trigger a single sweep of swept-sine frequency modulation.

The **Trigger** key has autorepeat capability. Hold it down and you will repeatedly trigger sweeps until you release the key.

Softkey Location: Press **FM/ΦM**, **More (1 of 2)**, **FM Waveform**, **Swept-Sine**, **FM Sweep Trigger**, **Trigger Key**

Status after Normal Preset: FM sweep trigger is set to Immediate

SCPI Commands:

[:SOURce]:FM[1]|2:INTernal[1]:SWEep:TRIGger KEY

[:SOURce]:FM[1]|2:INTernal[1]:SWEep:TRIGger?

Trigger Out Polarity Neg Pos

This softkey toggles the polarity of the TTL signal that is output at the rear panel TRIGGER OUT connector. When **Trigger Out Polarity Neg Pos** is set to **Pos**, the output signal is asserted high (+5 V) at the start of the swept-sine frequency modulation sweep and low (0 V) when the sweep is concluded. Setting **Trigger Out Polarity Neg Pos** to **Neg** reverses the polarity, where a high is 0 V and a low is +5 V.

This softkey is coupled to the **Trigger Out Polarity Neg Pos** softkey in the swept-sine AM, ΦM, and LF Out menus and the sweep/list menu. When the polarity is toggled for this softkey in any one of these menus, it affects all locations of the softkey.

Softkey Location: Press **FM/ΦM**, **More (1 of 2)**, **FM Waveform**, **Swept-Sine**, **Trigger Out Polarity Neg Pos**

Status after Normal Preset: Pos

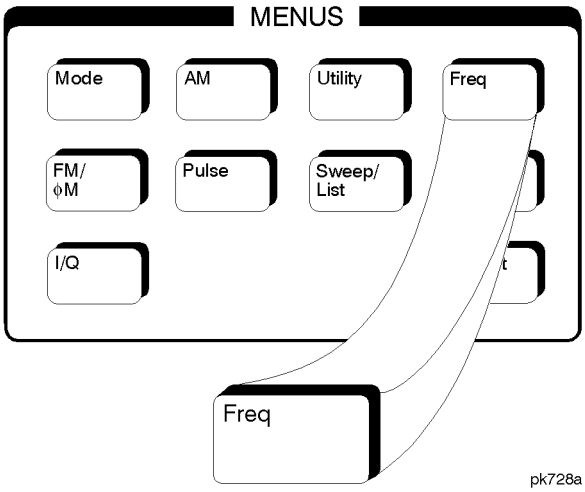
SCPI Commands:

:TRIGger:OUTPut:POLarity POSitive|NEGative

:TRIGger:OUTPut:POLarity?

Freq

Pressing the front panel **Freq** key reveals a menu of softkeys. These softkeys are described in this section in alphabetical order.



Adjust Phase

Use this softkey to change the phase of the RF OUTPUT signal. You can change the phase relative to whatever phase the signal generator locked to the last time it changed frequency. For this reason, the phase adjustment does not survive changes in frequency and must be readjusted. If you first press **Phase Ref Set**, the current output phase is set as a zero reference and any subsequent phase adjustment is displayed as relative to the zero reference. Phase adjustment cannot be used with frequency or phase modulation.

To change the phase, press the softkey once. Phase adjustment becomes the active function. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **rad** or **deg** terminator softkey. The range of values allowed is ±3.141 radians or ±180 degrees.

Softkey Location: Press **Freq**, **Adjust Phase**

Status after Normal Preset: 0 radians

SCPI Commands:

[:SOURce]:PHASe:[ADJust] <val><unit>

[:SOURce]:PHASe:[ADJust]?

Freq Multiplier

You can multiply the frequency shown on the display without changing the frequency output at the RF OUTPUT connector (simulating the frequency at the output of a harmonic multiplier). Press this softkey and enter a value from 1 through 50. Use the up and down arrow keys, the front panel knob, or enter a value using the numeric keypad and press the **Enter** terminator softkey. For example, set the output frequency to 1 MHz. Then press **Freq**, **Freq Multiplier**, **3**, **Enter**. The display will now show an output frequency of 3 MHz but the actual output frequency will remain at 1 MHz. For any multiplier greater than 1, the **MULT** indicator is shown in the frequency area of the display.

Softkey Location: Press **Freq**, **Freq Multiplier**

Status after Normal Preset: 1

SCPI Commands:

[:SOURce]:FREQuency:MULTiplier <val>

[:SOURce]:FREQuency:MULTiplier?

Freq Offset

Press this softkey to set a value for frequency offset. A frequency offset changes the value shown in the frequency area of the display but does not affect the output frequency. For example, if the current output frequency is 1 MHz and you enter a frequency offset of 3 MHz, the output frequency will remain at 1 MHz but the display will show a frequency of 4 MHz. This feature lets you simulate the frequency at the output of a frequency translating device.

A frequency offset can be entered at any time during normal operation and also when you are operating in frequency reference mode. To enter an offset, press **Freq Offset** and enter the desired frequency value using the up and down arrow keys, the front panel knob, or enter a value using the numeric keypad and press the **Hz**, **kHz**, **MHz**, or **GHz** terminator softkey. When an offset has been entered, the **OFFSET** indicator is turned on in the frequency area of the display.

Softkey Location: Press **Freq**, **Freq Offset**

Status after Normal Preset: 0 Hz

SCPI Commands:

[:SOURce]:FREQuency:OFFSet <val><unit>

[:SOURce]:FREQuency:OFFSet?

Freq Ref Off On

This softkey toggles the frequency reference mode on and off. When frequency reference mode is turned on, the frequency value displayed is equal to the current hardware output frequency minus the reference value set by the **Freq Ref Set** softkey. (The **Freq Ref Set** softkey sets the reference value equal to the current output frequency. If you have not yet set the reference value, the preset value for frequency reference is 0 Hz.) The **REF** indicator is turned on in the frequency area of the display. All frequency parameters will now be set as relative to the reference value.

Frequency offsets can be used with frequency reference mode. In this situation, the display will show the frequency calculated as the current hardware output frequency minus the reference value plus the frequency offset.

Frequency reference mode only changes the display; it does not change the RF output frequency. For example, if you set your RF output frequency to 700 MHz, set your reference value, and then turn frequency relative mode on, your display shows your frequency as 0 Hz but your output frequency remains at 700 MHz.

Softkey Location: Press **Freq**, **Freq Ref Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:FREQuency:REFerence:STATe ON|OFF|1|0

[:SOURce]:FREQuency:REFerence:STATe?

Freq Ref Set

This softkey sets the current output frequency as a frequency reference value. It also causes the **Freq Ref Off On** softkey to toggle to the **On** position, turning on frequency reference mode. All frequency parameters are then set as relative to the reference value.

Softkey Location: Press **Freq**, **Freq Ref Set**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:FREQuency:REFerence <val><unit>

[:SOURce]:FREQuency:REFerence?

Mode 1 Optimize <10kHz Offset

Press this softkey to set the signal generator to mode 1 which optimizes phase noise at offsets below 10 kHz.

Softkey Location: Press **Freq**, **Optimize Φ Noise**, **Mode 1 Optimize <10kHz Offset**

SCPI Commands:

[:SOURce]:FREQuency:SYNThesis 1

[:SOURce]:FREQuency:SYNThesis?

Mode 2 Optimize >10kHz Offset

Press this softkey to set the signal generator to mode 2 which optimizes phase noise at offsets above 10 kHz.

Softkey Location: Press **Freq**, **Optimize Φ Noise**, **Mode 2 Optimize >10kHz Offset**

SCPI Commands:

[:SOURce]:FREQuency:SYNThesis 2

[:SOURce]:FREQuency:SYNThesis?

Optimize Φ Noise

Press this softkey for two choices in optimizing phase noise. You can choose to set the phase-lock loop bandwidth to optimize phase noise for offsets below or above 10 kHz offsets as shown in Figure 5-1.

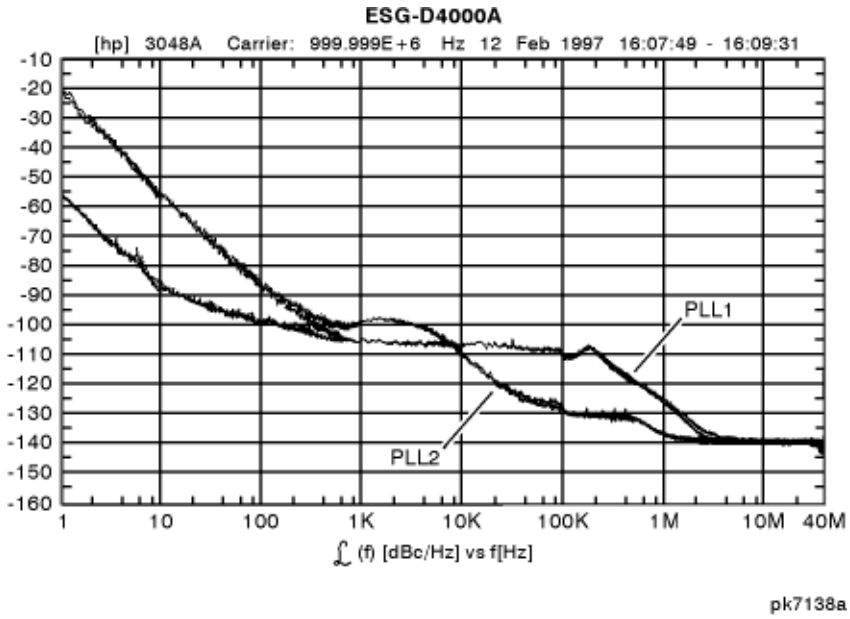


Figure 5-1. **Phase Noise Performance Mode 1 Versus Mode 2**

Softkey Location: Press **Freq**, **Optimize Φ Noise**

Status after Normal Preset: Mode 2

Phase Ref Set

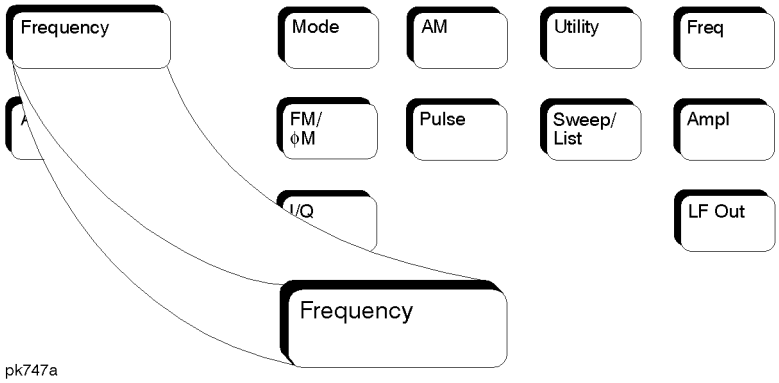
This softkey sets the current output phase as a zero reference. All phase parameters are then set as relative to the zero reference.

Softkey Location: Press **Freq**, **Phase Ref Set**

SCPI Commands:

[:SOURce]:PHASe:REFerence

Frequency



Press this front panel hardkey to change the RF output frequency. Frequency becomes the active function and the current value is also shown in the active entry area of the display. To enter a new value for frequency, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **GHz**, **MHz**, **kHz**, or **Hz** terminator softkey. The output frequency range allowed depends on your instrument model. Refer to Chapter 9, “Specifications.”

The current RF output frequency is always shown in the frequency area of the display (unless you have altered the display by turning on frequency reference mode or entering an offset or a multiplier). The frequency area of the display is blanked whenever a frequency sweep is selected.

Status after Normal Preset: Maximum specified output frequency

SCPI Commands:

[:SOURce]:FREQuency[:CW] <val><unit>

[:SOURce]:FREQuency[:CW]?

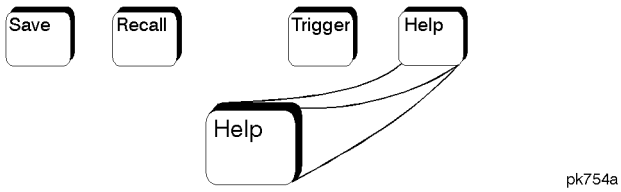
[:SOURce]:FREQuency:FIXed <val><unit>

[:SOURce]:FREQuency:FIXed?

[:SOURce]:FREQuency:MODE CW|FIXed

[:SOURce]:FREQuency:MODE?

Help



Press this hardkey for a short description of the function of any front panel hardkey or softkey. When you press the **Help** key, the following message is displayed:

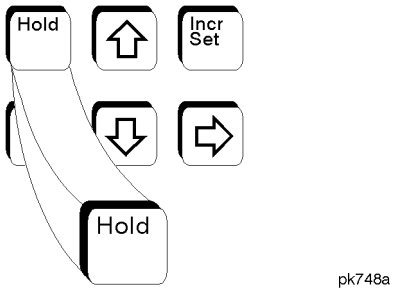
```
Press a key for help on that key.
```

Press a front panel hardkey or a softkey and a short description of that key's function will be displayed. Press another key and you will be returned to normal instrument operation.

The **Help** key can be set to either single or continuous mode. In single mode, when you press the **Help** key, help text is provided only for the next key that you press and then you are returned to normal operation. In continuous mode, when you press the **Help** key, help text is provided for the next key that you press and that key's function is also executed (except for the **Preset** key). This help mode remains active until you press the **Help** key again.

Refer to the description of the **Help Mode** softkey in the **Utility** section for instructions on changing the help mode from single to continuous.

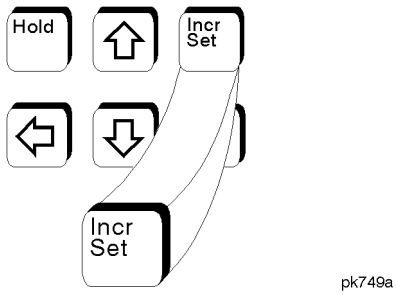
Hold



Press this front panel hardkey to de-activate the current active function and blank the softkey menu. Once **Hold** is pressed, the front panel knob, the arrow keys, and the numeric keypad have no effect.

To return to normal operation, press any front panel hardkey.

Incr Set



Press this front panel hardkey to change the incremental value of the up and down arrow keys for the current active function. For example, press **Frequency** to make it the active function. The current frequency is shown in the active entry area. The incremental value for frequency is set to 1 MHz at the factory. Press **Incr Set** and the incremental value of the up and down arrow keys for frequency becomes the active function. You can change the value by using three different methods:

- Use the up and down arrow keys.

  The arrow keys will change the incremental value in steps equal to the current incremental value (in this example, these are 1 MHz steps.)

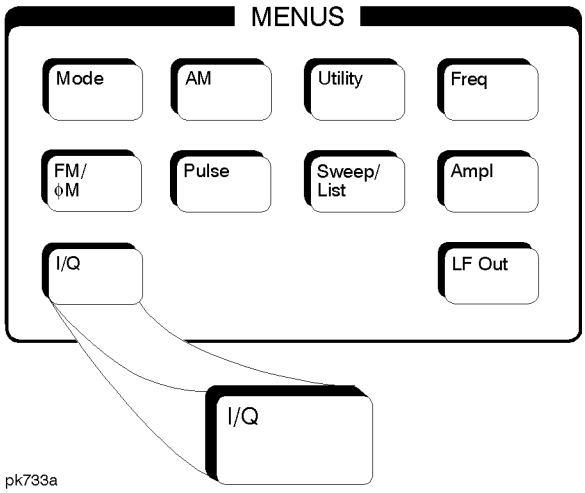
- Use the front panel knob.
- Use the numeric keypad and complete your entry with a terminator softkey.

Press **Incr Set** again and the active function toggles, making frequency the active function again.

Incremental values are persistent states; they are not affected by an instrument preset or by a power cycle.

I/Q

Pressing the front panel **I/Q** key reveals a menu of softkeys. These softkeys are described in this section in alphabetical order.



ALC Off On

This softkey toggles the automatic leveling control (ALC) circuit off and on.

The ALC is normally on. The RF output power of the signal generator is constantly monitored and controlled by the ALC circuit. Its purpose is to hold output power at its desired level in spite of drift due to temperature and time.

There are some modulation conditions which the ALC circuit cannot handle properly which lead to output level errors. In these conditions, better power level accuracy can be obtained by turning the ALC off and using power search. (Refer to the **Power Search Manual Auto** softkey documented in this section for more information about power search.) ALC off is useful with pulse modulation with a pulse width narrower than 2 µs and with certain external I/Q modulation.

Pulse modulation is accomplished using a modulator which precedes the ALC detector. The ALC must, therefore, measure a pulsed signal, and it is able to do this if the pulse width exceeds 2 µs. For narrower pulses, set the **ALC** softkey to **Off**.

With external I/Q modulation, the ALC loop acts to hold the signal generator's average output power constant, in spite of variations in the I/Q input power ($I^2 + Q^2$). Rapid variations of ($I^2 + Q^2$) propagate to the output, while slow variations are removed by the ALC loop, with a high-pass corner of 1 kHz. If you do not want this high-pass filtering, set the **ALC Off On** softkey to **Off**. With ALC off, the I/Q modulation will be DC-coupled. Using power search, power level accuracy is preserved if $\sqrt{I^2+Q^2}$ = 0.5 V_{rms}.

When ALC is off, the **ALC OFF** display annunciator will turn on.

Softkey Location: Press **I/Q**, **More (1 of 2)**, **ALC Off On**

Status after Normal Preset: On

SCPI Commands:

[:SOURce]:POWer:ALC[:STATe] ON|OFF|1|0

[:SOURce]:POWer:ALC[:STATe]?

Burst Envelope Off On

Press this softkey to toggle on and off the burst envelope modulator. The burst envelope modulator is used to burst the RF carrier. When the **Burst Source** softkey is set to **Ext1 DC**, the shape of the burst output is the same as the shape of the EXT 1 analog input. The **Burst Envelope Off On** softkey is toggled automatically to **On** when any enabled digital modulation format also has burst turned on (Option UN3 or UN4 only). Whenever the burst envelope modulator is on, the **ENVLP** annunciator is turned on in the display.

Softkey Location: Press **I/Q**, **Burst Envelope Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:BURSt:STATe ON|OFF|1|0

[:SOURce]:BURSt:STATe?

Burst Source

Press this softkey to change the source for burst modulation. If you do not have Option UN3 or UN4, your only choice is a DC-coupled, analog input using the EXT 1 INPUT connector. Using this selection, the bursted output signal will have the same shape as the analog input. If you have Option UN3 or UN4, this softkey will automatically toggle to **Int Burst** if you have turned on burst for an enabled digital modulation format. In this mode, the internal baseband generator bursts the RF carrier. You can override this automatic selection by selecting **Ext1 DC** as the **Burst Source**. As long as burst is turned on in an enabled digital modulation format, you can toggle between the internal and external burst sources.

Softkey Location: Press **I/Q**, **Burst Source**

Status after Normal Preset: Ext1 DC

SCPI Commands:

[:SOURce]:BURSt:SOURce?

Calibration Type User Full

Press this softkey to toggle between an I/Q calibration executed over the full frequency range of the signal generator (**Full**) or an I/Q calibration over a frequency range which you specify (**User**) using the **Start Frequency** and **Stop Frequency** softkeys. Once you have chosen either **Full** or **User**, and specified the frequency range, as required, press **Execute Cal** to start the I/Q calibration.

The I/Q calibration type is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **I/Q**, **More (1 of 2)**, **I/Q Calibration**, **Calibration Type User Full**

Do Power Search

Press this softkey to execute the power search routine one time. Power search is an internal calibration routine used to achieve calibrated output power when the ALC is off. You can execute a power search at any time by pressing this softkey. You do not need to disconnect modulation inputs, however modulation is disabled during power search. If you are using external I/Q modulation, the power search routine assumes that the I/Q input level is $\sqrt{I^2+Q^2}$ = 0.5 V_{rms}. Actual output amplitude will scale directly with $\sqrt{I^2+Q^2}$.

The following conditions must be met in order to execute the power search routine:

- **ALC Off On** is set to **Off**
- **RF On/Off** is set to **On**

Softkey Location: Press **I/Q**, **More (1 of 2)**, toggle **ALC Off On** softkey to **Off**, press **Do Power Search**

SCPI Commands:

[:SOURce]:POWer:ALC:SEARch ONCE

Execute Cal

Press this softkey to begin the I/Q calibration for the frequency range that you have specified. The calibration can be aborted at any time during the procedure by pressing the **Abort Cal** softkey. If you do abort the calibration, the previous calibration is restored.

Softkey Location: Press **I/Q**, **More (1 of 2)**, **I/Q Calibration**, **Execute Cal**

SCPI Commands:

:Calibration:IQ

:Calibration:IQ:FULL

Ext1 DC

Press this softkey to change the burst source for modulation to a DC-coupled, analog input using the EXT 1 INPUT connector. Using this selection, the bursted output signal will have the same shape as the analog input. If you do not have Option UN3 or UN4, this is the only burst source and it cannot be changed. If you have Option UN3 or UN4, the burst source can also be set to an internal source (refer to the **Int Burst** softkey).

Softkey Location: Press **I/Q**, **Burst Source**, **Ext1 DC**

SCPI Commands:

[:SOURce]:BURSt:SOURce EXTernal[1]

[:SOURce]:BURSt:SOURce?

Ext I/Q

Press this softkey to change the I/Q source to externally supplied I and Q signals. Apply the in-phase and quadrature-phase signals to the I INPUT and Q INPUT connectors. The recommended signal level is $\sqrt{I^2+Q^2}$ = 0.5 V_{rms}. With equal levels at I and Q, as is usually the case, this is equivalent to 0.35 V_{rms} simultaneously at I and Q. For typical π/4DQPSK signals, a 0.35 V_{rms} waveform will be approximately 1.3 Vp-p, whereas for GMSK it will be 1.0 Vp-p. If you do not have Option UN3 or UN4, this is the only I/Q source and it cannot be changed. If you have Option UN3 or UN4, the I/Q source can also be set to an internal I/Q source (refer to the **Int I/Q** softkey).

Softkey Location: Press **I/Q**, **I/Q Source**, **Ext I/Q**

SCPI Commands:

[:SOURce]:DM:SOURce EXTernal

[:SOURce]:DM:SOURce?

High Crest Mode Off On

Press this softkey to toggle high crest mode off and on. Turn high crest mode on with externally-applied signals with high crest factors (such as CDMA). High crest mode allows the signal generator to process these signals with less distortion. With high crest factor signals, it is recommended that the I and Q inputs seldom exceed 1.0 Vp-p. Some output power and power level accuracy is sacrificed in this mode. This softkey is active only if the I/Q source is external and I/Q is turned on.

Softkey Location: Press **I/Q**, toggle **I/Q Off On** softkey to **On**, press **High Crest Mode Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:DM:EXTernal:HICRest[:STATe] ON|OFF|1|0

[:SOURce]:DM:EXTernal:HICRest[:STATe]?

I Offset

Press this softkey to enter an origin offset voltage for internally-generated or externally-applied in-phase signals. Enter the value as a percentage of full scale (500 mV). The range of values allowed is –100% to +100%. Change the origin offset to adjust out imperfections in the in-phase signal or to introduce calibrated impairments. Set the origin offset as desired and then toggle the **I/Q Adjustments Off On** softkey to **On**.

Softkey Location: Press **I/Q**, **I/Q Adjustments**, **I Offset**

Status after Normal Preset: 0.0%

SCPI Commands:

[:SOURce]:DM:IQADjustment:IOFFset <val><unit>

[:SOURce]:DM:IQADjustment:IOFFset?

I/Q Adjustments

Pressing this softkey reveals a menu of I/Q adjustment choices for internally-generated or externally-applied I and Q signals. In this menu you can change the I to Q gain ratio, change the I and Q offset voltages, and turn on and off these I/Q adjustments.

Softkey Location: Press **I/Q**, **I/Q Adjustments**

Status after Normal Preset: Off

I/Q Adjustments Off On

Press this softkey to toggle off and on the I to Q gain ratio and the I and Q offset voltage adjustments. The values entered for the **I/Q Gain**, **I Offset**, and **Q Offset** are not applied to the I and Q signals until the **I/Q Adjustments Off On** softkey is set to **On**.

Softkey Location: Press **I/Q**, **I/Q Adjustments**, **I/Q Adjustments Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:DM:IQADjustment[:STATe] ON|OFF|1|0

[:SOURce]:DM:IQADjustment[:STATe]?

I/Q Calibration

Pressing this softkey reveals a menu of choices for executing an I/Q calibration. An I/Q calibration should be performed approximately every 30 days, but it can be performed at any time to peak the performance of the I/Q modulator. You can set the start and stop frequency for a user-defined I/Q calibration, or choose an I/Q calibration over the signal generator's entire frequency range. In this menu, you can also restore the values for the I/Q calibration performed at the factory (the instrument discards the latest calibration data and uses the data installed by the factory).

Softkey Location: Press **I/Q**, **More (1 of 2)**, **I/Q Calibration**

I/Q Gain

Press this softkey to change the I to Q gain ratio. For example, if you enter in a value of +1 dB, the I signal will have 1 dB more amplitude than the Q signal. The range of gain adjustment values allowed is –4 dB to +4 dB. The gain ratio adjustment can be used with externally-applied I and Q signals or with internally-generated I and Q signals. Change the gain ratio to adjust out imperfections in I and Q or to introduce calibrated impairments. Set the gain ratio as desired and then toggle the **I/Q Adjustments Off On** softkey to **On**.

Softkey Location: Press **I/Q**, **I/Q Adjustments**, **I/Q Gain**

Status after Normal Preset: 0 dB

SCPI Commands:

[:SOURce]:DM:IQADjustment:GAIN <val><unit>

[:SOURce]:DM:IQADjustment:GAIN?

I/Q Off On

This softkey enables the I/Q modulation. Notice, however, that although you can enable I/Q modulation with this softkey, the RF carrier is modulated only when you have also set **Mod On/Off** to **On**. **I/Q Off/On** is also toggled automatically to **On** when any of the digital modulation formats are enabled (Option UN3 or UN4 only). However, you can turn off the I/Q modulation with this softkey even though the digital modulation mode is enabled. With this configuration, the RF output signal would not be modulated but the I/Q signals will be present at the rear panel I/Q outputs. Whenever I/Q modulation is enabled, the **I/Q** annunciator is turned on in the display.

Softkey Location: Press **I/Q**, **I/Q Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:DM:STATe ON|OFF|1|0

[:SOURce]:DM:STATe?

I/Q Source

Pressing this softkey reveals a menu of I/Q source choices. If you have enabled a digital modulation format (Option UN3 or UN4 only), the signal generator is automatically set to internally generate I and Q signals (**Int I/Q**). You cannot use the internal source unless you have also enabled a digital modulation format. You can externally supply the I and Q signals via the I INPUT and Q INPUT connectors by pressing **Ext I/Q**. Apply the in-phase and quadrature-phase signals to the I and Q inputs. The signal level is $\sqrt{I^2+Q^2}$ = 0.5 V_{rms}. (See the sections on Ext I/Q and High Crest Mode.)

Softkey Location: Press **I/Q**, **I/Q Source**

Status after Normal Preset: Ext I/Q

SCPI Commands:

[:SOURce]:DM:SOURce?

Int Burst

This softkey is automatically selected for the burst source when you have enabled one of the digital modulation formats with burst on (Option UN3 or UN4 only). In this mode, the internal baseband generator bursts the RF carrier. You can override this automatic selection by selecting **Ext1 DC** as the **Burst Source**. As long as burst is turned on in an enabled digital modulation format, you can toggle between the internal and external burst sources.

Softkey Location: Press **I/Q**, **Burst Source**, **Int Burst**

SCPI Commands:

[:SOURce]:BURSt:SOURce INTernal[1]

[:SOURce]:BURSt:SOURce?

Int I/Q

This softkey is automatically selected for the I/Q source when you have enabled a digital modulation format (Option UN3 or UN4 only). In this mode, the signal generator is automatically set to internally generate I and Q signals. You can override this selection by setting the **I/Q Source** to **Ext1 I/Q**. As long as digital modulation is enabled, you can toggle between the internal and external I/Q sources.

Softkey Location: Press **I/Q**, **I/Q Source**, **Int I/Q**

SCPI Commands:

[:SOURce]:DM:SOURce INTernal

[:SOURce]:DM:SOURce?

Phase Polarity Normal Invert

Press this softkey to toggle between the **Normal** and **Invert** settings for I/Q phase polarity. In the inverted mode, the input applied to the I INPUT connector is physically routed to the Q input port of the internal I/Q modulator. In addition, the input applied to the Q INPUT connector is physically routed to the I input port of the internal I/Q modulator. This inverts the direction of phase rotation of the I/Q modulation. If you have enabled a digital modulation format (Option UN3 or UN4 only), I/Q phase polarity will be automatically set to normal. You can override this setting with this key.

Softkey Location: Press **I/Q**, **More (1 of 2)**, **Phase Polarity Normal Invert**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:DM:POLarity[:ALL] NORMal|INVerted

[:SOURce]:DM:POLarity[:ALL]?

Power Search Manual Auto

This softkey toggles between the auto and manual modes of power search mode. Power search is an internal calibration routine used to achieve calibrated output power when the ALC is off. When you set **Power Search Manual Auto** to **Auto**, power search will execute automatically with each change to the RF frequency or power, and also with each change to the AM, burst, pulse, or I/Q modulation state. You do not need to disconnect modulation inputs, however modulation is disabled during power search. If you are using external I/Q modulation, the power search routine assumes that the I/Q input level is $\sqrt{I^2+Q^2}$ = 0.5 V_{rms}. Actual output amplitude will scale directly with $\sqrt{I^2+Q^2}$.

When you set **Power Search Manual Auto** to **Manual**, the power search routine is not run until the **Do Power Search** softkey is pressed. As with auto mode, you do not need to disconnect modulation inputs during power search, however modulation is disabled during the power search.

The following conditions must be met in order to engage either power search mode:

- **ALC Off On** is set to **Off**
- **RF On/Off** is set to **On**

Softkey Location: Press **I/Q**, **More (1 of 2)**, toggle **ALC Off On** softkey to **Off**, press **Power Search Manual Auto**

Status after Normal Preset: Manual

SCPI Commands:

[:SOURce]:POWer:ALC:SEARch ON|OFF|1|0|ONCE

[:SOURce]:POWer:ALC:SEARch?

Q Offset

Press this softkey to enter an origin offset voltage for internally-generated or externally-applied quadrature-phase signals. Enter the value as a percentage of full scale (500 mV). The range of values allowed is –100% to +100%. Change the origin offset to adjust out imperfections in the quadrature-phase signal or to introduce calibrated impairments. Set the origin offset as desired and then toggle the **I/Q Adjustments Off On** softkey to **On**.

Softkey Location: Press **I/Q**, **I/Q Adjustments**, **Q Offset**

Status after Normal Preset: 0.0%

SCPI Commands:

[:SOURce]:DM:IQADjustment:QOFFset <val><unit>

[:SOURce]:DM:IQADjustment:QOFFset?

Revert to Default Cal Settings

Press this softkey to restore the original factory calibration data for the internal I/Q modulator. The latest calibration data from the user calibration is discarded. Although the factory calibration data may not be optimized for the signal generator's present status, the data can be used as a starting point if the current data is lost (if the I/Q calibration is unable to execute).

Softkey Location: Press **I/Q**, **More (1 of 2)**, **I/Q Calibration**, **Revert to Default Cal Settings**

SCPI Commands:

:CALibration:IQ:DEFault

Start Frequency

Press this softkey in the I/Q Calibration menu to set the start frequency for executing an I/Q calibration. You can select a portion of the frequency range for an I/Q calibration by selecting **Calibration Type User** and setting new start and stop frequencies. Limiting the frequency range of the calibration will decrease the time required for the calibration to be executed. To enter a frequency, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Hz**, **kHz**, **MHz**, or **GHz** terminator softkey. This softkey is automatically set to the minimum specified frequency of the signal generator if you have set the **Calibration Type User Full** softkey to **Full** (entire frequency range of the signal generator.) The **User** value for **Start Frequency** is not changed, however. If you toggle back to **User** from the **Full** setting, notice that the **User** value is unchanged.

Start Frequency is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **I/Q**, **More (1 of 2)**, **I/Q Calibration**, **Start Frequency**

SCPI Commands:

:CALibration:IQ:STARt <value><units>

:CALibration:IQ:STARt?

Stop Frequency

Press this softkey in the I/Q Calibration menu to set the stop frequency for executing an I/Q calibration. You can select a portion of the frequency range for an I/Q calibration by selecting **Calibration Type User** and setting new start and stop frequencies. Limiting the frequency range of the calibration will decrease the time required for the calibration to be executed. To enter a frequency, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Hz**, **kHz**, **MHz**, or **GHz** terminator softkey. This softkey is automatically set to the maximum specified frequency of the signal generator if you have set the **Calibration Type User Full** softkey to **Full** (entire frequency range of the signal generator.) The **User** value for **Stop Frequency** is not changed, however. If you toggle back to **User** from the **Full** setting, notice that the **User** value is unchanged.

Stop Frequency is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **I/Q**, **More (1 of 2)**, **I/Q Calibration**, **Stop Frequency**

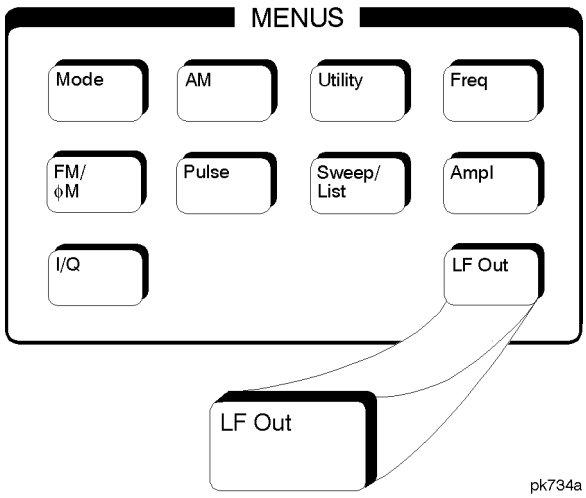
SCPI Commands:

:CALibration:IQ:STOP <value><units>

:CALibration:IQ:STOP?

LF Out

Pressing the front panel **LF Out** key reveals a menu of softkeys for configuring the internal low frequency generator. These softkeys are described in this section in alphabetical order.



Bus

This softkey is one of the choices in the LF Out Sweep Trigger menu. With **Bus** selected, you use the HP-IB to trigger single sweeps of swept-sine low frequency output.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **Swept-Sine**, **LF Out Sweep Trigger**, **Bus**

Status after Normal Preset: LF out sweep trigger is set to Immediate

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:SWEep:TRIGger BUS

[:SOURce]:LFOutput:FUNCtion:SWEep:TRIGger?

DC

This softkey lets you specify DC as the waveform for the LF output signal.

This softkey is only active when you have selected the internal source to operate as a function generator.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **More 1 of 2**, **DC**

Status after Normal Preset: LF Out Waveform is set to DC

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:SHAPe DC

[:SOURce]:LFOutput:FUNCtion:SHAPe?

Dual-Sine

Pressing this softkey reveals a menu of choices for setting the dual-sine low frequency output parameters. In this menu you can set the frequencies for two separate tones. In addition you can set a ratio of the tone 2 LF amplitude to the tone 1 LF amplitude.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **Dual-Sine**

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:SHAPe DUALsine

[:SOURce]:LFOutput:FUNCtion:SHAPe?

Ext

This softkey is one of the choices in the LF Output Sweep Trigger menu. Choosing **Ext** allows you to trigger swept-sine low frequency output using the signal applied to the TRIGGER IN rear panel connector. Set the polarity of the trigger signal using the **Trigger In Polarity Neg Pos** softkey.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **Swept-Sine**, **LF Out Sweep Trigger**, **Ext**

Status after Normal Preset: LF output sweep trigger is set to Immediate

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:SWEep:TRIGger EXTernal

[:SOURce]:LFOutput:FUNCtion:SWEep:TRIGger?

Function Generator

This softkey lets you set the **LF Out Source** to be a function generator. You can select a frequency and shape in addition to selecting the amplitude for a signal that is output at the LF OUTPUT front panel connector. When you use the internal source in this capacity, any modulation with the internal source selected is turned off.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**

Status after Normal Preset: LF Out Source is set to Internal Modulation

SCPI Commands:

[:SOURce]:LFOutput:SOURce FUNCtion

[:SOURce]:LFOutput:SOURce?

Immediate

This softkey is one of the choices in the LF Output Sweep Trigger menu. Choosing **Immediate** immediately triggers swept-sine low frequency output in a continuous mode. To stop the sweep, choose a different trigger such as **Ext**, or set the waveform to something other than **Swept-Sine**.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **Swept-Sine**, **LF Output Sweep Trigger**, **Immediate**

Status after Normal Preset: LF output sweep trigger is set to Immediate

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:SWEep:TRIGger IMMediate

[:SOURce]:LFOutput:FUNCtion:SWEep:TRIGger?

Internal

This softkey lets you output a signal at the LF OUTPUT connector where the frequency and shape of the signal is set by the internal source as it is being used by a modulation. For example, if the internal source is currently assigned to an AM path configuration and AM is turned on, the signal output at the LF OUTPUT connector will have the frequency and shape of the amplitude modulating signal. You can scale the amplitude of the output signal using the **LF Out Amplitude** softkey.

For internal square pulse modulation, the internal source is a sinewave which is later squared by the modulator to generate the pulse squarewave. The LF OUTPUT signal for this internal source, therefore, is a sinewave. For internal pulse modulation, a true variable-width pulse will be seen on the LF OUTPUT.

Softkey Location: Press **LF Out**, **LF Out Source**, **Internal Modulation**

Status after Normal Preset: LF Out Source is set to Internal Modulation

SCPI Commands:

[:SOURce]:LFOutput:SOURce INT[1]

[:SOURce]:LFOutput:SOURce?

LF Out Amplitude

Use this softkey to scale the output of the signal at the LF OUTPUT connector. To change the value, press the softkey once. The current value for LF output amplitude is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **V**, or **mV** terminator softkey. The range of values allowed is 0 to 5 Vpk in increments from 1 mV to 5 V.

Softkey Location: Press **LF Out**, **LF Out Amplitude**

Status after Normal Preset: 0V

SCPI Commands:

[:SOURce]:LFOutput:AMPLitude <val><unit>

[:SOURce]:LFOutput:AMPLitude?

LF Out Freq

Use this softkey to set the modulating frequency for the LF output signal when you have selected the internal source as a function generator. To change the frequency, press the softkey once. The current modulating frequency is displayed in the active entry area. To enter a new frequency, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Hz** or **kHz** terminator softkey. The range of frequencies allowed is 0.1 Hz to 10 kHz. (0.1 Hz to 50 kHz is the range allowed if sinewave is selected as the internal waveform.)

This softkey is only active when you have selected the internal source to operate as a function generator.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Freq**

Status after Normal Preset: 400 Hz

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:FREQuency <val><unit>

[:SOURce]:LFOutput:FUNCtion:FREQuency?

LF Out Off On

This softkey toggles on and off the output of the selected source at the LF OUTPUT front panel connector. You can choose either the modulation signal generated by the internal source or you can use the low frequency source as a function generator and select that signal to output at the LF OUTPUT connector. Refer to the description of the **LF Out Source** softkey in this section for more information on choosing the source.

Once you have toggled this state on, the signal is immediately available at the LF OUTPUT connector. The **Mod On/Off** and **RF On/Off** keys do not apply to this state.

Softkey Location: Press **LF Out**, **LF Out Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:LFOutput:STATe ON|OFF|1|0

[:SOURce]:LFOutput:STATe?

LF Out Period

Use this softkey to change the pulse period for the pulsed low frequency waveform. To change the period, press the softkey once. The current value for pulse period is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **µsec** or **msec** terminator softkey. The range of values allowed is from 16 µs to 30 s. If you set the pulse period to a smaller value than the pulse width, an error message will be generated and the pulse width will be reduced to the value of the pulse period.

This softkey is only active when you have selected the internal source to operate as a function generator and when the LF Out waveform is specified as pulse.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **More 1 of 2**, **Pulse**, **LF Out Period**

Status after Normal Preset: 80 µs

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:PERiod <val><unit>

[:SOURce]:LFOutput:FUNCtion:PERiod?

LF Out Source

Pressing this softkey reveals a menu of choices for LF output sources. You can choose to output the signal from the internal source as it is being used by a modulation or you can use the internal source as a function generator and select that signal to output at the LF OUTPUT connector.

If you choose the internal source, the frequency and shape of the signal at the LF OUTPUT connector is set by the internal source as it is being used by a modulation. For example, if the internal source is currently assigned to an AM path configuration and AM is turned on, the signal output at the LF OUTPUT connector will have the frequency and shape of the amplitude modulating signal. You can scale the amplitude of the output signal using the **LF Out Amplitude** softkey.

If you choose to set the internal source as a function generator, you can select a frequency and shape in addition to selecting the amplitude for the LF output signal. When you use the internal source in this capacity, any modulation with the internal source selected is turned off.

Softkey Location: Press **LF Out**, **LF Out Source**

Status after Normal Preset: Internal Modulation

SCPI Commands:

[:SOURce]:LFOutput:SOURce?

LF Out Start Freq

Use this softkey to change the starting frequency for swept-sine low frequency output. To change the value, press the softkey once. The current value for the LF Out start frequency is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Hz** or **kHz** terminator softkey. The range of values allowed is 0.1 Hz to 50 kHz. The minimum increment allowed is 0.1 Hz.

This softkey is coupled to the **LF Out Freq** softkey in the initial LF Out Menu and the **LF Out Tone 1 Freq** softkey in the LF Out Dual-Sine Menu. Any value set for **LF Out Start Freq** is reflected in the **LF Out Freq** and **LF Out Tone 1 Freq** softkeys. Conversely, if you change the value for either the **LF Out Freq** softkey or the **LF Out Tone 1 Freq** softkey, the value for **LF Out Start Freq** is changed to match.

This softkey is only active when you have selected the internal source to operate as a function generator.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **Swept-Sine**, **LF Out Start Freq**

Status after Normal Preset: 400.0 Hz

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:FREQuency <val><unit>

[:SOURce]:LFOutput:FUNCtion:FREQuency?

LF Out Stop Freq

Use this softkey to change the ending frequency for swept-sine low frequency output. To change the value, press the softkey once. The current value for the LF Out stop frequency is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Hz** or **kHz** terminator softkey. The range of values allowed is 0.1 Hz to 50 kHz. The minimum increment allowed is 0.1 Hz.

This softkey is coupled to the **LF Out Tone 2 Freq** softkey in the LF Out Dual-Sine Menu. Any value set for **LF Out Stop Freq** is reflected in the **LF Out Tone 2 Freq** softkey. Conversely, if you change the value for the **LF Out Tone 2 Freq** softkey, the value for **LF Out Stop Freq** is changed to match.

This softkey is only active when you have selected the internal source to operate as a function generator.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **Swept-Sine**, **LF Out Stop Freq**

Status after Normal Preset: 400.0 Hz

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:FREQuency:ALTernate <val><unit>

[:SOURce]:LFOutput:FUNCtion:FREQuency:ALTernate?

LF Out Sweep Time

Press this softkey to set the sweep time for low frequency swept-sine output. The signal generator will sweep from the specified start frequency to the stop frequency in the time set with this softkey. Enter the desired sweep time using the up and down arrow keys, the front panel knob, or enter a value using the numeric keypad and press the **sec** or **msec** terminator softkey. The range of values allowed is 1 ms through 65.535 s. The minimum increment allowed is 1 ms.

This softkey is only active when you have selected the internal source to operate as a function generator.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **Swept-Sine**, **LF Out Sweep Time**

Status after Normal Preset: 100.0 msec

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:SWEep:TIME <val><unit>

[:SOURce]:LFOutput:FUNCtion:SWEep:TIME?

LF Out Sweep Trigger

Pressing this softkey reveals a menu of choices for triggering swept-sine low frequency output. You can choose triggering that occurs immediately, triggering that is supplied by the HP-IB, triggering on either a positive or negative level of a signal supplied to the TRIGGER IN connector, or triggering by the front panel **Trigger** key.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **Swept-Sine**, **LF Out Sweep Trigger**

Status after Normal Preset: Immediate

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:SWEep:TRIGger IMMediate|BUS|EXTernal|KEY

[:SOURce]:LFOutput:FUNCtion:SWEep:TRIGger?

LF Out Tone 1 Freq

Press this softkey to set the frequency for the LF Out tone 1. Enter the desired frequency using the up and down arrow keys, the front panel knob, or enter a value using the numeric keypad and press the **kHz** or **Hz** terminator softkey. The range of values allowed is 0.1 Hz through 50 kHz. The minimum increment allowed is 0.1 Hz.

This softkey is coupled to the **LF Out Freq** softkey in the initial LF Out Menu and the **LF Out Start Freq** softkey in the LF Out Swept-Sine Menu. Any value set for **LF Out Tone 1 Freq** is reflected in the **LF Out Freq** and **LF Out Start Freq** softkeys. Conversely, if you change the value for either the **LF Out Freq** softkey or the **LF Out Start Freq** softkey, the value for **LF Out Tone 1 Freq** is changed to match.

This softkey is only active when you have selected the internal source to operate as a function generator.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **Dual-Sine**, **LF Out Tone 1 Freq**

Status after Normal Preset: 400.0 Hz

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:FREQuency <val><unit>

[:SOURce]:LFOutput:FUNCtion:FREQuency?

LF Out Tone 2 Ampl % Of Peak

Press this softkey to set the ratio of the peak amplitude of LF Out tone 2 to the peak amplitude of LF Out as a percent. The range of values allowed is 0 to 100%. The minimum increment allowed is 0.1%. The sum of the two LF Out amplitudes results in the total LF Out amplitude (set by the **LF Out Amplitude** softkey in the initial LF Out Menu).

For example, if the total LF Out amplitude is 300 mVp and you set **LF Out Tone 2 Ampl % Of Peak** to 33%, then the amplitude of LF Out tone 1 will be 200 mVp and the amplitude of LF Out tone 2 will be 100 mVp (33% of 300 mVp) so that the amplitude of the two tones adds up to 300 mVp (200 mVp plus 100 mVp).

This softkey is only active when you have selected the internal source to operate as a function generator.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **Dual-Sine**, **LF Out Tone 2 Ampl % Of Peak**

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:FREQuency:ALTernate:AMPLitude:PERCent <val><unit>

[:SOURce]:LFOutput:FUNCtion:FREQuency:ALTernate:AMPLitude:PERCent?

LF Out Tone 2 Freq

Press this softkey to set the frequency for the LF Out tone 2. Enter the desired frequency using the up and down arrow keys, the front panel knob, or enter a value using the numeric keypad and press the **kHz** or **Hz** terminator softkey. The range of values allowed is 0.1 Hz through 50 kHz. The minimum increment allowed is 0.1 Hz.

This softkey is coupled to the **LF Out Freq** softkey in the initial LF Out Menu and the **LF Out Stop Freq** softkey in the LF Out Swept-Sine Menu. Any value set for **LF Out Tone 2 Freq** is reflected in the **LF Out Freq** and **LF Out Stop Freq** softkeys. Conversely, if you change the value for either the **LF Out Freq** softkey or the **LF Out Stop Freq** softkey, the value for **LF Out Tone 2 Freq** is changed to match.

This softkey is only active when you have selected the internal source to operate as a function generator.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **Dual-Sine**, **LF Out Tone 2 Freq**

Status after Normal Preset: 400.0 Hz

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:FREQuency:ALTernate <val><unit>

[:SOURce]:LFOutput:FUNCtion:FREQuency:ALTernate?

LF Out Waveform

Pressing this softkey reveals a menu of LF output waveform choices for your LF function generator. Select from sine, dual-sine, swept-sine, triangle, ramp, square, pulse, noise, and DC waveforms.

This softkey is only active when you have selected the internal source to operate as a function generator.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**

Status after Normal Preset: Sine

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:SHAPe?

LF Out Width

Use this softkey to change the pulse width for the pulsed low frequency waveform. To change the width, press the softkey once. The current value for pulse width is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the µ**sec** or **msec** terminator softkey. The range of values allowed is from 8 µs to a maximum of the value for the pulse period.

This softkey is only active when you have selected the internal source to operate as a function generator and when the LF Out waveform is specified as pulse.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **More 1 of 2**, **Pulse**, **LF Out Width**

Status after Normal Preset: 40 µs

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:PWIDth <val><unit>

[:SOURce]:LFOutput:FUNCtion:PWIDth?

Noise

This softkey lets you specify noise as the waveform for the LF output signal.

This softkey is only active when you have selected the internal source to operate as a function generator.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **More 1 of 2**, **Noise**

Status after Normal Preset: LF Out Waveform is set to Sine

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:SHAPe NOISe

[:SOURce]:LFOutput:FUNCtion:SHAPe?

Pulse

This softkey lets you specify pulse as the waveform for the LF output signal. The signal shape can only be specified when you have selected the internal source to operate as a function generator. Use the **LF Out Period** and **LF Out Width** softkeys to define the pulse shape.

This softkey is only active when you have selected the internal source to operate as a function generator.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **More 1 of 2**, **Pulse**

Status after Normal Preset: LF Out Waveform is set to Sine

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:SHAPe PULSe

[:SOURce]:LFOutput:FUNCtion:SHAPe?

Ramp

This softkey lets you specify ramp as the waveform for the LF output signal.

This softkey is only active when you have selected the internal source to operate as a function generator.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **Ramp**

Status after Normal Preset: LF Out Waveform is set to Sine

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:SHAPe RAMP

[:SOURce]:LFOutput:FUNCtion:SHAPe?

Sine

This softkey lets you specify sine as the waveform for the LF output signal.

This softkey is only active when you have selected the internal source to operate as a function generator.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **Sine**

Status after Normal Preset: LF Out Waveform is set to Sine

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:SHAPe SINe

[:SOURce]:LFOutput:FUNCtion:SHAPe?

Square

This softkey lets you specify square as the waveform for the LF output signal.

This softkey is only active when you have selected the internal source to operate as a function generator.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **More 1 of 2**, **Square**

Status after Normal Preset: LF Out Waveform is set to Sine

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:SHAPe SQUare

[:SOURce]:LFOutput:FUNCtion:SHAPe?

Swept-Sine

Pressing this softkey reveals a menu of choices for setting the swept-sine low frequency output. In this menu you can set the LF start and stop frequency and the sweep time. You can also set the trigger for the swept-sine output, and the polarity of the TRIGGER IN and TRIGGER OUT signals.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **Swept-Sine**

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:SHAPe SWEPtsine

[:SOURce]:LFOutput:FUNCtion:SHAPe?

Triangle

This softkey lets you specify triangle as the waveform for the LF output signal.

This softkey is only active when you have selected the internal source to operate as a function generator.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **Triangle**

Status after Normal Preset: LF Out Waveform is set to Sine

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:SHAPe TRIangle

[:SOURce]:LFOutput:FUNCtion:SHAPe?

Trigger In Polarity Neg Pos

Press this softkey to toggle between a negative TTL level trigger (0 V) and a positive TTL level trigger (+5 V) for externally triggering swept-sine low frequency output.

This softkey is coupled to the **Trigger In Polarity Neg Pos** softkey for swept-sine AM, FM, and ΦM, and to the **Ext Neg** and **Ext Pos** sweep trigger selections in the Sweep/List Menu. If you set the **Trigger In Polarity Neg Pos** softkey in the LF Out Swept-Sine Menu to **Neg**, the **Trigger In Polarity Neg Pos** softkey is also set to **Neg** for swept-sine AM, FM, and ΦM. In addition, if the step or list sweep is set to externally trigger, the selection will automatically be set to **Ext Neg**. The same softkeys will toggle to **Pos** or to **Ext Pos** if you select **Pos** in the Swept-Sine LF Out Menu.

Conversely, if the **Trigger In Slope Neg Pos** softkey is toggled in the swept-sine AM, FM, or ΦM menus, it will cause the swept-sine LF Out softkey to toggle also. This is also true for the **Ext Neg** and **Ext Pos** step or list sweep trigger selections.

This softkey is only active when you have selected the internal source to operate as a function generator.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **Swept-Sine**, **Trigger In Polarity Neg Pos**

Status after Normal Preset: Pos

SCPI Commands:

:TRIGger[:SEQuence]:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:SLOPe?

Trigger Key

This softkey is one of the choices in the LF Output Sweep Trigger menu. With **Trigger Key** selected, when you press the **Trigger** front panel key you immediately trigger a single sweep of swept-sine low frequency output.

The **Trigger** key has autorepeat capability. Hold it down and you will repeatedly trigger sweeps until you release the key.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **Swept-Sine**, **LF Output Sweep Trigger**, **Trigger Key**

Status after Normal Preset: LF output sweep trigger is set to Immediate

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:SWEep:TRIGger KEY

[:SOURce]:LFOutput:FUNCtion:SWEep:TRIGger?

Trigger Out Polarity Neg Pos

This softkey toggles the polarity of the TTL signal that is output at the rear panel TRIGGER OUT connector. When **Trigger Out Polarity Neg Pos** is set to **Pos**, the output signal is asserted high (+5 V) at the start of the swept-sine low frequency sweep and low (0 V) when the sweep is concluded. Setting **Trigger Out Polarity Neg Pos** to **Neg** reverses the polarity, where a high is 0 V and a low is +5 V.

This softkey is coupled to the **Trigger Out Polarity Neg Pos** softkey in the swept-sine AM, FM, and ΦM menus and the sweep/list menu. When the polarity is toggled for this softkey in any one of these menus, it affects all locations of the softkey.

This softkey is only active when you have selected the internal source to operate as a function generator.

Softkey Location: Press **LF Out**, **LF Out Source**, **Function Generator**, **LF Out Waveform**, **Swept-Sine**, **Trigger Out Polarity Neg Pos**

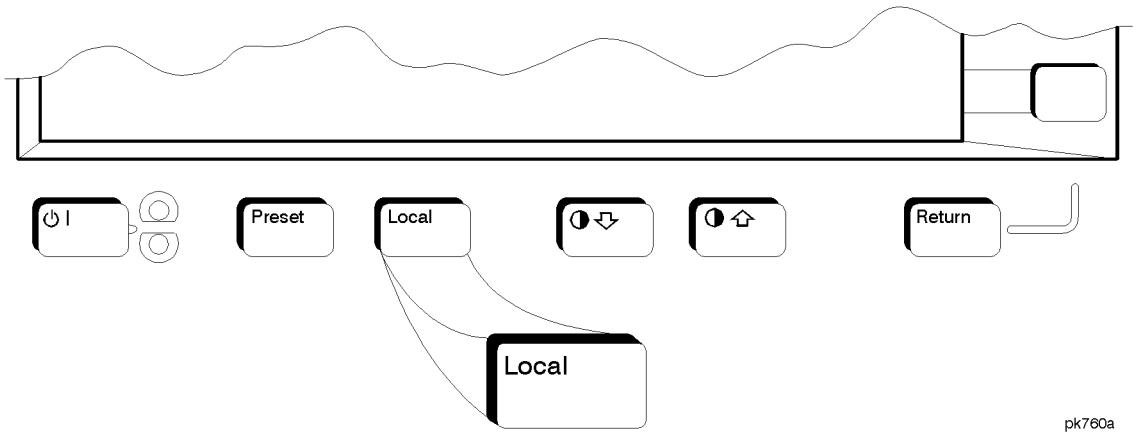
Status after Normal Preset: Pos

SCPI Commands:

:TRIGger:OUTPut:POLarity POSitive|NEGative

:TRIGger:OUTPut:POLarity?

Local

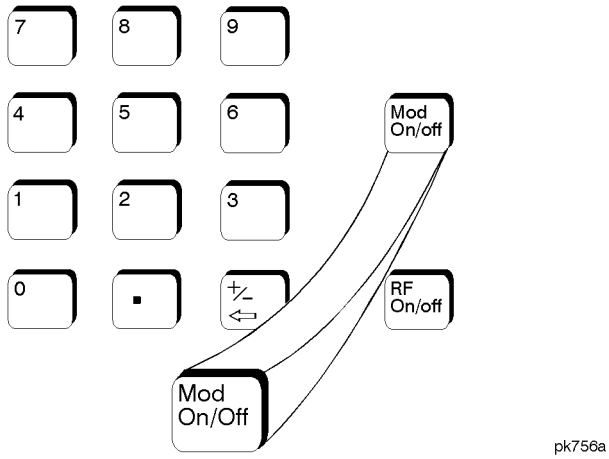


Press this key to return the signal generator to local (front panel) control from remote operation or to restore the front panel menu and status area display after RS-232 control. You can also press this key to restore the display once the screen saver has started.

This key has autorepeat capability. Hold it down and its function is continuously executed until you release it.

Status after Normal Preset: Local (unless a LOCAL LOCKOUT command has been sent).

Mod On/Off



Set this front panel hardkey to **On** to modulate the RF carrier with the modulations that you have enabled. All modulation types can be simultaneously enabled except FM with ΦM, AM with external burst source, and wideband AM with I/Q. An annunciator is always turned on in the display to indicate whether modulation is turned on or off.

Status after Normal Preset: Mod Off

SCPI Commands:

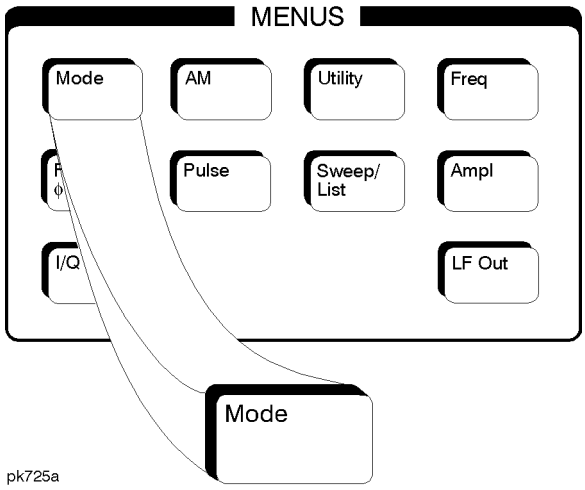
:OUTPut:MODulation[:STATe] ON|OFF|1|0

:OUTPut:MODulation[:STATe]?

Mode

Pressing the front panel **Mode** key reveals a menu of softkeys. These softkeys let you access further menus for configuring the following digital modulation formats: DECT, GSM, NADC, PDC, PHS, and TETRA. These menus are only available on signal generators with Option UN3 or UN4. The softkeys for each of the communications standards are described in alphabetical order in the appropriate section (see 'Mode - DECT', "Mode - GSM", "Mode - NADC", "Mode - PDC", "Mode - PHS", and "Mode - TETRA").

Pressing the **Mode** key twice causes the currently active mode menu to be displayed. For example, if NADC is enabled (the **NADC Off On** softkey is set to **On**) but the NADC menu is not currently displayed, press **Mode** twice to display the first level menu for NADC.



Mode - DECT

Pressing this softkey reveals a menu of softkeys for generating data patterns that are formatted into a framed structure (where the data bits are located in fields defined by the DECT protocol) or for generating just the data pattern where the data sequence can be output a single time or repeatedly. These softkeys are described in this section in alphabetical order.

4 1's & 4 0's

Press this softkey to select a binary data pattern that consists of four ones followed by four zeroes. If you have selected **4 1's & 4 0's** in a pattern data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P4** (where "P" refers to Pattern and "4" refers to four ones and four zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **4 1's & 4 0's** in a framed data transmission, both the **B field** and the **Other Patterns** softkeys will show this selection. Also, **P4** is displayed in the **B** field located near the bottom of the text area of the display. A single output of a framed P4 data pattern consists of enough repetitions of four ones followed by four zeroes, followed by four ones and four zeroes, and so on, until the data field in the timeslot is filled.

Softkey Location: Press **Mode**, **DECT**, **Data**, **Other Patterns**, **4 1's & 4 0's**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **Other Patterns**, **4 1's & 4 0's**

4 1's & 4 0's is also located in the Other Patterns menus found in the portable part Configure Traffic Bearer menu and in the portable part and radio fixed part Configure Low Capacity menus.

SCPI Commands:

[:SOURce]:RADio:DECT:DATA P4

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom P4

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] P4

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] P4

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom P4

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] P4

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] P4

8 1’s & 8 0’s

Press this softkey to select a binary data pattern that consists of eight ones followed by eight zeroes. If you have selected **8 1’s & 8 0’s** and the data format is output as a pattern only, not framed data, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P8** (where “P” refers to Pattern and “8” refers to eight ones and eight zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **8 1’s & 8 0’s** and the data format is a framed transmission, both the **B field** and the **Other Patterns** softkeys will show this selection. Also, **P8** is displayed in the **B** field located near the bottom of the text area of the display. A single output of a framed P8 data pattern consists of enough repetitions of eight ones followed by eight zeroes, followed by eight ones and eight zeroes, and so on, until the data field in the timeslot is filled.

Softkey Location: Press **Mode**, **DECT**, **Data**, **Other Patterns**, **8 1’s & 8 0’s**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **Other Patterns**, **8 1’s & 8 0’s**

8 1’s & 8 0’s is also located in the Other Patterns menus found in the portable part Configure Traffic Bearer menu and in the portable part and radio fixed part Configure Low Capacity menus.

SCPI Commands:

[:SOURce]:RADio:DECT:DATA P8

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom P8

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] P8

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] P8

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom P8

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] P8

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] P8

16 1’s & 16 0’s

Press this softkey to select a binary data pattern that consists of sixteen ones followed by sixteen zeroes. If you have selected **16 1’s & 16 0’s** and the data format is output as a pattern only, not framed data, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P16** (where “P” refers to Pattern and “16” refers to sixteen ones and sixteen zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **16 1’s & 16 0’s** and the data format is a framed transmission, both the **B field** and the **Other Patterns** softkeys will show this selection. Also, **P16** is displayed in the **B** field located near the bottom of the text area of the display. A single output of a framed P16 data pattern consists of enough repetitions of sixteen ones followed by sixteen zeroes, followed by sixteen ones and sixteen zeroes, and so on, until the data field in the timeslot is filled.

Softkey Location: Press **Mode**, **DECT**, **Data**, **Other Patterns**, **16 1’s & 16 0’s**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **Other Patterns**, **16 1’s & 16 0’s**

16 1’s & 16 0’s is also located in the Other Patterns menus found in the portable part Configure Traffic Bearer menu and in the portable part and radio fixed part Configure Low Capacity menus.

SCPI Commands:

[:SOURce]:RADio:DECT:DATA P16

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom P16

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] P16

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] P16

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom P16

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] P16

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] P16

32 1’s & 32 0’s

Press this softkey to select a binary data pattern that consists of thirty-two ones followed by thirty-two zeroes. If you have selected **32 1’s & 32 0’s** and the data format is output as a pattern only, not framed data, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P32** (where “P” refers to Pattern and “32” refers to thirty-two ones and thirty-two zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **32 1’s & 32 0’s** and the data format is a framed transmission, both the **B field** and the **Other Patterns** softkeys will show this selection. In addition, **P32** is displayed in the **B** field located near the bottom of the text area of the display. A single output of a framed P32 data pattern consists of enough repetitions of thirty-two ones followed by thirty-two zeroes, followed by thirty-two ones and thirty-two zeroes, and so on, until the data field in the timeslot is filled.

Softkey Location: Press **Mode**, **DECT**, **Data**, **Other Patterns**, **32 1’s & 32 0’s** or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **Other Patterns**, **32 1’s & 32 0’s**

32 1’s & 32 0’s is also located in the Other Patterns menus found in the portable part Configure Traffic Bearer menu and in the portable part and radio fixed part Configure Low Capacity menus.

SCPI Commands:

[:SOURce]:RADio:DECT:DATA P32

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom P32

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] P32

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] P32

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom P32

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] P32

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] P32

64 1’s & 64 0’s

Press this softkey to select a binary data pattern that consists of sixty-four ones followed by sixty-four zeroes. If you have selected **64 1’s & 64 0’s** and the data format is output as a pattern only, not framed data, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P64** (where “P” refers to Pattern and “64” refers to sixty-four ones and sixty-four zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **64 1’s & 64 0’s** and the data format is a framed transmission, both the **B field** and the **Other Patterns** softkeys will show this selection. In addition, **P64** is displayed in the **B** field located near the bottom of the text area of the display. A single output of a framed P64 data pattern consists of enough repetitions of sixty-four ones followed by sixty-four zeroes, followed by sixty-four ones and sixty-four zeroes, and so on, until the data field in the timeslot is filled.

Softkey Location: Press **Mode**, **DECT**, **Data**, **Other Patterns**, **64 1’s & 64 0’s** or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **Other Patterns**, **64 1’s & 64 0’s**

64 1’s & 64 0’s is also located in the Other Patterns menus found in the portable part Configure Traffic Bearer menu and in the portable part and radio fixed part Configure Low Capacity menus.

SCPI Commands:

[:SOURce]:RADio:DECT:DATA P64

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom P64

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] P64

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] P64

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom P64

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] P64

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] P64

A

Press this softkey to change the 64-bit A field. (The A field and the B field are sub-fields of the DECT D field.) The A field consists of 48 bits of signalling data and 16 bits of error correction. The preset hexadecimal value (when normal preset is selected) for the A field reflects the DECT standard, however you can enter a new value by pressing this softkey. To enter a value (in hexadecimal), press **A**. The A field value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The current value for the A field is displayed in the **A** field near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **A**

A is also located in the portable part Configure Traffic Bearer menu and the radio fixed part and portable part Low Capacity menus.

Status after Normal Preset: 0000FFFF0000FFFF

SCPI Commands:

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity:A <64 bit value>

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity:A?

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic:A <64 bit value>

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic:A?

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:DUMM[1]:A <64 bit value>

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:DUMM[1]:A?

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:DUMM2:S <16 bit value>

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:DUMM2:A <64 bit value>

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:DUMM2:A?

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity:S <16 bit value>

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity:A <64 bit value>

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity:A?

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic:S <64 bit value>

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic:A?

All Timeslots

Press this softkey to output a 1-bit pulse to the EVENT 1 rear panel connector that is synchronized to the first bit of each timeslot in a frame. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **All Timeslots**

SCPI Commands:

[:SOURce]:RADio:DECT:SOUT ALL

B

Pressing this softkey reveals a menu of choices for internal data generation (PN9, PN15, fixed, 4-bit repeating sequences, set patterns of ones and zeroes) or you can choose to supply your own data (download a binary file or input data using the DATA INPUT connector) for configuring the timeslot data bit fields (B field). (The A field and the B field are sub-fields of the DECT D field.)

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B**

B is also located in the portable part Configure Traffic Bearer menu and the radio fixed part and portable part Low Capacity menus.

Status after Normal Preset: PN9

SCPI Commands:

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity:B?

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic:B?

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity:B?

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic:B?

BBG Data Clock Ext Int

Press this softkey to select the internal data clock for the baseband generator or to select an externally-supplied data clock. A data clock or symbol clock input must be supplied when external mode is selected. For more information on input and output signals, refer to Chapter 7, “Operation”.

Softkey Location: Press **Mode**, **DECT**, **More (1 of 2)**, **Configure Hardware**, **BBG Data Clock Ext Int**

Status after Normal Preset: Int

SCPI Commands:

[:SOURce]:RADio:DECT:BBCLock INT[1]|EXTernal[1]

[:SOURce]:RADio:DECT:BBCLock?

Begin Frame

Press this softkey to output a 1-bit pulse to the EVENT 1 rear panel connector that is synchronized to the first bit of the first frame. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified. The number of trigger pulses generated depends on the framed data patterns selected:

- If a PN9 or PN15 data pattern is selected, a single frame is generated. The data fields of the frame are filled sequentially with the PRBS data. The synchronizing pulse occurs at the beginning of the frame each time it is transmitted.
- Any combination of external data and a PN9 data pattern will cause 511 frames to be generated. The synchronizing pulse occurs at the beginning of the first of the 511 frames each time that frame is transmitted.
- Any combination of external data and a PN15 data pattern will cause a discontinuous PN15. A discontinuous PN15 pattern consists of as many complete frames of PN15 data as can be generated. The remaining bits that do not completely fill a frame are truncated. The synchronizing pulse occurs at the beginning of the first frame each time that frame is transmitted.
- Any combination of user’s files and a PN15 data pattern will cause a discontinuous PN15. The synchronizing pulse occurs at the beginning of the first frame each time that frame is transmitted.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **Begin Frame**

SCPI Commands:

[:SOURce]:RADio:DECT:SOUT FRAME

Begin Pattern

Press this softkey to output a 1-bit pulse to the EVENT 1 rear panel connector that is synchronized to the first bit of your unframed data pattern (**Data Format Pattern Framed** is set to **Pattern**), and for each repetition of the pattern. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified.

Softkey Location: Press **Mode**, **DECT**, **More (1 of 2)**, **Sync Out**, **Begin Pattern**

SCPI Commands:

[:SOURce]:RADio:DECT:SOUT FRAME

Begin Timeslot

Press this softkey to output a 1-bit signal to the EVENT 1 rear panel connector that is synchronized to the first bit of a selected timeslot. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified. Select the timeslot by pressing **Begin Timeslot**. The timeslot number for the synchronization signal becomes the active function. Enter a value using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **Begin Timeslot**

SCPI Commands:

[:SOURce]:RADio:DECT:SOUT SLOT

[:SOURce]:RADio:DECT:SOUT:SLOT <value>

[:SOURce]:RADio:DECT:SOUT:SLOT?

Bit Rate

There are two softkeys named **Bit Rate**. The first is a menu key (distinguished by an arrow pointing to the right). Pressing this softkey reveals a menu of choices for setting the transmission bit rate. In this menu, there is another softkey named **Bit Rate**. Press this softkey to set the bit rate to any value from 922.000 kbps through 1.209600 Mbps. Enter the desired value using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Mbps**, **kbps**, or **bps** terminator softkey.

Softkey Location: Press **Mode**, **DECT**, **More (1 of 2)**, **Modify Standard**, **Bit Rate**
or press **Mode**, **DECT**, **More (1 of 2)**, **Modify Standard**, **Bit Rate**, **Bit Rate**

Status after Normal Preset: 1.152000 Mbps

SCPI Commands:

[:SOURce]:RADio:DECT:BRATe <value>

[:SOURce]:RADio:DECT:BRATe?

Burst Shape

Pressing this softkey reveals a menu of choices for modifying the burst shape of the framed data. In this menu, you can change the rise and fall time of the burst, in bits, and you can change the rise and fall delay of the burst, in bits. A softkey is also provided to return the default burst shape values.

Softkey Location: Press **Mode**, **DECT**, **More (1 of 2)**, **Modify Standard**, **Burst Shape**

Bus

Press this softkey to use the HP-IB as the pattern trigger for a single output of your unframed data pattern or as the frame trigger for a single output of your framed data. Once selected, you can trigger a single event at any time by sending a trigger command over HP-IB (*TRG) or by asserting the HP-IB GET (group execute trigger) line.

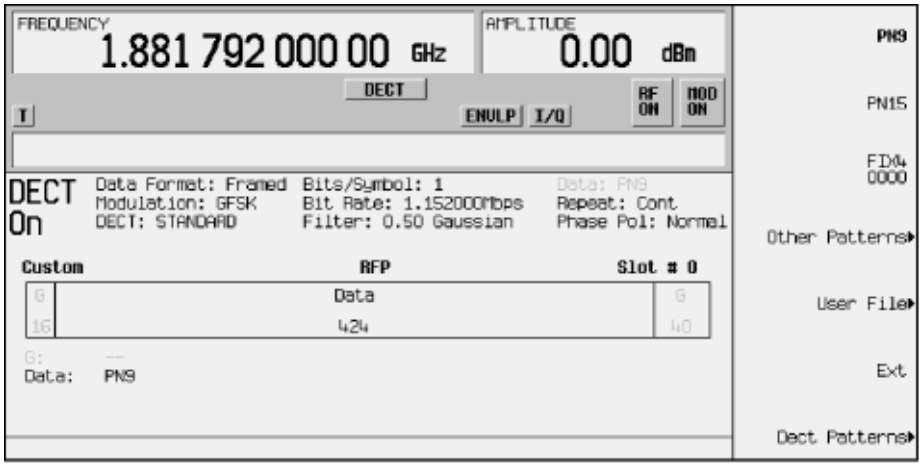
Softkey Location: Press **Mode**, **DECT**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Bus**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Bus**

SCPI Commands:

[:SOURce]:RADio:DECT:TRIGger[:SOURce] BUS

Configure Custom

Pressing this softkey reveals a menu of softkeys for selecting the data pattern for a custom timeslot. The following figure shows an example of display graphics for a radio fixed part custom timeslot. The visual representation of the timeslot shows each field of the custom timeslot.



pk7112a

In this example:

- **G: --** - There are two guard time fields. The text in this field is grey, indicating that you cannot change the contents of the guard time fields.
- **Data: PN9** - Indicates that the data selection for this custom timeslot is PN9. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, DECT-specific patterns, user files, or external data.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Custom**, **Configure Custom**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Transmit Link RFP PP**, **Timeslot Type**, **Custom**, **Configure Custom**

SCPI Commands:

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom PN9|PN15|FIX4|"filename"|EXT|FDEV1_HS|FDEV1_FS|FDEV2_FS|FACCCuracy|DM1|DM0|P4|P8|P16|P32|P64

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom?

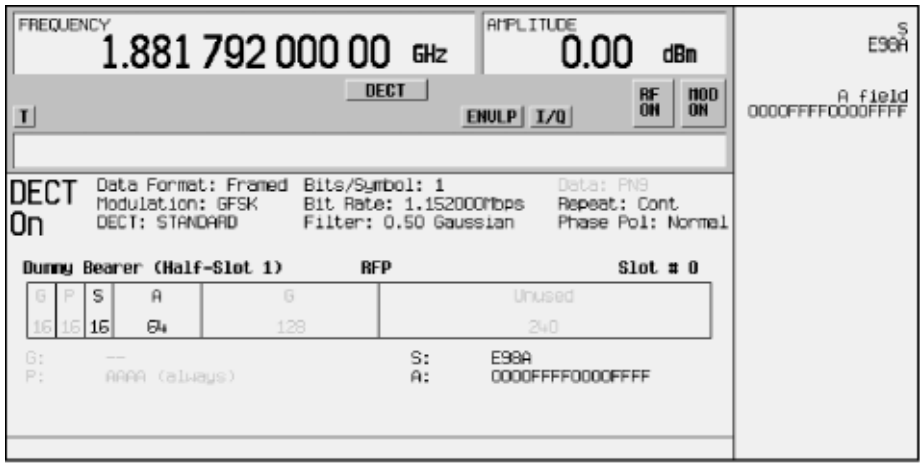
[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom PN9|PN15|FIX4|"filename"|EXT|FDEV1_HS|FDEV1_FS|FDEV2_FS|FACCCuracy|

DM1|DM0|P4|P8|P16|P32|P64

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom?

Configure Dummy Bearer 1

Pressing this softkey reveals a menu of softkeys for configuring a timeslot as a dummy bearer 1 burst. The following figure shows an example of display graphics for a dummy bearer 1 timeslot. In this configuration, the dummy bearer occupies the first half of a full slot. The dummy bearer 1 timeslot type is only available in the radio fixed part link.



pk7113a

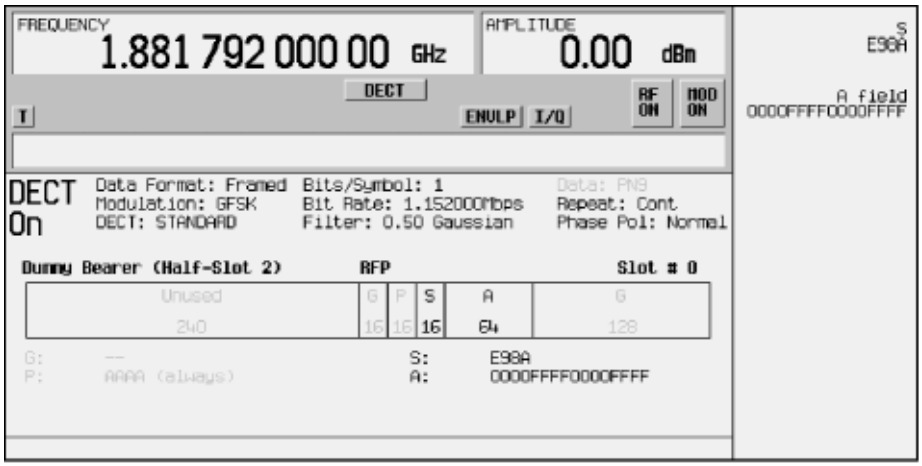
In this example:

- **G: --** - There are two guard time fields. The text in this field is grey, indicating that you cannot change the contents of the guard time fields.
- **P: AAAA (always)** - The preamble is a 16-bit field. The text in this field is grey, indicating that you cannot change the contents of the start symbol field.
- **S: E98A** - Indicates that the 16-bit synchronization word is set to hexadecimal E98A. Press the **S** softkey in the Configure Dummy Bearer 1 menu to change the contents of the synchronization word field.
- **A:0000FFFF0000FFFF** - Indicates that the A field is set to hexadecimal 0000FFFF0000FFFF. Press the **A** softkey in the Configure Dummy Bearer 1 menu to change the contents of the A field.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Dummy Bearer 1**, **Configure Dummy Bearer 1**

Configure Dummy Bearer 2

Pressing this softkey reveals a menu of softkeys for configuring a timeslot as a dummy bearer 2 burst. The following figure shows an example of display graphics for a dummy bearer 2 timeslot. In this configuration, the dummy bearer occupies the first half of a full slot. The dummy bearer 1 timeslot type is only available in the radio fixed part link.



pk7114a

In this example:

- **G: --** - There are two guard time fields. The text in this field is grey, indicating that you cannot change the contents of the guard time fields.
- **P: AAAA (always)** - The preamble is a 16-bit field. The text in this field is grey, indicating that you cannot change the contents of the start symbol field.
- **S: E98A** - Indicates that the 16-bit synchronization word is set to hexadecimal E98A. Press the **S** softkey in the Configure Dummy Bearer 2 menu to change the contents of the synchronization word field.
- **A:0000FFFF0000FFFF** - Indicates that the A field is set to hexadecimal 0000FFFF0000FFFF. Press the **A** softkey in the Configure Dummy Bearer 2 menu to change the contents of the A field.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Dummy Bearer 2**, **Configure Dummy Bearer 2**

Configure Frame

Pressing this softkey accesses the **PN9 Mode Normal Quick** softkey to toggle between normal and quick PN9 modes.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Frame**

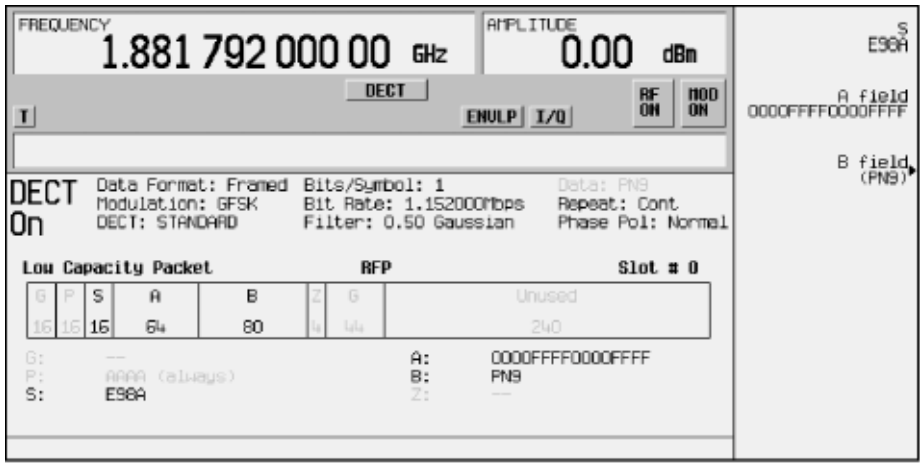
Configure Hardware

Pressing this softkey reveals a menu that allows you to set or select a particular latch or hardware configuration to meet your specific needs.

Softkey Location: Press **Mode**, **DECT**, **More (1 of 2)**, **Configure Hardware**

Configure Low Capacity

Pressing this softkey reveals a menu of softkeys for configuring a timeslot as a low capacity burst. The following figure shows an example of display graphics for a radio fixed part low capacity timeslot. The portable part low capacity timeslot is identical except for the instrument preset values.



pk7115a

In this example:

- **`G: --`** - There are two guard time fields. The text in this field is grey, indicating that you cannot change the contents of the guard time fields.
- **`P: AAAA (always)`** - The preamble is a 16-bit field. The text in this field is grey,

indicating that you cannot change the contents of the preamble field.

- **S: E98A** - Indicates that the 16-bit synchronization word is set to hexadecimal E98A. Press the **S** softkey in the Configure Low Capacity menu to change the contents of the synchronization word field.
- **A: 0000FFFF0000FFFF** - Indicates that the A field is set to hexadecimal 0000FFFF0000FFFF. Press the **A** softkey in the Configure Low Capacity menu to change the contents of the A field.
- **B: PN9** - Indicates that the B field data selection is PN9. Press the **B field** softkey in the Configure Low Capacity menu to change the data selection. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, DECT-specific patterns, user files, or external data.
- **Z: --** - The Z field is a 4-bit error detection field. The Z field repeats the last 4 bits of the B field. The text in this field is grey, indicating that you cannot change the contents of the Z field.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Low Capacity**, **Configure Low Capacity** or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Transmit Link RFP PP**, **Timeslot Type**, **Low Capacity**, **Configure Low Capacity**

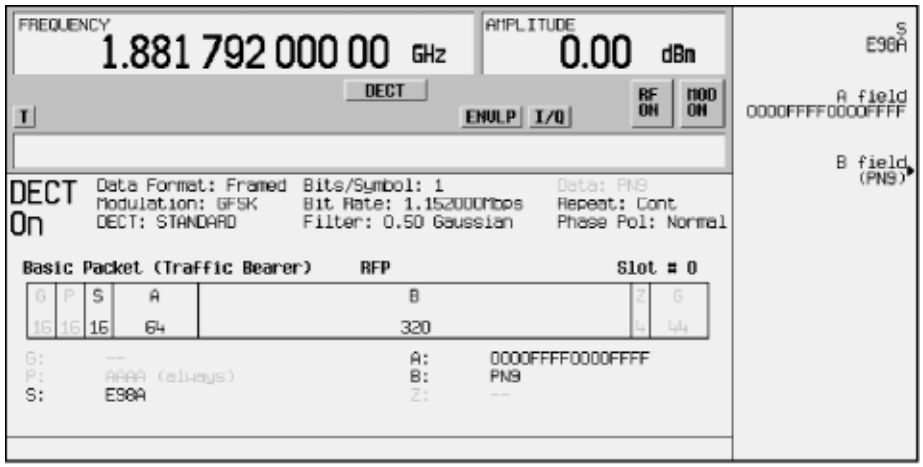
Configure Timeslot

Pressing this softkey reveals a menu of choices for configuring the timeslots. In this menu, configure the timeslots as radio fixed part or portable part. Select which timeslots to turn on and choose from traffic bearer, low capacity, dummy bearer 1 or 2, and custom burst. Then use the subsequent menus to configure the timeslots. This softkey is inactive until you set **Data Format Pattern Framed** to **Framed**.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**

Configure Traffic Bearer

Pressing this softkey reveals a menu of softkeys for configuring a timeslot as a traffic bearer. The following figure shows an example of display graphics for a radio fixed part traffic bearer timeslot. The portable part traffic bearer timeslot is identical except for the instrument preset values.



pk7116a

In this example:

- **G: --** - There are two guard time fields. The text in this field is grey, indicating that you cannot change the contents of the guard time fields.
- **P: AAAA (always)** - The preamble is a 16-bit field. The text in this field is grey, indicating that you cannot change the contents of the preamble field.
- **S: E98A** - Indicates that the 16-bit synchronization word is set to hexadecimal E98A. Press the **S** softkey in the Configure Low Capacity menu to change the contents of the synchronization word field.
- **A: 0000FFFF0000FFFF** - Indicates that the A field is set to hexadecimal 0000FFFF0000FFFF. Press the **A** softkey in the Configure Low Capacity menu to change the contents of the A field.I
- **B: PN9** - Indicates that the B field data selection is PN9. Press the **B field** softkey in the Configure Low Capacity menu to change the data selection. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, DECT-specific patterns, user files, or external data.
- **Z: --** - The Z field is a 4-bit error detection field. The Z field repeats the last 4 bits of the B field. The text in this field is grey, indicating that you cannot change the contents of the Z field.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Transmit Link RFP PP**, **Configure Traffic Bearer**

Custom

Press this softkey to select a custom timeslot type for the active timeslot. A custom timeslot is configured using an internally-generated data pattern, a downloaded sequence of bits stored in a user file, or by supplying external data. The custom timeslot is provided for users' flexibility but it is not a standard DECT timeslot type.

When you have selected **Custom** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your configuration.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Custom**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Transmit Link RFP PP**, **Timeslot Type**, **Custom**

SCPI Commands:

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11[:TYPE] CUSTom

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11[:TYPE] CUSTom

Data

Pressing this softkey reveals a menu of choices for internal data generation (PN9, PN15, fixed 4-bit repeating sequences, set patterns of ones and zeroes, DECT-specific patterns) or you can choose to supply your own data (download a binary file or input data using the DATA INPUT connector). This softkey is available in the DECT menu to select a data pattern for modulated transmissions that are not framed. With **DECT Off On** set to **On** and **Data Format Pattern Framed** set to **Pattern**, the signal generator then outputs either a single occurrence (**Pattern Repeat Single**) or a continuous stream (**Pattern Repeat Cont**) of your choice of data.

For framed transmissions, use the **B field** softkey for configuring the traffic bearer and low capacity timeslot data fields, or the **Configure Custom** softkey for configuring the custom data field.

Softkey Location: Press **Mode**, **DECT**, **Data**

Status after Normal Preset: PN9

SCPI Commands:

[:SOURce]:RADio:DECT:DATA
PN9|PN15|FIX4|"filename"|EXTernal|P4|P8|P15|P32|P64

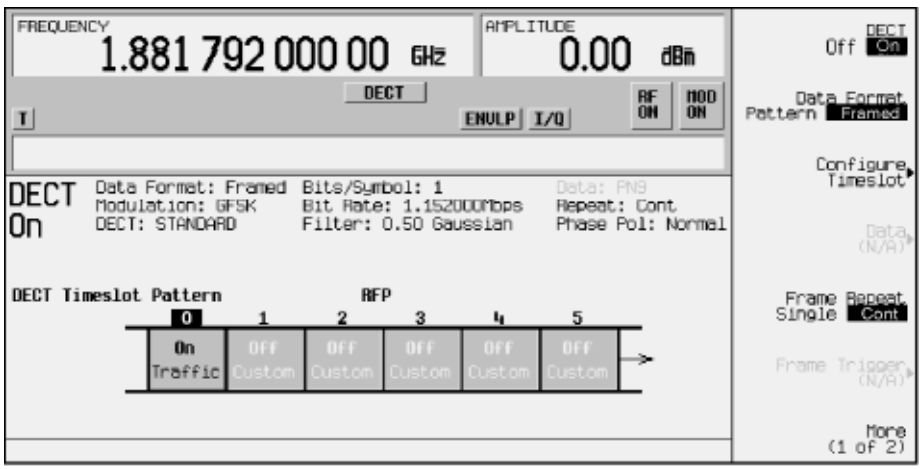
[:SOURce]:RADio:DECT:DATA?

Data Format Pattern Framed

Press this softkey to toggle between **Data Format Pattern** and **Data Format Framed** modes. When you select **Framed**, you will be transmitting your framed data pattern in a DECT format.

When you select **Data Format Pattern**, you will be transmitting a continuous stream of your selected data pattern. Select the data pattern using the **Data** softkey. The **Data** softkey is activated when you select **Data Format Pattern** and inactivated when you select **Data Format Framed**.

The **Data Format Pattern Framed** softkey is coupled to the **Burst Envelope Off On** softkey in the I/Q menu. At any time that DECT is enabled (**DECT Off On** is set to **On**) and **Data Format Framed** is selected, the **ENVLP** annunciator is turned on in the display (indicating that **Burst Envelope On** is also selected). The following figure shows the display graphics that appear when the DECT menu is accessed, **Data Format Pattern Framed** is set to **Framed**, and you are not configuring a timeslot:



pk7111a

In this example:

- **`DECT On`** - Indicates that DECT is enabled. This field changes to **`DECT Off`** when **DECT Off On** is set to **Off**.
- **`Data Format: Framed`** - Indicates that the data pattern is a framed transmission. This field changes to **`Data Format: Pattern`** when **Data Format Pattern Framed** is set to **Pattern** indicating that you are transmitting a

continuous stream of your selected data pattern.

- **`Modulation: GFSK`** - Indicates that GFSK modulation is being internally generated.
- **`DECT: STANDARD`** - Indicates that the structure of the DECT transmission follows the standard as defined by the DECT protocol. This field changes to **`DECT: MODIFIED`** under the following circumstances:
  - filter bandwidth-multiplied-by-bit-time (BbT) is changed
  - bit rate is changed
  - burst shape is changed
  - phase polarity is set to invert
- **`Bit/Symbol: 1`** - Indicates that 1 bit per symbol is required according to the DECT standard.
- **`Bit Rate: 1.152000Mbps`** - The bit rate is set according to the DECT standard. This can be changed in the Bit Rate menu. A * next to the value indicates that it differs from the standard.
- **`Filter: 0.50 Gaussian`** - Indicates that the Gaussian filter is used with a BbT of 0.50. This can be changed in the Filter menu. A * next to the BbT value indicates that it differs from the standard.
- **`Data: PN9`** - Indicates that a PN9 sequence has been selected for transmitting without framing. In this example, the text in this field is grey, indicating an inactive function (framed mode is on). Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, DECT-specific patterns, user files, or external data.
- **`Repeat: Cont`** - Indicates that the data pattern repeat is set to continuous mode. If you select single mode, this field changes to **`Repeat: Single`**.
- **`Phase Pol: Normal`** - Indicates the direction of rotation of the phase modulation vector. If you select inverted mode, this field changes to **`Phase Pol: Invert`**.
- The visual representation of the DECT timeslot pattern shows, in this case, that the radio fixed part timeslots are active (any configuration changes will apply to the radio fixed part timeslot that is turned on). The timeslot pattern is displayed only when **Data Format Pattern Framed** is set to **Framed**.

To configure the timeslots, press the **Configure Timeslot** softkey. The **Configure Timeslot** softkey is activated when you select **Data Format Framed** and is inactivated when you select **Data Format Pattern**.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**

Status after Normal Preset: Pattern

SCPI Commands:

[:SOURce]:RADio:DECT:BURSt[:STATe] ON|OFF|1|0

[:SOURce]:RADio:DECT:BURSt[:STATe]?

DECT Off On

Press this softkey to enable the DECT communications standard. Setting **DECT Off On** to **On** sets up the internal hardware to generate the structure that follows the DECT standard. The internal I/Q modulator generates GFSK digital modulation and the **DECT** and **I/Q** annunciators are turned on in the display. Although the digital modulation is enabled with this softkey, the RF carrier is modulated by the enabled modulation only when you have also set **Mod On/Off** to **On**.

Setting **DECT Off On** to **On** presets the following softkeys in the I/Q menu: **I/Q Off On** is set to **On** and **I/Q Source** is set to **Int I/Q**. You can override these selections in the I/Q menu.

Softkey Location: Press **Mode**, **DECT**, **DECT Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:RADio:DECT[:STATe] ON|OFF|1|0

[:SOURce]:RADio:DECT[:STATe]?

Dect Patterns

Pressing this softkey reveals a menu of DECT-specific data pattern selections. The following internally-generated patterns are available:

- FDEV1_HS - (frequency deviation, half slot) 8 bits: repetitive pattern of 1, 0, 1, 0... followed by 32 ones, 32 zeroes, and 8 bits: repetitive pattern of 1, 0, 1, 0...
- FDEV1_FS - (frequency deviation, full slot) 128 bits: repetitive pattern of 1, 0, 1, 0... followed by 64 ones, 64 zeroes, and 64 bits: repetitive pattern of 1, 0, 1, 0...
- FDEV2_FS - (frequency deviation, full slot) 128 bits: repetitive pattern of 1, 0, 1, 0... followed by 64 ones, 64 zeroes, and 64 bits: repetitive pattern of 1, 0, 1, 0...
- FACCuracy - (frequency accuracy) repetitive pattern of 4 ones followed by 4 zeroes
- DM1 - All ones
- DM0 - All zeroes

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **Dect Patterns**

Dect Patterns is also located in the B field menus found in the portable part Configure Traffic Bearer menu and the radio fixed part and portable part Low Capacity menus, and also in the radio fixed part and portable part Configure Custom menus.

DM0

Press this softkey to select a binary data pattern that consists of all zeroes. This internally-generated data pattern is available for framed transmissions only. When **DM0** is selected, both the **B field** and the **Dect Patterns** softkeys will show this selection. Also, **DM0** is displayed in the **B** field located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **Dect Patterns**, **DM0**

DM0 is also located in the Dect Patterns menus found in the portable part Configure Traffic Bearer menu and the radio fixed part and portable part Low Capacity menus, and also in the radio fixed part and portable part Configure Custom menus.

SCPI Commands:

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom DM0

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] DM0

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] DM0

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom DM0

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] DM0

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] DM0

DM1

Press this softkey to select a binary data pattern that consists of all ones. This internally-generated data pattern is available for framed transmissions only. When **DM1** is selected, both the **B field** and the **Dect Patterns** softkeys will show this selection. Also, **DM1** is displayed in the **B** field located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **Dect Patterns**, **DM1**

DM1 is also located in the Dect Patterns menus found in the portable part Configure Traffic Bearer menu and the radio fixed part and portable part Low Capacity menus, and also in the radio fixed part and portable part Configure Custom menus.

SCPI Commands:

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom DM1

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] DM1

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] DM1

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom DM1

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] DM1

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] DM1

Dummy Bearer 1

Press this softkey to select dummy bearer 1 as the timeslot type for the active timeslot. When you have selected **Dummy Bearer 1** for a timeslot, the visual representation of the timeslot type on the display is immediately updated to show your configuration.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Dummy Bearer 1**

SCPI Commands:

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11[:TYPE] DUMM[1]

Dummy Bearer 2

Press this softkey to select dummy bearer 2 as the timeslot type for the active timeslot. When you have selected **Dummy Bearer 2** for a timeslot, the visual representation of the timeslot type on the display is immediately updated to show your configuration.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Dummy Bearer 2**

SCPI Commands:

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11[:TYPE] DUMM2

Ext

Press this softkey in the data selection menus to select external data. With **Ext** selected, you should apply the data signal to the DATA INPUT connector. If you have selected **Ext** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **Ext** is displayed in the **Data** field in the top line of the text area of the display. If you have selected **Ext** for configuring the timeslot data fields, **EXT** is displayed in either the **Data** field or the **B** field, both of which are located near the bottom of the text area of the display. In framed mode, the external data is gated to the data regions of the timeslot.

Another **Ext** softkey is located in the Frame Trigger and Pattern Trigger menus. Press **Ext** in either of these two menus to select external triggering for your data pattern. Apply a TTL input to the rear panel PATTERN TRIG IN connector to trigger your frame or pattern data.

Softkey Location: Press **Mode**, **DECT**, **Data**, **Ext**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **Ext**
or press **Mode**, **DECT**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Ext**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Ext**

Ext is also located in the B field menus found in the portable part Configure Traffic Bearer menu and the radio fixed part and portable part Low Capacity menus, and also in the radio fixed part and portable part Configure Custom menus.

SCPI Commands:

[:SOURce]:RADio:DECT:DATA EXTernal

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom EXTernal

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] EXTernal

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] EXTernal

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom EXTernal

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] EXTernal

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] EXTernal

[:SOURce]:RADio:DECT:TRIGger[:SOURce] EXTernal

Ext Delay Bits

Press this softkey to specify the number of bits for the external trigger delay. When **Ext Delay Off On** is set to **On**, a value greater than 0 will delay the transmission of the triggered data after the external trigger event by the number of bits specified. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. The range of values allowed is 0 through 65,535 bits. This softkey is inactive until the trigger selection is set to **Ext**.

Softkey Location: Press **Mode**, **DECT**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Ext**, **Ext Delay Bits**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Ext**, **Ext Delay Bits**

Status after Normal Preset: 0

SCPI Commands:

[:SOURce]:RADio:DECT:TRIGger[:SOURce]:EXTernal:DELay <value>

[:SOURce]:RADio:DECT:TRIGger[:SOURce]:EXTernal:DELay?

Ext Delay Off On

Press this softkey to toggle the external trigger delay on and off. When this function is turned on, the transmission of the triggered data will be delayed after the external trigger event by the number of bits specified by the **Ext Delay Bits** softkey. This function is only available when the trigger selection is set to **Ext**.

Softkey Location: Press **Mode**, **DECT**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Ext**, **Ext Delay Off On**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Ext**, **Ext Delay Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:RADio:DECT:TRIGger[:SOURce]:EXTernal:DELay:STATe ON|OFF|1|0

[:SOURce]:RADio:DECT:TRIGger[:SOURce]:EXTernal:DELay:STATe?

FACC

Press this softkey to select a binary data pattern (frequency accuracy) that consists of a repetitive pattern of 4 ones followed by 4 zeroes. This internally-generated data pattern is available for framed transmissions only. When **FACC** is selected, both the **B field** and the **Dect Patterns** softkeys will show this selection. Also, **FACC** is displayed in the **B** field located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **Dect Patterns**, **FACC**

FACC is also located in the Dect Patterns menus found in the portable part Configure Traffic Bearer menu and the radio fixed part and portable part Low Capacity menus, and also in the radio fixed part and portable part Configure Custom menus.

SCPI Commands:

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom FACCuracy

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] FACCuracy

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] FACCuracy

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom FACCuracy

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] FACCuracy

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] FACCuracy

Fall Delay

Press this softkey to change the shape of the bursted RF signal by entering a falling edge delay. To change the fall delay, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0 through 31.75 bits.

Softkey Location: Press **Mode**, **DECT**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Fall Delay**

Status after Normal Preset: 0.00 bits

SCPI Commands:

[:SOURce]:RADio:DECT:BURSt:SHAPe:FALL:DELay <value>

[:SOURce]:RADio:DECT:BURSt:SHAPe:FALL:DELay?

[:SOURce]:RADio:DECT:BURSt:SHAPe:FDELay <value>

[:SOURce]:RADio:DECT:BURSt:SHAPe:FDELay?

Fall Time

Press this softkey to change the shape of the bursted RF signal by entering a falling edge time. To change the fall time, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0.80 through 30 bits.

Softkey Location: Press **Mode**, **DECT**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Fall Time**

Status after Normal Preset: 11.55 bits

SCPI Commands:

[:SOURce]:RADio:DECT:BURSt:SHAPe:FALL:TIME <value>

[:SOURce]:RADio:DECT:BURSt:SHAPe:FALL:TIME?

[:SOURce]:RADio:DECT:BURSt:SHAPe:FTIMe <value>

[:SOURce]:RADio:DECT:BURSt:SHAPe:FTIMe?

FDEV1_FS

Press this softkey to select a binary data pattern (frequency deviation, full-slot) that consists of 128 bits: repetitive pattern of 1, 0, 1, 0... followed by 64 ones, 64 zeroes, and 64 bits: repetitive pattern of 1, 0, 1, 0... This internally-generated data pattern is available for framed transmissions only. When **FDEV1_FS** is selected, both the **B field** and the **Dect Patterns** softkeys will show this selection. Also, **FDEV1_FS** is displayed in the **B** field located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **Dect Patterns**, **FDEV_FS**

FDEV1_FS is also located in the Dect Patterns menus found in the portable part Configure Traffic Bearer menu and the radio fixed part and portable part Low Capacity menus, and also in the radio fixed part and portable part Configure Custom menus.

SCPI Commands:

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom FDEV1_FS

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] FDEV1_FS

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] FDEV1_FS

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom FDEV1_FS

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] FDEV1_FS

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] FDEV1_FS

FDEV1_HS

Press this softkey to select a binary data pattern (frequency deviation, half-slot) that consists of 8 bits: repetitive pattern of 1, 0, 1, 0... followed by 32 ones, 32 zeroes, and 8 bits: repetitive pattern of 1, 0, 1, 0... This internally-generated data pattern is available for framed transmissions only. When **FDEV1_HS** is selected, both the **B field** and the **Dect Patterns** softkeys will show this selection. Also, **FDEV1_HS** is displayed in the **B** field located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **Dect Patterns**, **FDEV_HS**

FDEV1_HS is also located in the Dect Patterns menus found in the portable part Configure Traffic Bearer menu and the radio fixed part and portable part Low Capacity menus, and also in the radio fixed part and portable part Configure Custom menus.

SCPI Commands:

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom FDEV1_HS

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] FDEV1_HS

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] FDEV1_HS

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom FDEV1_FHS

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] FDEV1_HS

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] FDEV1_HS

FDEV2_FS

Press this softkey to select a binary data pattern (frequency deviation, full-slot) that consists of a repetitive pattern of 1, 0, 1, 0... This internally-generated data pattern is available for framed transmissions only. When **FDEV2_FS** is selected, both the **B field** and the **Dect Patterns** softkeys will show this selection. Also, **FDEV_FS** is displayed in the **B** field located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **Dect Patterns**, **FDEV2_FS**

FDEV2_FS is also located in the Dect Patterns menus found in the portable part Configure Traffic Bearer menu and the radio fixed part and portable part Low Capacity menus, and also in the radio fixed part and portable part Configure Custom menus.

SCPI Commands:

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom FDEV2_FS

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] FDEV2_FS

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] FDEV2_FS

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom FDEV2_FS

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] FDEV2_FS

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] FDEV2_FS

Filter

Pressing this softkey reveals a menu of choices for changing the bandwidth-multiplied-by-bit-time (BbT) filter parameter and for restoring the default filter BbT.

Softkey Location: Press **Mode**, **DECT**, **(More 1 of 2)**, **Modify Standard**, **Filter**

Filter BbT

Press this softkey to change the bandwidth-multiplied-by-bit-time (BbT) filter parameter. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. The range of values allowed is 0.20 through 0.70.

Softkey Location: Press **Mode**, **DECT**, **(More 1 of 2)**, **Modify Standard**, **Filter**, **Filter BbT**

Status after Normal Preset: 0.50

SCPI Commands:

[:SOURce]:RADio:DECT:BBT <value>

[:SOURce]:RADio:DECT:BBT?

FIX4

Press this softkey to select a 4-bit repeating sequence data pattern. Press **FIX4** and the 4-bit pattern becomes the active function. Enter your desired 4-bit pattern using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. If you have selected **FIX4** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **FIX4** is displayed in the **Data** field in the top line of the text area of the display. If you have selected **FIX4** for configuring the timeslot data fields, your 4-bit pattern is displayed in either the **Data** field or the **B** field, both of which are located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **DECT**, **Data**, **FIX4**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **FIX4**

FIX4 is also located in the B field menus found in the portable part Configure Traffic Bearer menu and the radio fixed part and portable part Low Capacity menus, and also in the radio fixed part and portable part Configure Custom menus.

Status after Normal Preset: 0000

SCPI Commands:

[:SOURce]:RADio:DECT:DATA FIX4

[:SOURce]:RADio:DECT:DATA:FIX4 <0-15>

[:SOURce]:RADio:DECT:DATA:FIX4?

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom FIX4

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom:FIX4 <0-15>

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom:FIX4?

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] FIX4

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B]:FIX4 <0-15>

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B]FIX4?

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] FIX4

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B]:FIX4 <0-15>

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B]FIX4?

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom FIX4

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom:FIX4 <0-15>

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom:FIX4?

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] FIX4

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B]:FIX4 0-15>

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity:FIX4?

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] FIX4

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B]:FIX4 <0-15>

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B]FIX4?

Frame Repeat Single Cont

Press this softkey to toggle between a single output of framed data and continuous transmission of frames. Selecting **Single** will output the following sequences:

- 4-Bit Patterns (FIX4) - A single frame is generated. The 4-bit pattern repeats until the data fields are completely filled. Each trigger transmits the same frame.
- Other Patterns (fixed patterns of equal quantities of ones and zeroes) - A single frame is generated. The selected pattern repeats until the data fields are completely filled. Each trigger transmits the same frame.
- PN9 - A single frame is generated. The data fields are filled with the leading bits of the PN9 sequence. A trigger causes the frame to be transmitted. The data fields of this frame are then filled sequentially with the next series of PN9 data bits. A trigger causes the frame to be transmitted. This process continues, transmitting the entire PN9 sequence frame by frame. The last bit of the PN9 sequence in a data field is immediately followed by the first bit of a second PN9 sequence.
- PN15 - A single frame is generated. The data fields are filled with the leading bits of the PN15 sequence. A trigger causes the frame to be transmitted. The data fields of this frame are then filled sequentially with the next series of PN15 data bits. A trigger causes the frame to be transmitted. This process continues, transmitting the entire PN15 sequence frame by frame. The last bit of the PN15 sequence in a data field is immediately followed by the first bit of a second PN15 sequence.
- User File - The user’s file should have the appropriate data to fill an integer number of timeslots. If not, the remaining bits are truncated. Depending on the size of the file, more than one frame can possibly be generated.

- External Data - External data is clocked into the data fields of the timeslot. A single frame is generated.

Combinations of these data patterns may cause some patterns to be truncated. Refer to Chapter 7, “Operation” for the details of the data dependencies.

Selecting **Cont** with framed data causes the frames to be transmitted continuously.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**

Status after Normal Preset: Continuous

SCPI Commands:

[:SOURce]:RADio:DECT:REPeat SINGle|CONTinuous

[:SOURce]:RADio:DECT:REPeat?

Frame Trigger

Pressing this softkey reveals a menu of choices for triggering your framed pattern. You can choose to trigger using the front panel **Trigger** key, an external trigger supplied to the PATTERN TRIG IN connector, or by a *TRG command or GET (group execute trigger) signal sent over HP-IB. This softkey is inactive until **Data Format Pattern Framed** is set to **Framed** and **Frame Repeat Single Cont** is set to **Single**.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**

Status after Normal Preset: Trigger Key

SCPI Commands:

[:SOURce]:RADio:DECT:TRIGger[:SOURce]?

Goto Bottom Row

Press this softkey to move the selection bar to the bottom row of file names in the Goto Row menu that is accessed from the User File menu.

Softkey Location: Press **Mode**, **DECT**, **Data**, **User File**, **Goto Row**, **Goto Bottom Row** or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **User File**, **Goto Row**, **Goto Bottom Row**

Goto Middle Row

Press this softkey to move the selection bar to the middle row of file names in the Goto Row menu that is accessed from the User File menu.

Softkey Location: Press **Mode**, **DECT**, **Data**, **User File**, **Goto Row**, **Goto Middle Row** or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **User File**, **Goto Row**, **Goto Middle Row**

Goto Row

Pressing this softkey reveals a menu of softkeys that help you move the selection bar through the rows of file names in the User File menu. You can also go to a specific row by rotating the front panel knob, using the up and down arrow keys, or entering the row number with the numeric keypad. Once the desired row number is displayed, press the **Enter** terminator softkey.

Softkey Location: Press **Mode**, **DECT**, **Data**, **User File**, **Goto Row**, or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **User File**, **Goto Row**

Goto Top Row

Press this softkey to move the selection bar to the top row of file names in the Goto Row menu that is accessed from the User File menu.

Softkey Location: Press **Mode**, **DECT**, **Data**, **User File**, **Goto Row**, **Goto Top Row** or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **User File**, **Goto Row**, **Goto Top Row**

Low Capacity

Press this softkey to select low capacity as the timeslot type for the active timeslot. When you have selected **Low Capacity** for a timeslot, the visual representation of the timeslot type on the display is immediately updated to show your configuration.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Low Capacity**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Transmit Link RFP PP**, **Timeslot Type**, **Low Capacity**

SCPI Commands:

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11[:TYPE] LCAPacity

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11[:TYPE] LCAPacity

Modify Standard

Pressing this softkey reveals a menu of choices for modifying the standard transmission in the following ways:

- changing the filter BbT
- changing the transmission bit rate
- changing the burst rising edge time and delay
- changing the burst falling edge time and delay
- inverting the phase polarity

Softkey Location: Press **Mode**, **DECT**, **(More 1 of 2)**, **Modify Standard**

Other Patterns

Pressing this softkey reveals a menu of data pattern selections. Each of the selections in this menu is a pattern of equal quantities of ones and zeroes (such as four ones and four zeroes).

Softkey Location: Press **Mode**, **DECT**, **Data**, **Other Patterns**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **Other Patterns**

Other Patterns is also located in the B field menus found in the portable part Configure Traffic Bearer menu and the radio fixed part and portable part Low Capacity menus, and also in the radio fixed part and portable part Configure Custom menus.

Page Down

Press this softkey to move down one page at a time in the displayed catalog of files.

Softkey Location: Press **Mode**, **DECT**, **Data**, **User File**, **Page Down**
or press **Mode**, **DECT**, **Data**, **User File**, **Goto Row**, **Page Down**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **User File**, **Page Down**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **User File**, **Goto Row**, **Page Down**

Page Down is also located in the User File menus found in the portable part Configure Traffic Bearer menu and the radio fixed part and portable part Low Capacity menus, and also in the radio fixed part and portable part Configure Custom menus.

Page Up

Press this softkey to move up one page at a time in the displayed catalog of files.

Softkey Location: Press **Mode**, **DECT**, **Data**, **User File**, **Page Up**
or press **Mode**, **DECT**, **Data**, **User File**, **Goto Row**, **Page Up**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **User File**, **Page Up**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **User File**, **Goto Row**, **Page Up**

Page Up is also located in the User File menus found in the portable part Configure Traffic Bearer menu and the radio fixed part and portable part Low Capacity menus, and also in the radio fixed part and portable part Configure Custom menus.

Pattern Repeat Single Cont

Set this softkey to **Single** to output one occurrence of a modulated data pattern that is not framed. Select the trigger event for the output using the **Pattern Trigger** softkey. Toggle to **Cont** to output a continuous stream of your data pattern.

Softkey Location: Press **Mode**, **DECT**, **Pattern Repeat Single Cont**

Status after Normal Preset: Continuous

SCPI Commands:

[:SOURce]:RADio:DECT:REPeat SINGle|CONTinuous

[:SOURce]:RADio:DECT:REPeat?

Pattern Trigger

Pressing this softkey reveals a menu of choices for triggering a modulated data pattern that is not framed. You can choose to trigger using the front panel **Trigger** key, an external trigger supplied to the PATTERN TRIG IN connector, or by a *TRG command or GET (group execute trigger) signal sent over HP-IB. This softkey is inactive until **Pattern Repeat Single Cont** is set to **Single**.

Softkey Location: Press **Mode**, **DECT**, **Pattern Repeat Single Cont**, **Pattern Trigger**

Status after Normal Preset: Trigger Key

SCPI Commands:

[:SOURce]:RADio:DECT:TRIGger[:SOURce]?

Phase Polarity Normal Invert

Press this softkey to reverse the direction of rotation of the phase modulation vector. Choose **Invert** and the in-phase component will lag the quadrature-phase component by 90° in the resulting modulation. The inverted selection also applies to the I OUT and Q OUT signals.

Softkey Location: Press **Mode**, **DECT**, **More (1 of 2)**, **Modify Standard**, **Phase Polarity Normal Invert**

Status after Normal Preset: Normal

SCPI Commands:

[:SOURce]:RADio:DECT:POLarity[:ALL] NORMal|INVerted

[:SOURce]:RADio:DECT:POLarity[:ALL]?

PN9

Press this softkey to select the PN9 pseudorandom bit pattern. If you have selected **PN9** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **PN9** is displayed in the **Data** field in the top line of the text area of the display. If you have selected **PN9** for configuring the framed timeslot data fields, **PN9** is displayed in the **Data** field or the **B** field, both of which are located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **DECT**, **Data**, **PN9**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **PN9**

PN9 is also located in the B field menus found in the portable part Configure Traffic Bearer menu and the radio fixed part and portable part Low Capacity menus, and also in the radio fixed part and portable part Configure Custom menus.

SCPI Commands:

[:SOURce]:RADio:DECT:DATA PN9

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom PN9

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] PN9

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] PN9

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom PN9

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] PN9

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] PN9

PN9 Mode Normal Quick

Press this softkey to toggle between normal and quick PN9 modes. A single output of a framed normal PN9 data pattern consists of enough frames so that the end of the PN9 sequence corresponds with the end of a frame. A single output of a framed quick PN9 data pattern consists of one entire PN9 sequence plus enough of a second PN9 sequence to fill the remaining data fields in the current frame. The second PN9 sequence is, therefore, truncated.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Frame**, **PN9 Mode Normal Quick**

Status after Normal Preset: Normal

SCPI Commands:

[:SOURce]:RADio:DECT:BURSt:PN9 NORMal|QUICk

[:SOURce]:RADio:DECT:BURSt:PN9?

PN15

Press this softkey to select the PN15 pseudorandom bit pattern. If you have selected **PN15** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **PN15** is displayed in the **Data** field in the top line of the text area of the display. If you have selected **PN15** for configuring the framed timeslot data fields, **PN15** is displayed in the **Data** field or the **B** field, both of which are located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **DECT**, **Data**, **PN15**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **PN15**

PN15 is also located in the B field menus found in the portable part Configure Traffic Bearer menu and the radio fixed part and portable part Low Capacity menus, and also in the radio fixed part and portable part Configure Custom menus.

SCPI Commands:

[:SOURce]:RADio:DECT:DATA PN15

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom PN15

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] PN15

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] PN15

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom PN15

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] PN15

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] PN15

Restore Default Bit Rate

Press this softkey to reset the transmission bit rate to the default value (1.52000 Mbps). This softkey is a convenience feature for quickly resetting the bit rate. You can also change the bit rate by pressing the **Bit Rate** softkey.

Softkey Location: Press **Mode**, **DECT**, **(More 1 of 2)**, **Modify Standard**, **Bit Rate**, **Restore Default Bit Rate**

Restore Default Burst Shape

Press this softkey to reset the burst shape characteristics to their default values (rise time = 13.75 bits, rise delay = 2.50 bits, fall time = 11.55 bits, fall delay = 0.00 bits). This softkey is a convenience feature for quickly resetting the burst shape. You can also change each of the burst characteristics individually by using the **Rise Time**, **Rise Delay**, **Fall Time**, and **Fall Delay** softkeys in this menu.

Softkey Location: Press **Mode**, **DECT**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Restore Default Burst Shape**

Restore Default Filter BbT

Press this softkey to reset the bandwidth-multiplied-by-bit-time (BbT) filter parameter to its default value (0.50). This softkey is a convenience feature for quickly resetting the filter BbT. You can also change the bit rate by pressing the **Filter BbT** softkey.

Softkey Location: Press **Mode**, **DECT**, **(More 1 of 2)**, **Modify Standard**, **Filter**, **Restore Default Filter BbT**

Rise Delay

Press this softkey to change the shape of the bursted RF signal by entering a rising edge delay. To change the rise delay, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0 through 31.75 bits.

Softkey Location: Press **Mode**, **DECT**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Rise Delay**

Status after Normal Preset: 2.50 bits

SCPI Commands:

[:SOURce]:RADio:DECT:BURSt:SHAPe:RISE:DELay <value>

[:SOURce]:RADio:DECT:BURSt:SHAPe:RISE:DELay?

[:SOURce]:RADio:DECT:BURSt:SHAPe:RDELay <value>

[:SOURce]:RADio:DECT:BURSt:SHAPe:RDELay?

Rise Time

Press this softkey to change the shape of the bursted RF signal by entering a rising edge time. To change the rise time, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0.80 through 30 bits.

Softkey Location: Press **Mode**, **DECT**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Rise Time**

Status after Normal Preset: 13.75 bits

SCPI Commands:

[:SOURce]:RADio:DECT:BURSt:SHAPe:RISE:TIME <value>

[:SOURce]:RADio:DECT:BURSt:SHAPe:RISE:TIME?

[:SOURce]:RADio:DECT:BURSt:SHAPe:RTIMe <value>

[:SOURce]:RADio:DECT:BURSt:SHAPe:RTIMe?

S

Press this softkey to change the 16-bit synchronization word (S). The preset hexadecimal value (when normal preset is selected) for synchronization reflects the DECT standard, however you can enter a new value by pressing this softkey. To enter a value (in hexadecimal), press **S**. The synchronization value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The current value for S is displayed in the **S** field near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **S**

S is also located in the portable part Configure Traffic Bearer menu and the radio fixed part and portable part Low Capacity menus.

Status after Normal Preset: E98A (RFP timeslots), 1675 (PP timeslots)

SCPI Commands:

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity:S <16 bit value>

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity:S?

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic:S <16 bit value>

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic:S?

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:DUMM[1]:S <16 bit value>

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:DUMM[1]:S?

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:DUMM2:S <16 bit value>

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:DUMM2:S?

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity:S <16 bit value>

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity:S?

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic:S <16 bit value>

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic:S?

Select File

Press this softkey to select a file in the displayed catalog of binary files. To make your selection, first scroll through the list, using the front panel knob or up and down arrow keys, until the desired file is highlighted. Press **Select File** and the highlighted file is specified as your data selection. If you have selected a custom file as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **`UserFile`** is displayed in the **`Data`** field in the top line of the text area of the display. If you have selected a custom file for configuring timeslot data fields, the file name you selected is displayed in the **`Data`** field or the **`B`** field, both of which are located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **DECT**, **Data**, **User File**, **Select File**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **User File**, **Select File**

Select File is also located in the User File menus found in the portable part Configure Traffic Bearer menu and the radio fixed part and portable part Low Capacity menus, and also in the radio fixed part and portable part Configure Custom menus.

SCPI Commands:

[:SOURce]:RADio:DECT:DATA “file name”

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom “file name”

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] “file name”

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] “file name”

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:CUSTom “file name”

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:LCAPacity[:B] “file name”

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:TRAFfic[:B] “file name”

Sync Out

Press this softkey to reveal a menu of choices for outputting a 1-bit synchronization signal to the EVENT 1 rear panel connector. In this menu you can choose to set the synchronization signal to occur at the beginning of a data pattern, at the beginning of a frame, at the beginning of a selected timeslot, or at the beginning of each timeslot in a frame.

Softkey Location: Press **Mode**, **DECT**, **More (1 of 2)**, **Sync Out**

Status after Normal Preset: Begin Pattern

SCPI Commands:

[:SOURce]:RADio:DECT:SOUT?

Sync Out Offset

Press this softkey to move the synchronization signal forward or back from the beginning of the data pattern, frame, or timeslot. To set the number of bits of offset, press **Sync Out Offset** and synchronization offset becomes the active function. Enter the desired value using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. The range of values allowed is –479 through +479 bits.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **Sync Out Offset**

Status after Normal Preset: 0 bits

SCPI Commands:

[:SOURce]:RADio:DECT:SOUT:OFFSet <value>

[:SOURce]:RADio:DECT:SOUT:OFFSet?

Traffic Bearer

Press this softkey to select traffic bearer as the timeslot type for the active timeslot. When you have selected **Traffic Bearer** for a timeslot, the visual representation of the timeslot type on the display is immediately updated to show your configuration.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Traffic Bearer**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Transmit Link RFP PP**, **Timeslot Type**, **Traffic Bearer**

SCPI Commands:

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11[:TYPE] TRAFfic

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11[:TYPE] TRAFfic

Timeslot

Press this softkey to select a timeslot to be configured. Choose any of the twelve timeslots. (Your selection will apply to the timeslots in either the radio fixed part or the portable part channel depending on which you have activated with the **Transmit Link RFP PP** softkey.) Enter the timeslot number using the front panel knob, the up and down arrow keys, or enter the number using the numeric keypad and press the **Enter** terminator softkey.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot #**

Timeslot Off On

Press this softkey to toggle the active timeslot on and off. For example, to turn on timeslot 2, select the timeslot by pressing the **Timeslot #** softkey in this same menu. Enter the number 2 to make timeslot 2 active. Then turn this timeslot on by toggling **Timeslot Off On** to **On**. Notice that the visual representation of the timeslot pattern now shows timeslot 2 turned on in either the radio fixed part or the portable part channel depending on which you have activated with the **Transmit Link RFP PP** softkey.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Off On**

Status after Normal Preset: On (for timeslot 0)

SCPI Commands:

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:STATe ON|OFF|1|0

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:STATe?

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:STATe ON|OFF|1|0

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11:STATe?

Timeslot Type

Pressing this softkey reveals a menu of choices for setting the timeslot type for the active timeslot. You can choose to set any radio fixed part timeslot to be a traffic bearer, low capacity, dummy bearer 1 or 2, or custom timeslot. You can choose to set any portable part timeslot to be a traffic bearer, low capacity, or a custom timeslot.When you have selected the type for the timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Transmit Link RFP PP**, **Timeslot Type**

Status after Normal Preset: Traffic Bearer (for timeslot 0)

SCPI Commands:

[:SOURce]:RADio:DECT:PPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11[:TYPE]?

[:SOURce]:RADio:DECT:RFPart:SLOT0|[1]|2|3|4|5|6|7|8|9|10|11[:TYPE]?

Transmit Link RFP PP

Press this softkey to toggle between the twelve radio fixed part (**RFP**) timeslots and the twelve portable part (**PP**) timeslots. Any timeslot number, type, or configuration settings will then apply to the chosen RFP or PP timeslot selection. RFP and PP timeslots can be active concurrently.

Softkey Location: Press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Transmit Link RFP PP**

Status after Normal Preset: RFP

Trigger Key

Press this softkey to select the front panel **Trigger** key as the pattern trigger for a single output of a modulated data transmission that is not framed (**Data Format Pattern Framed** is set to **Pattern**) or select the **Trigger** key as the frame trigger for a single output of your framed data. Once selected, you can trigger a single event at any time by pressing the **Trigger** key.

Softkey Location: Press **Mode**, **DECT**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Trigger Key**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Trigger Key**

SCPI Commands:

[:SOURce]:RADio:DECT:TRIGger[:SOURce] KEY

User File

Press this softkey to display the catalog of binary files stored in the signal generator's memory. You can select a custom file from this catalog for your data pattern. Scroll through the listed files and when your selection is highlighted, press the **Select File** softkey. If you have selected **User File** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **`UserFile`** is displayed in the **`Data`** field in the top line of the text area of the display. If you have selected **User File** for configuring timeslot data fields, the file name you selected is displayed in the **`Data`** field or the **`B`** field, both of which are located near the bottom of the text area of the display.

User's files should exactly fill the data fields in a framed transmission. (Create the files to fill an integer number of frames.) If the end of the user's file does not coincide with the end of a frame, data will be truncated in one of the following ways:

- Enough frames will be generated to transmit as much of the data pattern as will fit into complete frames. The remaining bits of the data pattern (which are too few to completely fill a frame) are truncated.
- If two files of unequal sizes are selected for the same framed transmission, enough frames will be generated to transmit as much of the data pattern of the largest file as will fit into complete frames. The remaining bits of the data pattern are truncated. The smaller file will be repeated as many times as necessary to completely fill these frames. Data will be truncated for the smaller file to coincide with the end of the last frame.
- If a user's file and a PN9 or PN15 file are selected for the same framed transmission and the user's file is shorter than the PN9/15, enough frames will be generated to transmit the PN9/15. The end of the PN9/15 data will coincide with the end of the last frame. The smaller user's file will be repeated as many times as necessary to completely fill these frames. Data will be truncated for the smaller file to coincide with the end of the last frame.
- If a user's file and a PN9 file are selected for the same framed transmission and the user's file is longer than the PN9, enough frames will be generated to transmit as much of the data pattern as will fit into complete frames. The remaining bits of the data pattern (which are too few to completely fill a frame) are truncated. The PN9 data will be repeated as many times as necessary to completely fill these frames.

Softkey Location: Press **Mode**, **DECT**, **Data**, **User File**
or press **Mode**, **DECT**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Traffic Bearer**, **B field**, **User File**

User File is also located in the B field menus found in the portable part Configure Traffic Bearer menu and the radio fixed part and portable part Low Capacity menus, and also in the radio fixed part and portable part Configure Custom menus.

Mode - GSM

Pressing this softkey reveals a menu of softkeys for generating data patterns that are formatted into a framed structure (where the data bits are located in fields defined by the GSM protocol) or for generating just the data pattern where the data sequence can be output a single time or repeatedly. These softkeys are described in this section in alphabetical order.

4 1's & 4 0's

Press this softkey to select a binary data pattern that consists of four ones followed by four zeroes. If you have selected **4 1's & 4 0's** in a pattern data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P4** (where "P" refers to Pattern and "4" refers to four ones and four zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **4 1's & 4 0's** in a framed data transmission, both the **E** and the **Other Patterns** softkeys will show this selection. Also, **P4** is displayed in either the **Data** field or the **E** field (encryption bits), both of which are located near the bottom of the text area of the display. A single output of a framed P4 data pattern consists of enough repetitions of four ones followed by four zeroes, followed by four ones and four zeroes, and so on, until the data fields in the timeslot are filled.

Softkey Location: Press **Mode**, **GSM**, **Data**, **Other Patterns**, **4 1's & 4 0's**
or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**, **E**, **Other Patterns**, **4 1's & 4 0's**

4 1's & 4 0's is also located in the Other Patterns Menus found in the Configure Sync, Configure Access, and Configure Custom Menus.

SCPI Commands:

[:SOURce]:RADio:GSM:DATA P4

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:ACCess:ENCRyption P4

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:CUSTom P4

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:NORMal:ENCRyption P4

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:SYNC:ENCRyption P4

8 1’s & 8 0’s

Press this softkey to select a binary data pattern that consists of eight ones followed by eight zeroes. If you have selected **8 1’s & 8 0’s** in a pattern data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P8** (where “P” refers to Pattern and “8” refers to eight ones and eight zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **8 1’s & 8 0’s** in a framed data transmission, both the **E** and the **Other Patterns** softkeys will show this selection. Also, **P8** is displayed in either the **Data** field or the **E** field (encryption bits), both of which are located near the bottom of the text area of the display. A single output of a framed P8 data pattern consists of enough repetitions of eight ones followed by eight zeroes, followed by eight ones and eight zeroes, and so on, until the data fields in the timeslot are filled.

Softkey Location: Press **Mode**, **GSM**, **Data**, **Other Patterns**, **8 1’s & 8 0’s** or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**, **E**, **Other Patterns**, **8 1’s & 8 0’s**

8 1’s & 8 0’s is also located in the Other Patterns Menus found in the Configure Sync, Configure Access, and Configure Custom Menus.

SCPI Commands:

[:SOURce]:RADio:GSM:DATA P8

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:ACCess:ENCRyption P8

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:CUSTom P8

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:NORMal:ENCRyption P8

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:SYNC:ENCRyption P8

16 1’s & 16 0’s

Press this softkey to select a binary data pattern that consists of sixteen ones followed by sixteen zeroes. If you have selected **16 1’s & 16 0’s** in a pattern data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P16** (where “P” refers to Pattern and “16” refers to sixteen ones and sixteen zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **16 1’s & 16 0’s** in a framed data transmission, both the **E** and the **Other Patterns** softkeys will show this selection. Also, **P16** is displayed in either the **Data** field or the **E** field (encryption bits), both of which are located near the bottom of the text area of the display. A single output of a framed P16 data pattern consists of enough repetitions of sixteen ones followed by sixteen zeroes, followed by sixteen ones and sixteen zeroes, and so on, until the data fields in the timeslot are filled.

Softkey Location: Press **Mode**, **GSM**, **Data**, **Other Patterns**, **16 1’s & 16 0’s** or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**, **E**, **Other Patterns**, **16 1’s & 16 0’s**

16 1’s & 16 0’s is also located in the Other Patterns Menus found in the Configure Sync, Configure Access, and Configure Custom Menus.

SCPI Commands:

[:SOURce]:RADio:GSM:DATA P16

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:ACCess:ENCRyption P16

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:CUSTom P16

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:NORMal:ENCRyption P16

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:SYNC:ENCRyption P16

32 1’s & 32 0’s

Press this softkey to select a binary data pattern that consists of thirty-two ones followed by thirty-two zeroes. If you have selected **32 1’s & 32 0’s** in a pattern data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P32** (where “P” refers to Pattern and “32” refers to thirty-two ones and thirty-two zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **32 1’s & 32 0’s** in a framed data transmission, both the **E** and the **Other Patterns** softkeys will show this selection. In addition, **P32** is displayed in either the **Data** field or the **E** field (encryption bits), both of which are located near the bottom of the text area of the display. A single output of a framed P32 data pattern consists of enough repetitions of thirty-two ones followed by thirty-two zeroes, followed by thirty-two ones and thirty-two zeroes, and so on, until the data fields in the timeslot are filled. If this data pattern is selected for a timeslot with fewer than 64 bits available in the data field, the data pattern is truncated at the point where the timeslot is filled.

Softkey Location: Press **Mode**, **GSM**, **Data**, **Other Patterns**, **32 1’s & 32 0’s**
or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**, **E**, **Other Patterns**, **32 1’s & 32 0’s**

32 1’s & 32 0’s is also located in the Other Patterns Menus found in the Configure Sync, Configure Access, and Configure Custom Menus.

SCPI Commands:

[:SOURce]:RADio:GSM:DATA P32

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:ACCess:ENCRyption P32

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:CUSTom P32

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:NORMal:ENCRyption P32

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:SYNC:ENCRyption P32

64 1’s & 64 0’s

Press this softkey to select a binary data pattern that consists of sixty-four ones followed by sixty-four zeroes. If you have selected **64 1’s & 64 0’s** in a pattern data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P64** (where “P” refers to Pattern and “64” refers to sixty-four ones and sixty-four zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **64 1’s & 64 0’s** in a framed data transmission, both the **E** and the **Other Patterns** softkeys will show this selection. In addition, **P64** is displayed in either the **Data** field or the **E** field (encryption bits), both of which are located near the bottom of the text area of the display. A single output of a framed P64 data pattern consists of enough repetitions of sixty-four ones followed by sixty-four zeroes, followed by sixty-four ones and sixty-four zeroes, and so on, until the data fields in the timeslot are filled. If this data pattern is selected for a timeslot with fewer than 128 bits available in the data field, the data pattern is truncated at the point where the timeslot is filled.

Softkey Location: Press **Mode**, **GSM**, **Data**, **Other Patterns**, **64 1’s & 64 0’s** or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**, **E**, **Other Patterns**, **64 1’s & 64 0’s**

64 1’s & 64 0’s is also located in the Other Patterns Menus found in the Configure Sync, Configure Access, and Configure Custom Menus.

SCPI Commands:

[:SOURce]:RADio:GSM:DATA P64

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:ACCess:ENCRyption P64

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:CUSTom P64

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:NORMal:ENCRyption P64

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:SYNC:ENCRyption P64

Access

Press this softkey to select access as the timeslot type for the active timeslot. Access is a short, uplink burst for the mobile to access service from a base station.

When you select **Access** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Access**

SCPI Commands:

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7[:TYPE] ACCess

All Timeslots

Press this softkey to output a 1-bit pulse to the EVENT 1 rear panel connector that is synchronized to the first bit of each timeslot in a frame. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **All Timeslots**

SCPI Commands:

[:SOURce]:RADio:GSM:SOUT ALL

BBG Data Clock Ext Int

Press this softkey to select the internal data clock for the baseband generator or to select an externally-supplied data clock. A data clock or symbol clock input must be supplied when external mode is selected. For more information on input and output signals, refer to Chapter 7, “Operation”.

Softkey Location: Press **Mode**, **GSM**, **More (1 of 2)**, **Configure Hardware**, **BBG Data Clock Ext Int**

Status after Normal Preset: Int

SCPI Commands:

[:SOURce]:RADio:GSM:BBCLock INT[1]|EXTernal[1]

[:SOURce]:RADio:GSM:BBCLock?

Begin Frame

Press this softkey to output a 1-bit pulse to the EVENT 1 rear panel connector that is synchronized to the first bit of the first frame. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified. The number of trigger pulses generated depends on the framed data patterns selected:

- If a PN9 or PN15 data pattern is selected, a single frame is generated. The data fields of the frame are filled sequentially with the PRBS data. The synchronizing pulse occurs at the beginning of the frame each time it is transmitted.
- Any combination of external data and a PN9 data pattern will cause 511 frames to be generated. The synchronizing pulse occurs at the beginning of the first of the 511 frames each time that frame is transmitted.
- Any combination of external data and a PN15 data pattern will cause a discontinuous PN15. A discontinuous PN15 pattern consists of as many complete frames of PN15 data as can be generated. The remaining bits that do not completely fill a frame are truncated. The synchronizing pulse occurs at the beginning of the first frame each time that frame is transmitted.
- Any combination of user's files and a PN15 data pattern will cause a discontinuous PN15. The synchronizing pulse occurs at the beginning of the first frame each time that frame is transmitted.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **Begin Frame**

SCPI Commands:

[:SOURce]:RADio:GSM:SOUT FRAMe

Begin Pattern

Press this softkey to output a 1-bit pulse to the EVENT 1 rear panel connector that is synchronized to the first bit of your unframed data pattern (**Data Format Pattern Framed** is set to **Pattern**), and for each repetition of the pattern. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified.

Softkey Location: Press **Mode**, **GSM**, **More (1 of 2)**, **Sync Out**, **Begin Pattern**

SCPI Commands:

[:SOURce]:RADio:GSM:SOUT FRAMe

Begin Timeslot

Press this softkey to output a 1-bit pulse to the EVENT 1 rear panel connector that is synchronized to the first bit of a selected timeslot. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified. Select the timeslot by pressing **Begin Timeslot**. The timeslot number for the synchronization signal becomes the active function. Enter a value using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **Begin Timeslot**

SCPI Commands:

[:SOURce]:RADio:GSM:SOUT SLOT

[:SOURce]:RADio:GSM:SOUT:SLOT <value>

[:SOURce]:RADio:GSM:SOUT:SLOT?

Bit Rate

There are two softkeys named **Bit Rate**. The first is a menu key (distinguished by an arrow pointing to the right). Pressing this softkey reveals a menu of choices for setting the transmission bit rate. In this menu, there is another softkey named **Bit Rate**. Press this softkey to set the bit rate to any value from 163 kbps through 300 kbps. Enter the desired value using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Mbps**, **kbps**, or **bps** terminator softkey.

Softkey Location: Press **Mode**, **GSM**, **More (1 of 2)**, **Modify Standard**, **Bit Rate** or press **Mode**, **GSM**, **More (1 of 2)**, **Modify Standard**, **Bit Rate**, **Bit Rate**

Status after Normal Preset: 270.833 kbps

SCPI Commands:

[:SOURce]:RADio:GSM:BRATe <value>

[:SOURce]:RADio:GSM:BRATe?

Burst Shape

Pressing this softkey reveals a menu of choices for modifying the burst shape of the framed data. In this menu, you can change the rise and fall time of the burst, in bits, and you can change the rise and fall delay of the burst, in bits. A softkey is also provided to return the default burst shape values.

Softkey Location: Press **Mode**, **GSM**, **More (1 of 2)**, **Modify Standard**, **Burst Shape**

Bus

Press this softkey to use the HP-IB as the pattern trigger for a single output of an unframed data pattern or as the frame trigger for a single output of framed data. Once selected, you can trigger a single event at any time by sending a trigger command over HP-IB (*TRG) or by asserting the HP-IB GET (group execute trigger) line.

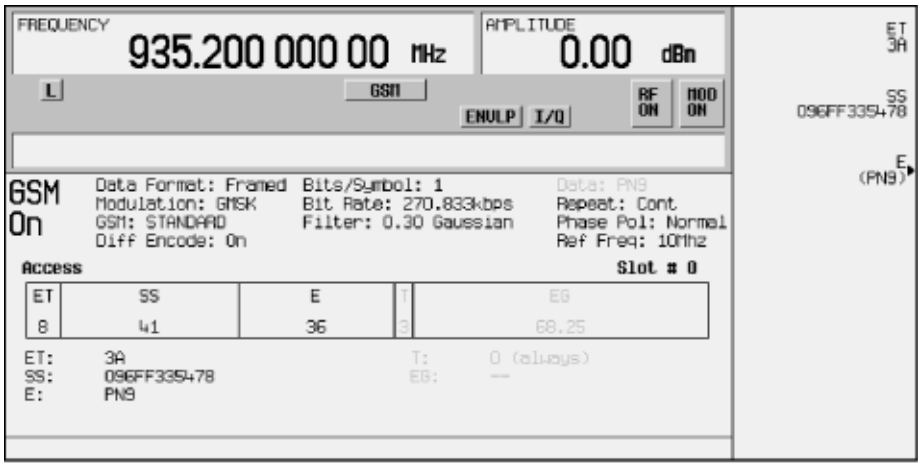
Softkey Location: Press **Mode**, **GSM**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Bus**
or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Bus**

SCPI Commands:

[:SOURce]:RADio:GSM:TRIGger[:SOURce] BUS

Configure Access

Pressing this softkey reveals a menu of softkeys for configuring an access timeslot. The following figure shows an example of the display graphics for an access timeslot. The visual representation of the timeslot shows each field of the access timeslot.



pk790a

In this example:

- **ET: 3A** - Indicates that the 8-bit extended tail is set to hexadecimal 3A. Press the **ET** softkey in the Configure Access menu to change the value of the extended tail.

  SS: 096FF335478 - Indicates that the 41-bit synchronization sequence is set to hexadecimal 096FF335478. Press the **SS** softkey in the Configure Access menu to change the value of the synchronization sequence.

- **E: PN9** - Indicates that the data selection (encryption bits) for this timeslot is PN9. Press the **E** softkey in the Configure Access menu to change the data selection. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.

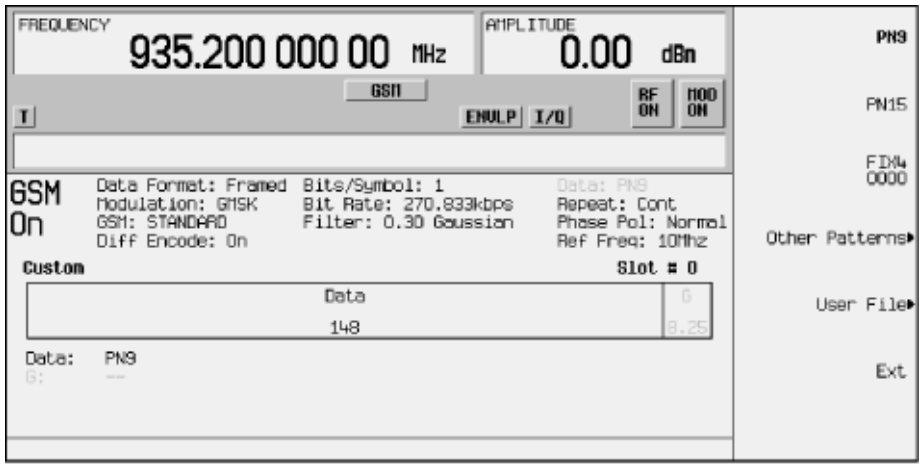
- **T: 0 (always)** - Indicates that the 3-bit tail field contains hexadecimal zero. The text in this field is grey, indicating that you cannot change the value for the tail bit field.

- **EG: --** - The extended guard time appears in the visual representation of the timeslot as a 68.25-bit field. In the actual implementation, the guard time field in timeslots 0 and 4 are 69 bits long and the remaining timeslots contain 68 bit fields. (This implementation is documented in the GSM standard “GSM REC. 05.10 Section 5.7” as follows: “Optionally, the BS may use a timeslot length of 157 bit periods on timeslots with TN=0 and 4, and 156 bit periods on timeslots with TN=1, 2, 3, 5, 6, 7, rather than 156.25 bit periods on all timeslots.”) The text in this field is grey, indicating that you cannot change the contents of the extended guard time field.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Access**, **Configure Access**

Configure Custom

Pressing this softkey reveals a menu of softkeys for selecting the data pattern for a custom timeslot. The following figure shows an example of the display graphics for a custom timeslot. The visual representation of the timeslot shows each field of the custom timeslot.



pk791a

In this example:

- **`Data: PN9`** - Indicates that the data selection for this custom timeslot is PN9. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.
- **`G: --`** - Guard time appears in the visual representation of the timeslot as an 8.25-bit field. In the actual implementation, the guard time field in timeslots 0 and 4 are 9 bits long and the remaining timeslots contain 8 bit fields. (This implementation is documented in the GSM standard “GSM REC. 05.10 Section 5.7” as follows: “Optionally, the BS may use a timeslot length of 157 bit periods on timeslots with TN=0 and 4, and 156 bit periods on timeslots with TN=1, 2, 3, 5, 6, 7, rather than 156.25 bit periods on all timeslots.”) The text in this field is grey, indicating that you cannot change the contents of the guard time field.

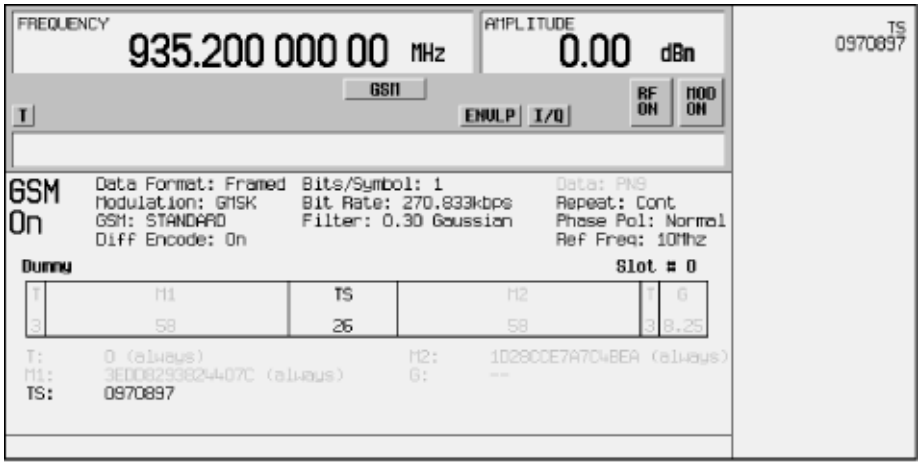
Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Custom**, **Configure Custom**

SCPI Commands:

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:CUSTom?

Configure Dummy

Pressing this softkey reveals a menu of softkeys for configuring a dummy timeslot. The following figure shows an example of the display graphics for a dummy timeslot. The visual representation of the timeslot shows each field of the dummy timeslot.



pk792a

In this example:

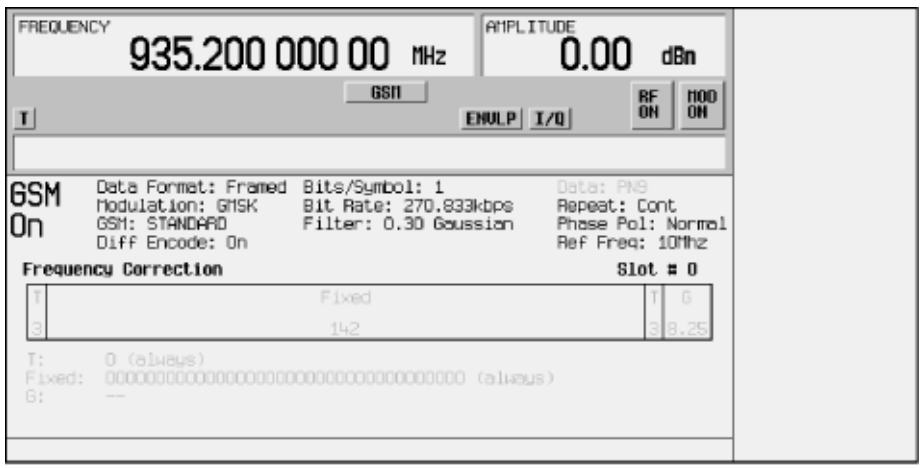
- **`T: 0 (always)`** - Indicates that both of the 3-bit tail fields are always hexadecimal zero. The text in this field is grey, indicating that you cannot change the contents of the tail bit fields.
- **`M1: 3EDD8293824407C (always)`** - Indicates that the 58-bit mixed bit field is set to 3EDD8293824407C. The text in this field is grey, indicating that you cannot change the contents of the mixed bit field.
- **`TS: 0970897`** - Indicates that the 26-bit training sequence for this timeslot is hexadecimal 0970897. Press the **TS** softkey in the Configure Dummy menu to change the value of the training sequence.

- **`M2: 1D28CCE7A7C4BEA(always)`** - Indicates that the 58-bit mixed bit field is set to 1D28CCE7A7C4BEA. The text in this field is grey, indicating that you cannot change the contents of the mixed bit field.
- **`G: --`** - Guard time appears in the visual representation of the timeslot as an 8.25-bit field. In the actual implementation, the guard time field in timeslots 0 and 4 are 9 bits long and the remaining timeslots contain 8 bit fields. (This implementation is documented in the GSM standard “GSM REC. 05.10 Section 5.7” as follows: “Optionally, the BS may use a timeslot length of 157 bit periods on timeslots with TN=0 and 4, and 156 bit periods on timeslots with TN=1, 2, 3, 5, 6, 7, rather than 156.25 bit periods on all timeslots.”) The text in this field is grey, indicating that you cannot change the contents of the guard time field.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Dummy**, **Configure Dummy**

Configure FCorr

Pressing this softkey reveals a menu of softkeys for configuring a frequency correction timeslot. The following figure shows an example of the display graphics for a frequency correction timeslot. The visual representation of the timeslot shows each field of the frequency correction timeslot.



pk793a

In this example:

- **`T: 0 (always)`** - Indicates that both of the 3-bit tail fields are always hexadecimal zero. The text in this field is grey, indicating that you cannot change the contents of the tail bit fields.

- **`Fixed: 00000000000000000000000000000000 (always)`** - Indicates that the 142-bit fixed field is set to all zeroes or hexadecimal 00000000000000000000000000000000000.The text in this field is grey, indicating that you cannot change the contents of the fixed field.
- **`G: --`** - Guard time appears in the visual representation of the timeslot as an 8.25-bit field. In the actual implementation, the guard time field in timeslots 0 and 4 are 9 bits long and the remaining timeslots contain 8 bit fields. (This implementation is documented in the GSM standard “GSM REC. 05.10 Section 5.7” as follows: “Optionally, the BS may use a timeslot length of 157 bit periods on timeslots with TN=0 and 4, and 156 bit periods on timeslots with TN=1, 2, 3, 5, 6, 7, rather than 156.25 bit periods on all timeslots.”) The text in this field is grey, indicating that you cannot change the contents of the guard time field.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **FCorr**, **Configure FCorr**

Configure Frame

This softkey will be used in the future for controlling the entire frame. At present, this softkey has no function.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Frame**

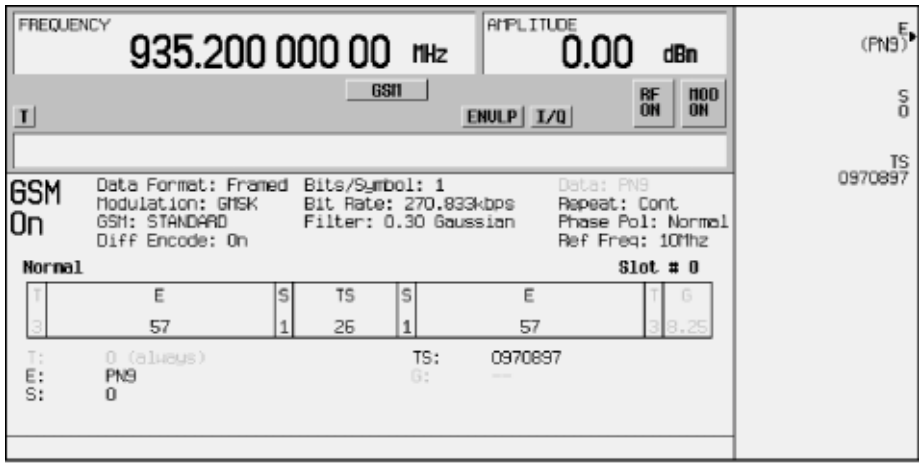
Configure Hardware

Pressing this softkey reveals a menu that allows you to set or select a particular latch or hardware configuration to meet your specific needs.

Softkey Location: Press **Mode**, **GSM**, **More (1 of 2)**, **Configure Hardware**

Configure Normal

Pressing this softkey reveals a menu of softkeys for configuring a normal timeslot. The following figure shows an example of display graphics for a normal timeslot. The visual representation of the timeslot shows each field of the timeslot as it is defined by the GSM standard.



pk794a

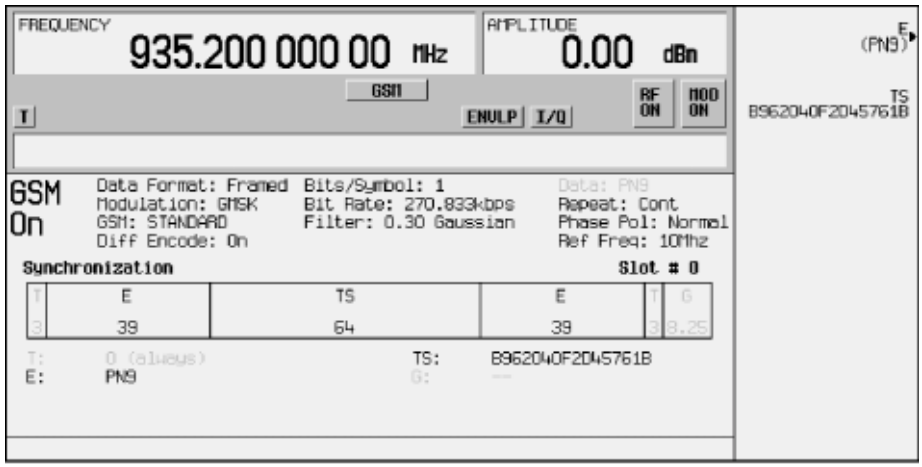
In this example:

- **T: 0 (always)** - Indicates that the 3-bit tail field contains hexadecimal zero. The text in this field is grey, indicating that you cannot change the value for the tail bit field.
- **E: PN9** - Indicates that the data selection (encryption bits) for this timeslot is PN9. Press the **E** softkey in the Configure Normal menu to change the data selection. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.
- **S: 0** - Indicates that both steal bits for this timeslot are zero. Press the **S** softkey in the Configure Normal menu to change both steal bits.
- **TS: 0970897** - Indicates that the 26-bit training sequence for this timeslot is hexadecimal 0970897. Press the **TS** softkey in the Configure Normal menu to change the contents of the training sequence.
- **G: --** - Guard time appears in the visual representation of the timeslot as an 8.25-bit field. In the actual implementation, the guard time field in timeslots 0 and 4 are 9 bits long and the remaining timeslots contain 8 bit fields. (This implementation is documented in the GSM standard “GSM REC. 05.10 Section 5.7” as follows: “Optionally, the BS may use a timeslot length of 157 bit periods on timeslots with TN=0 and 4, and 156 bit periods on timeslots with TN=1, 2, 3, 5, 6, 7, rather than 156.25 bit periods on all timeslots.”) The text in this field is grey, indicating that you cannot change the contents of the guard time field.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**

Configure Sync

Pressing this softkey reveals a menu of softkeys for configuring a synchronization timeslot. The following figure shows an example of display graphics for a synchronization timeslot. The visual representation of the timeslot shows each field of the timeslot as it is defined by the GSM standard.



pk795a

In this example:

- **T: 0 (always)** - Indicates that both of the 3-bit tail fields are always hexadecimal zero. The text in this field is grey, indicating that you cannot change the contents of the tail bit fields.
- **E: PN9** - Indicates that the data selection (encryption bits) for this timeslot is PN9. Press the **E** softkey in the Configure Sync menu to change the data selection. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.
- **TS: B962040F2D45761B** - Indicates that the 64-bit training sequence for this timeslot is hexadecimal B962040F2D45761B. Press the **TS** softkey in the Configure Sync menu to change the contents of the training sequence.
- **G: --** - Guard time appears in the visual representation of the timeslot as an 8.25-bit field. In the actual implementation, the guard time field in timeslots 0 and 4 are 9 bits long and the remaining timeslots contain 8 bit fields. (This implementation is documented in the GSM standard “GSM REC. 05.10 Section 5.7” as follows: “Optionally, the BS may use a timeslot length of 157 bit periods on timeslots with TN=0 and 4, and 156 bit periods on timeslots with TN=1, 2, 3, 5, 6, 7, rather than 156.25 bit periods on all timeslots.”) The text in this field is grey, indicating that you cannot change the contents of the guard time field.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Sync**, **Configure Sync**

Configure Timeslot

Pressing this softkey reveals a menu of choices for configuring the timeslots. In this menu, select which timeslots to turn on or off. Then use the Timeslot Type menu to choose between custom, normal, frequency correction, synchronization, dummy and access bursts. Use the subsequent menus to configure the timeslots. This softkey is inactive until you set the **Data Format Pattern Framed** softkey to **Framed**.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**

Custom

Press this softkey to select a custom timeslot type for the active timeslot. A custom timeslot is configured using an internally-generated data pattern, a downloaded sequence of bits stored in a user file, or by supplying external data. The custom timeslot is provided for users' flexibility but it is not a standard GSM timeslot type.

When you have selected **Custom** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your configuration.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Custom**

SCPI Commands:

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7[:TYPE] CUSTom

Data

Pressing this softkey reveals a menu of choices for internal data generation (PN9, PN15, fixed, 4-bit repeating sequences, set patterns of ones and zeroes) or you can choose to supply your own data (download a binary file or input data using the DATA INPUT connector). This softkey is available in the GSM menu to select a data pattern for modulated transmissions that are not framed. With **GSM Off On** set to **On** and **Data Format Pattern Framed** set to **Pattern**, the signal generator then outputs either a single modulated occurrence (**Pattern Repeat Single**) or a continuous modulated stream (**Pattern Repeat Cont**) of your choice of data.

Softkey Location: Press **Mode**, **GSM**, **Data**

Status after Normal Preset: PN9

SCPI Commands:

[:SOURce]:RADio:GSM:DATA?

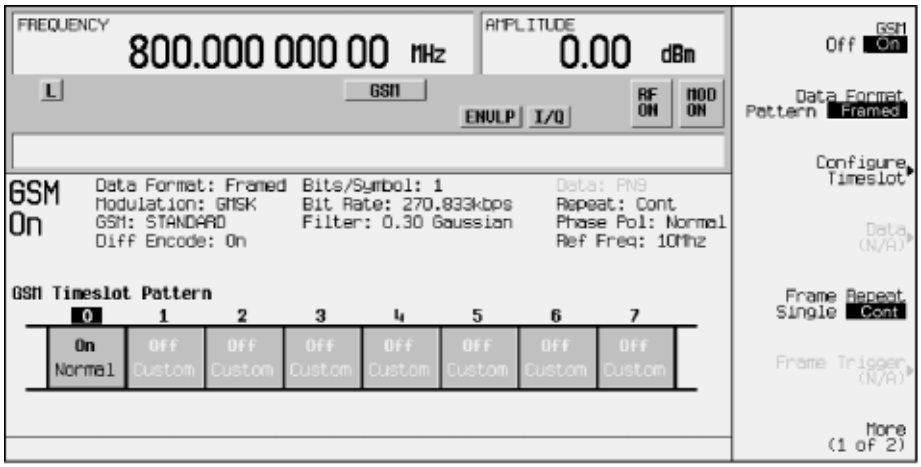
[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:CUSTom?

Data Format Pattern Framed

Press this softkey to toggle between **Data Format Pattern** and **Data Format Framed** modes. When you select **Framed** you will be transmitting your framed data pattern in a GSM format.

When you select **Data Format Pattern**, you will be transmitting a continuous stream of your selected data pattern. Select the data pattern using the **Data** softkey. The **Data** softkey is activated when you select **Data Format Pattern** and inactivated when you select **Data Format Framed**.

The **Data Format Pattern Framed** softkey is coupled to the **Burst Envelope Off On** softkey in the I/Q menu. At any time that GSM is enabled (**GSM Off On** is set to **On**) and **Data Format Pattern Framed** is set to **Framed**, the **ENVLP** annunciator is turned on in the display (indicating that **Burst Envelope On** is also selected). The following figure shows the display graphics that appear when the GSM menu is accessed, **Data Format Pattern Framed** is set to **Framed**, and you are not configuring a timeslot:



pk789a

In this example:

- **`GSM On`** - Indicates that GSM is enabled. This field changes to **`GSM Off`** when **GSM Off On** is set to **Off**.
- **`Data Format: Framed`** - Indicates that the data pattern is a framed transmission. This field changes to **`Data Format: Pattern`** when the **Data Format Pattern Framed** softkey is set to **Pattern** indicating that you are transmitting a continuous stream of your selected data pattern.
- **`Modulation: GMSK`** - Indicates that GMSK modulation is being internally generated.
- **`GSM: STANDARD`** - Indicates that the structure of the GSM transmission follows the standard as defined by the GSM protocol. This field changes to **`GSM: MODIFIED`** under the following circumstances:
  - filter bandwidth-multiplied-by-bit-time (BbT) is changed
  - bit rate is changed
  - burst shape is changed
  - phase polarity is set to invert
  - differential encoding is turned off
- **`Diff Encode: On`** - Indicates that differential encoding is turned on.
- **`Bit/Symbol: 1`** - Indicates that 1 bit per symbol is required according to the GSM standard.
- **`Bit Rate: 270.833kbps`** - The bit rate is set according to the GSM standard. This can be changed in the Bit Rate menu. A * next to the value indicates that it differs from the standard.
- **`Filter: 0.30 Gaussian`** - Indicates that the Gaussian filter is used with a BbT of 0.30. This can be changed in the Filter menu. A * next to the BbT value indicates that it differs from the standard.
- **`Data: PN9`** - Indicates that a PN9 sequence has been selected for transmitting without framing. In this example, the text in this field is grey, indicating an inactive function (framed mode is on). Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.
- **`Repeat: Cont`** - Indicates that the data pattern repeat is set to continuous mode. If you select single mode, this field changes to **`Repeat: Single`**.
- **`Phase Pol: Normal`** - Indicates the direction of rotation of the phase modulation vector. If you select inverted mode, this field changes to **`Phase Pol: Invert`**.
- **`Ref Freq: 10Mhz`** - Indicates the timebase reference frequency is 10 MHz. This field changes to 13 MHz if external 13 MHz is on.

- The visual representation of the GSM timeslot pattern shows, in this case, that timeslot 0 is on and configured as a normal timeslot. Timeslots 1, 2, 3, 4, 5, 6, and 7 are off and configured as custom timeslots. The timeslot pattern is displayed only when **Data Format Pattern Framed** is set to **Framed**.

To configure the timeslots, press the **Configure Timeslot** softkey. The **Configure Timeslot** softkey is activated when you select **Data Format Framed** and is inactivated when you select **Data Format Pattern**.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**

Status after Normal Preset: Pattern

SCPI Commands:

[:SOURce]:RADio:GSM:BURSt[:STATe] ON|OFF|1|0

[:SOURce]:RADio:GSM:BURSt[:STATe]?

Diff Encode Off On

Press this softkey to toggle differential encoding on and off. Set **Diff Encode** to **On** to transmit only the data bits that are different from the previous bit. Set **Diff Encode** to **Off** to transmit the true data pattern.

Softkey Location: Press **Mode**, **GSM**, **More (1 of 2)**, **Modify Standard**, **Diff Encode Off On**

Status after Normal Preset: On

SCPI Commands:

[:SOURce]:RADio:GSM:DENCode ON|OFF|1|0

[:SOURce]:RADio:GSM:DENCode?

Dummy

Press this softkey to select dummy as the timeslot type for the active timeslot. The dummy burst is used as filler information for unused timeslots on the forward link.

When you select **Dummy** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Dummy**

SCPI Commands:

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7[:TYPE] DUMMy

E

Pressing this softkey reveals a menu of choices for internal data generation (PN9, PN15, fixed, 4-bit repeating sequences, set patterns of ones and zeroes) or you can choose to supply your own data (download a binary file or input data using the DATA INPUT connector) for configuring the timeslot encryption bit fields.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**, **E**

E is also located in the Configure Sync and Configure Access menus.

Status after Normal Preset: PN9

SCPI Commands:

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:ACCess:ENCRyption PN9|PN15|FIX4|"filename"|EXTernal|P4|P8|P16|P32|P64

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:ACCess:ENCRyption?

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:NORMal:ENCRyption PN9|PN15|FIX4|"filename"|EXTernal|P4|P8|P16|P32|P64

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:NORMal:ENCRyption?

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:SYNC:ENCRyption PN9|PN15|FIX4|"filename"|EXTernal|P4|P8|P16|P32|P64

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:SYNC:ENCRyption?

ET

Press this softkey to change the 8-bit extended tail field (ET). The preset hexadecimal value (when normal preset is selected) for ET reflects the GSM standard, however you can enter a new value by pressing this softkey. To enter a value (in hexadecimal), press **ET**. The ET value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The current value for ET is displayed in the **ET** field near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Access**, **Configure Access**, **ET**

Status after Normal Preset: 3A

SCPI Commands:

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:ACCess:ETail <bit_pattern>

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:ACCess:ETail?

Ext

Press this softkey in the data selection menus to select external data. With **Ext** selected, you should apply the data signal to the DATA INPUT connector. If you have selected **Ext** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **Ext** is displayed in the **Data** field in the top line of the text area of the display. If you have selected **Ext** for configuring the timeslot data fields, **EXT** is displayed in either the **Data** field or the **E** field (encryption bits), both of which are located near the bottom of the text area of the display. In framed mode, the external data is gated to the data regions of the timeslot.

Another **Ext** softkey is located in the Frame Trigger and Pattern Trigger menus. Press **Ext** in either of these two menus to select external triggering for your data pattern. Apply a TTL input to the rear panel PATTERN TRIG IN connector to trigger your frame or pattern data.

Softkey Location: Press **Mode**, **GSM**, **Data**, **Ext**
or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**, **E**, **Ext**
or press **Mode**, **GSM**, **Pattern Repeat Single Cont**, **Frame Trigger**, **Ext**
or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Ext**

Ext is also located in the Configure Custom menu and in the E Menus found in the Configure Sync menu and the Configure Access menu.

SCPI Commands:

[:SOURce]:RADio:GSM:DATA EXTernal

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:ACCess:ENCRyption EXTernal

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:CUSTom EXTernal

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:NORMal:ENCRyption EXTernal

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:SYNC:ENCRyption EXTernal

[:SOURce]:RADio:GSM:TRIGger[:SOURce] EXTernal

Ext Delay Bits

Press this softkey to specify the number of bits for the external trigger delay. When **Ext Delay Off On** is set to **On**, a value greater than 0 will delay the transmission of the triggered data after the external trigger event by the number of bits specified. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. The range of values allowed is 0 through 65,535 bits. This softkey is inactive until the trigger selection is set to **Ext**.

Softkey Location: Press **Mode**, **GSM**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Ext**, **Ext Delay Bits**
or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Ext**, **Ext Delay Bits**

Status after Normal Preset: 0

SCPI Commands:

[:SOURce]:RADio:GSM:TRIGger[:SOURce]:EXTernal:DELay <value>

[:SOURce]:RADio:GSM:TRIGger[:SOURce]:EXTernal:DELay?

Ext Delay Off On

Press this softkey to toggle the external trigger delay on and off. When this function is turned on, the transmission of the triggered data will be delayed after the external trigger event by the number of bits specified by the **Ext Delay Bits** softkey. This function is only available when the trigger selection is set to **Ext**.

Softkey Location: Press **Mode**, **GSM**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Ext**, **Ext Delay Off On**
or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Ext**, **Ext Delay Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:RADio:GSM:TRIGger[:SOURce]:EXTernal:DELay:STATe ON|OFF|1|0

[:SOURce]:RADio:GSM:TRIGger[:SOURce]:EXTernal:DELay:STATe?

External 13 MHz Off On

Press this softkey to specify an external 13 MHz reference for the internal reference clock for the data generator. Supply the 13 MHz signal to the rear panel 13 MHz IN connector. This signal is for the bit clock only. The RF signal still requires the internal or external 10 MHz reference.

Softkey Location: Press **Mode**, **GSM**, **More (1 of 2)**, **Configure Hardware**, **External 13 MHz Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:RADio:GSM:EREFerence ON|OFF|1|0

[:SOURce]:RADio:GSM:EREFerence?

Fall Delay

Press this softkey to change the shape of the bursted RF signal by entering a falling edge delay. To change the fall delay, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0 through 10 bits.

Softkey Location: Press **Mode**, **GSM**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Fall Delay**

Status after Normal Preset: 4.38 bits

SCPI Commands:

[:SOURce]:RADio:GSM:BURSt:SHAPe:FALL:DELay <value>

[:SOURce]:RADio:GSM:BURSt:SHAPe:FALL:DELay?

[:SOURce]:RADio:GSM:BURSt:SHAPe:FDELay <value>

[:SOURce]:RADio:GSM:BURSt:SHAPe:FDELay?

Fall Time

Press this softkey to change the shape of the bursted RF signal by entering a falling edge time. To change the fall time, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0.20 through 30 bits.

Softkey Location: Press **Mode**, **GSM**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Fall Time**

Status after Normal Preset: 3.44 bits

SCPI Commands:

[:SOURce]:RADio:GSM:BURSt:SHAPe:FALL:TIME <value>

[:SOURce]:RADio:GSM:BURSt:SHAPe:FALL:TIME?

[:SOURce]:RADio:GSM:BURSt:SHAPe:FTIMe <value>

[:SOURce]:RADio:GSM:BURSt:SHAPe:FTIMe?

FCorr

Press this softkey to select frequency correction as the timeslot type for the active timeslot. Frequency correction is a burst where all of the bits are set to zero. This burst is used for synchronizing the mobile to the correct frequency.

When you select **FCorr** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **FCorr**

SCPI Commands:

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7[:TYPE] FCORrection

Filter

Pressing this softkey reveals a menu of choices for changing the bandwidth-multiplied-by-bit-time (BbT) filter parameter and for restoring the default filter BbT.

Softkey Location: Press **Mode**, **GSM**, **(More 1 of 2)**, **Modify Standard**, **Filter**

Filter BbT

Press this softkey to change the bandwidth-multiplied-by-bit-time (BbT) filter parameter. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. The range of values allowed is 0.20 through 0.70.

Softkey Location: Press **Mode**, **GSM**, **(More 1 of 2)**, **Modify Standard**, **Filter**, **Filter BbT**

Status after Normal Preset: 0.30

SCPI Commands:

[:SOURce]:RADio:GSM:BBT <value>

[:SOURce]:RADio:GSM:BBT?

FIX4

Press this softkey to select a 4-bit repeating sequence data pattern. Press **FIX4** and the 4-bit pattern becomes the active function. Enter your desired 4-bit pattern using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. If you have selected **FIX4** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **FIX4** is displayed in the **Data** field in the top line of the text area of the display. If you have selected **FIX4** for configuring the timeslot data fields, your 4-bit pattern is displayed in either the **Data** field or the **E** field (encryption bits), both of which are located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **GSM**, **Data**, **FIX4**
or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**, **E**, **FIX4**

FIX4 is also located in Configure Custom menu and in the E Menus found in the Configure Sync and Configure Access Menus.

Status after Normal Preset: 0000

SCPI Commands:

[:SOURce]:RADio:GSM:DATA FIX4

[:SOURce]:RADio:GSM:DATA:FIX4 <0-15>

[:SOURce]:RADio:GSM:DATA:FIX4?

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:ACCess:ENCRyption FIX4

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:ACCess:ENCRyption:FIX4 <0-15>

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:ACCess:ENCRyption:FIX4?

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:CUSTom FIX4

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:CUSTom:FIX4 <0-15>

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:CUSTom:FIX4?

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:NORMal:ENCRyption FIX4

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:NORMal:ENCRyption:FIX4 <0-15>

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:NORMal:ENCRyption:FIX4?

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:SYNC:ENCRyption FIX4

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:SYNC:ENCRyption:FIX4 <0-15>

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:SYNC:ENCRyption:FIX4?

Frame Repeat Single Cont

Press this softkey to toggle between a single output of framed data and continuous transmission of frames. If only one timeslot is on, selecting **Single** will output the following sequences:

- 4-Bit Patterns (FIX4) - A single frame is generated. The 4-bit pattern repeats until the data fields are completely filled. Each trigger transmits the same frame.
- Other Patterns (fixed patterns of equal quantities of ones and zeroes) - A single frame is generated. The selected pattern repeats until the data fields are completely filled. Each trigger transmits the same frame.
- PN9 - A single frame is generated. The data fields are filled with the leading bits of the PN9 sequence. A trigger causes the frame to be transmitted. The data fields of this frame are then filled sequentially with the next series of PN9 data bits. A trigger causes the frame to be transmitted. This process continues, transmitting the entire PN9 sequence frame by frame. The last bit of the PN9 sequence in a data field is immediately followed by the first bit of a second PN9 sequence.
- PN15 - A single frame is generated. The data fields are filled with the leading bits of the PN15 sequence. A trigger causes the frame to be transmitted. The data fields of this frame are then filled sequentially with the next series of PN15 data bits. A trigger causes the frame to be transmitted. This process continues, transmitting the entire PN15 sequence frame by frame. The last bit of the PN15 sequence in a data field is immediately followed by the first bit of a second PN15 sequence.

- User File - The user's file should have the appropriate data to fill an integer number of timeslots. If not, the remaining bits are truncated. Depending on the size of the file, more than one frame can possibly be generated.
- External Data - External data is clocked into the data fields of the timeslot. A single frame is generated.

Combinations of these data patterns may cause some patterns to be truncated. Refer to Chapter 7, "Operation" for the details of the data dependencies.

Selecting **Cont** with framed data causes the frames to be transmitted continuously.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**

Status after Normal Preset: Continuous

SCPI Commands:

[:SOURce]:RADio:GSM:REPeat SINGle|CONTinuous

[:SOURce]:RADio:GSM:REPeat?

Frame Trigger

Pressing this softkey reveals a menu of choices for triggering your framed pattern. You can choose to trigger using the front panel **Trigger** key, an external trigger supplied to the PATTERN TRIG IN connector, or by a *TRG command or GET (group execute trigger) signal sent over HP-IB. This softkey is inactive until **Data Format Pattern Framed** is set to **Framed** and **Frame Repeat Single Cont** is set to **Single**.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**

Status after Normal Preset: Trigger Key

SCPI Commands:

[:SOURce]:RADio:GSM:TRIGger[:SOURce]?

Goto Bottom Row

Press this softkey to move the selection bar to the bottom row of file names in the Goto Row menu that is accessed from the User File menu.

Softkey Location: Press **Mode**, **GSM**, **Data**, **User File, Goto Row**, **Goto Bottom Row** or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**, **E**, **User File**, **Goto Row**, **Goto Bottom Row**

Goto Middle Row

Press this softkey to move the selection bar to the middle row of file names in the Goto Row menu that is accessed from the User File menu.

Softkey Location: Press **Mode**, **GSM**, **Data**, **User File, Goto Row**, **Goto Middle Row** or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**, **E**, **User File**, **Goto Row**, **Goto Middle Row**

Goto Row

Pressing this softkey reveals a menu of softkeys that help you move the selection bar through the rows of file names in the User File menu. You can also go to a specific row by rotating the front panel knob, using the up and down arrow keys, or entering the row number with the numeric keypad. Once the desired row number is displayed, press the **Enter** terminator softkey.

Softkey Location: Press **Mode**, **GSM**, **Data**, **User File, Goto Row** or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**, **E**, **User File**, **Goto Row**

Goto Top Row

Press this softkey to move the selection bar to the top row of file names in the Goto Row menu that is accessed from the User File menu.

Softkey Location: Press **Mode**, **GSM**, **Data**, **User File, Goto Row**, **Goto Top Row** or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**, **E**, **User File**, **Goto Row**, **Goto Top Row**

GSM Off On

Press this softkey to enable the GSM communications standard. Setting **GSM Off On** to **On** sets up the internal hardware to generate a signal that follows the GSM standard. The internal I/Q modulator generates GMSK digital modulation and the **GSM** and **I/Q** annunciators are turned on in the display. Although the digital modulation is enabled with this softkey, the RF carrier is modulated by the enabled modulation only when you have also set **Mod On/Off** to **On**.

Setting **GSM Off On** to **On** presets the following softkeys in the I/Q menu: **I/Q Off On** is set to **On** and **I/Q Source** is set to **Int I/Q**. You can override these selections in the I/Q menu.

Softkey Location: Press **Mode**, **GSM**, **GSM Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:RADio:GSM[:STATe] ON|OFF|1|0

[:SOURce]:RADio:GSM[:STATe]?

Modify Standard

Pressing this softkey reveals a menu of choices for modifying the standard transmission in the following ways:

- changing the filter BbT
- changing the transmission bit rate
- changing the burst rising edge time and delay
- changing the burst falling edge time and delay
- inverting the phase polarity
- turning on and off differential encoding

Softkey Location: Press **Mode**, **GSM**, **(More 1 of 2)**, **Modify Standard**

Normal

Press this softkey to select normal as the timeslot type for the active timeslot.

When you select **Normal** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Normal**

SCPI Commands:

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7[:TYPE] NORMal

Normal All

Press this softkey to select normal as the timeslot type for all timeslots.

When you select **Normal All**, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Normal All**

SCPI Commands:

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7[:TYPE] NORMAL_ALL

Other Patterns

Pressing this softkey reveals a menu of data pattern selections. Each of the selections in this menu is a pattern of equal quantities of ones and zeroes (such as four ones and four zeroes).

Softkey Location: Press **Mode**, **GSM**, **Data**, **Other Patterns**
or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**, **Data**, **Other Patterns**

Other Patterns is also located in the Configure Custom menu and in the E Menus found in the Configure Sync and Configure Access Menus.

Page Down

Press this softkey to move down one page at a time in the displayed catalog of files.

Softkey Location: Press **Mode**, **GSM**, **Data**, **User File**, **Page Down**
or press **Mode**, **GSM**, **Data**, **User File**, **Goto Row**, **Page Down**
or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**, **E**, **User File**, **Page Down**
or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**, **E**, **User File**, **Goto Row**, **Page Down**

Page Down is also located in the User File menus found in the Configure Custom, Configure Sync, and Configure Access menus.

Page Up

Press this softkey to move up one page at a time in the displayed catalog of files.

Softkey Location: Press **Mode**, **GSM**, **Data**, **User File**, **Page Up**
or press **Mode**, **GSM**, **Data**, **User File**, **Goto Row**, **Page Up**
or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**, **E**, **User File**, **Page Up**
or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**, **E**, **User File**, **Goto Row**, **Page Up**

Page Up is also located in the User File menus found in the Configure Custom, Configure Sync, and Configure Access menus.

Pattern Repeat Single Cont

Set this softkey to **Single** to output one occurrence of a modulated data pattern that is not framed. Select the trigger event for the output using the **Pattern Trigger** softkey. Toggle to **Cont** to output a continuous stream of your data pattern.

Softkey Location: Press **Mode**, **GSM**, **Pattern Repeat Single Cont**

Status after Normal Preset: Continuous

SCPI Commands:

[:SOURce]:RADio:GSM:REPeat SINGle|CONTinuous

[:SOURce]:RADio:GSM:REPeat?

Pattern Trigger

Pressing this softkey reveals a menu of choices for triggering a modulated data pattern that is not framed. You can choose to trigger using the front panel **Trigger** key, an external trigger supplied to the PATTERN TRIG IN connector, or by a *TRG command or GET (group execute trigger) signal sent over HP-IB. This softkey is inactive until **Pattern Repeat Single Cont** is set to **Single**.

Softkey Location: Press **Mode**, **GSM**, **Pattern Repeat Single Cont**, **Pattern Trigger**

Status after Normal Preset: Trigger Key

SCPI Commands:

[:SOURce]:RADio:GSM:TRIGger[:SOURce]?

Phase Polarity Normal Invert

Press this softkey to reverse the direction of rotation of the phase modulation vector. Choose **Invert** and the in-phase component will lag the quadrature-phase component by 90° in the resulting modulation.The inverted selection also applies to the I OUT and Q OUT signals.

Softkey Location: Press **Mode**, **GSM**, **More (1 of 2)**, **Modify Standard**, **Phase Polarity Normal Invert**

Status after Normal Preset: Normal

SCPI Commands:

[:SOURce]:RADio:GSM:POLarity[:ALL] NORMal|INVerted

[:SOURce]:RADio:GSM:POLarity[:ALL]?

PN9

Press this softkey to select the PN9 pseudorandom bit pattern. If you have selected **PN9** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **PN9** is displayed in the **Data** field in the top line of the text area of the display. If you have selected **PN9** for configuring the framed timeslot data fields, **PN9** is displayed in either the **Data** field or the **E** field (encryption bits), both of which are located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **GSM**, **Data**, **PN9**
or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**, **E**, **PN9**

PN9 is also located in the Configure Custom menu and in the E Menus found in the Configure Sync and Configure Access Menus.

SCPI Commands:

[:SOURce]:RADio:GSM:DATA PN9

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:ACCess:ENCRyption PN9

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:CUSTom PN9

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:NORMal:ENCRyption PN9

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:SYNC:ENCRyption PN9

PN9 Mode Normal Quick
Option 1EH Only

Press this softkey to toggle between normal and quick PN9 modes. A single output of a framed normal PN9 data pattern consists of enough frames so that the end of the PN9 sequence corresponds with the end of a frame. A single output of a framed quick PN9 data pattern consists of one entire PN9 sequence plus enough of a second PN9 sequence to fill the remaining data fields in the current frame. The second PN9 sequence is, therefore, truncated.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Frame**, **PN9 Mode Normal Quick**

Status after Normal Preset: Normal

SCPI Commands:

[:SOURce]:RADio:GSM:BURSt:PN9 NORMal|QUICk

[:SOURce]:RADio:GSM:BURSt:PN9?

PN15

Press this softkey to select the PN15 pseudorandom bit pattern. If you have selected **PN15** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **PN15** is displayed in the **Data** field in the top line of the text area of the display. If you have selected **PN15** for configuring the framed timeslot data fields, **PN15** is displayed in either the **Data** field or the **E** field (encryption bits), both of which are located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **GSM**, **Data**, **PN15**
or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**, **E**, **PN15**

PN15 is also located in the Configure Custom menu and in the E Menus found in the Configure Sync and Configure Access Menus.

SCPI Commands:

[:SOURce]:RADio:GSM:DATA PN15

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:ACCess:ENCRyption PN15

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:CUSTom PN15

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:NORMal:ENCRyption PN15

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:SYNC:ENCRyption PN15

Restore Default Bit Rate

Press this softkey to reset the transmission bit rate to the default value (270.833 kbps). This softkey is a convenience feature for quickly resetting the bit rate. You can also change the bit rate by pressing the **Bit Rate** softkey.

Softkey Location: Press **Mode**, **GSM**, **(More 1 of 2)**, **Modify Standard**, **Bit Rate**, **Restore Default Bit Rate**

Restore Default Burst Shape

Press this softkey to reset the burst shape characteristics to their default values (rise time = 4.22 bits, rise delay = 0 bits, fall time = 3.44 bits, fall delay = 4.38 bits). This softkey is a convenience feature for quickly resetting the burst shape. You can also change each of the burst characteristics individually by using the **Rise Time**, **Rise Delay**, **Fall Time**, and **Fall Delay** softkeys in this menu.

Softkey Location: Press **Mode**, **GSM**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Restore Default Burst Shape**

Restore Default Filter BbT

Press this softkey to reset the bandwidth-multiplied-by-bit-time (BbT) filter parameter to its default value (0.30). This softkey is a convenience feature for quickly resetting the filter BbT. You can also change the bit rate by pressing the **Filter BbT** softkey.

Softkey Location: Press **Mode**, **GSM**, **(More 1 of 2)**, **Modify Standard**, **Filter**, **Restore Default Filter BbT**

Rise Delay

Press this softkey to change the shape of the bursted RF signal by entering a rising edge delay. To change the rise delay, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0 through 10 bits.

Softkey Location: Press **Mode**, **GSM**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Rise Delay**

Status after Normal Preset: 0.00 bits

SCPI Commands:

[:SOURce]:RADio:GSM:BURSt:SHAPe:RISE:DELay <value>

[:SOURce]:RADio:GSM:BURSt:SHAPe:RISE:DELay?

[:SOURce]:RADio:GSM:BURSt:SHAPe:RDELay <value>

[:SOURce]:RADio:GSM:BURSt:SHAPe:RDELay?

Rise Time

Press this softkey to change the shape of the bursted RF signal by entering a rising edge time. To change the rise time, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0.20 through 30 bits.

Softkey Location: Press **Mode**, **GSM**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Rise Time**

Status after Normal Preset: 4.22 bits

SCPI Commands:

[:SOURce]:RADio:GSM:BURSt:SHAPe:RISE:TIME <value>

[:SOURce]:RADio:GSM:BURSt:SHAPe:RISE:TIME?

[:SOURce]:RADio:GSM:BURSt:SHAPe:RTIMe <value>

[:SOURce]:RADio:GSM:BURSt:SHAPe:RTIMe?

S

Press this softkey to change the 1-bit binary stealing flag for both stealing flag fields in the normal burst timeslot. The stealing flag fields accept binary values of zero or one, however, the front panel data entry is actually hexadecimal. Any value entered that is greater than one is automatically clipped back to a value of one.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**, **S**

Status after Normal Preset: 0

SCPI Commands:

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:NORMal:STeal <1 bit_pattern>

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:NORMal:STeal?

SS

Press this softkey to change the 41-bit synchronization sequence in the access burst timeslot. The preset hexadecimal value (when normal preset is selected) for SS reflects the GSM standard, however you can enter a new value by pressing this softkey. To enter a value (in hexadecimal), press **SS**. The SS value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The current value for SS is displayed in the **SS** field near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Access**, **Configure Access**, **SS**

Status after Normal Preset: 096FF335478

SCPI Commands:

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:ACCess:SSEQuence <bit_pattern>

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:ACCess:SSEQuence?

Select File

Press this softkey to select a file in the displayed catalog of binary files. To make your selection, first scroll through the list, using the front panel knob or up and down arrow keys, until the desired file is highlighted. Press **Select File** and the highlighted file is specified as your data selection. If you have selected a custom file as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **`UserFile`** is displayed in the **`Data`** field in the top line of the text area of the display. If you have selected a custom file for configuring timeslot data fields, the file name you selected is displayed in either the **`Data`** field or the **E** field (encryption bits), both of which are located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **GSM**, **Data**, **User File**, **Select File**
or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**, **E**, **User File**, **Select File**

Select File is also located in the User File Menus found in the Configure Sync and Configure Access and Configure Custom Menus.

SCPI Commands:

[:SOURce]:RADio:GSM:DATA “file name”

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:ACCess:ENCRyption “file name”

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:CUSTom “file name”

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:NORMal:ENCRyption “file name”

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:SYNC:ENCRyption “file name”

Sync

Press this softkey to select synchronization as the timeslot type for the active timeslot. Synchronization is a downlink burst that allows the mobile to synchronize in time with the base station.

When you select **Sync** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Sync**

SCPI Commands:

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7[:TYPE] SYNC

Sync Out

Press this softkey to reveal a menu of choices for outputting a 1-bit synchronization signal to the EVENT 1 rear panel connector. In this menu you can choose to set the synchronization signal to occur at the beginning of a data pattern, at the beginning of a frame, at the beginning of a selected timeslot, or at the beginning of each timeslot in a frame.

Softkey Location: Press **Mode**, **GSM**, **More (1 of 2)**, **Sync Out**

Status after Normal Preset: Begin Pattern

SCPI Commands:

[:SOURce]:RADio:GSM:SOUT?

Sync Out Offset

Press this softkey to move the synchronization signal forward or back from the beginning of the data pattern, frame, or timeslot. To set the number of bits of offset, press **Sync Out Offset** and synchronization offset becomes the active function. Enter the desired value using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. The range of values allowed is –155 through +155 bits.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **Sync Out Offset**

Status after Normal Preset: 0 bits

SCPI Commands:

[:SOURce]:RADio:GSM:SOUT:OFFSet <value>

[:SOURce]:RADio:GSM:SOUT:OFFSet?

Timeslot

Press this softkey to select a timeslot to be configured. Choose any of the eight timeslots. Enter the timeslot number using the front panel knob, the up and down arrow keys, or enter the number using the numeric keypad and press the **Enter** terminator softkey.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot #**

Status after Normal Preset: 0

Timeslot Off On

Press this softkey to toggle the active timeslot on and off. For example, to turn on timeslot 2, select the timeslot by pressing the **Timeslot #** softkey in this same menu. Enter the number 2 to make timeslot 2 active. Then turn this timeslot on by toggling **Timeslot Off On** to **On**. Notice that the visual representation of the timeslot pattern now shows timeslot 2 turned on.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Off On**

Status after Normal Preset: On (for timeslot 0)

SCPI Commands:

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:STATe ON|OFF|1|0

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7:STATe?

Timeslot Type

Pressing this softkey reveals a menu of choices for setting the timeslot type for the active timeslot. You can choose between normal, frequency correction, synchronization, dummy, and access timeslots. An additional selection, custom, is available. This choice is provided for users' flexibility but it is not, however, a standard GSM timeslot type.When you have selected the type for the timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**

Status after Normal Preset: Normal (for timeslot 0)

SCPI Commands:

[:SOURce]:RADio:GSM:SLOT0|[1]|2|3|4|5|6|7[:TYPE]?

Trigger Key

Press this softkey to select the front panel **Trigger** key as the pattern trigger for a single output of a modulated data transmission that is not framed (**Data Format Pattern Framed** is set to **Pattern**) or select the **Trigger** key as the frame trigger for a single output of your framed data. Once selected, you can trigger a single event at any time by pressing the **Trigger** key.

Softkey Location: Press **Mode**, **GSM**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Trigger Key**
or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Trigger Key**

SCPI Commands:

[:SOURce]:RADio:GSM:TRIGger[:SOURce] KEY

TS

Press this softkey to change the training sequence (TS). The preset hexadecimal value (when normal preset is selected) for TS reflects the GSM standard, however you can enter a new value by pressing this softkey. To enter a value (in hexadecimal), press **TS**. The TS value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The current value for TS is displayed in the **TS** field near the bottom of the text area of the display.

Softkey Location: **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**, **TS**

TS is also located in the Configure Dummy and Configure Sync menus.

Status after Normal Preset: 0970897 (Normal and Dummy), B962040F2D45761B (Sync)

SCPI Commands:

[:SOURce]:RADio:GSM:SLOT0|1|2|3|4|5|6|7:DUMMy:TSEQuence <bit_pattern>

[:SOURce]:RADio:GSM:SLOT0|1|2|3|4|5|6|7:DUMMy:TSEQuence?

[:SOURce]:RADio:GSM:SLOT0|1|2|3|4|5|6|7:NORMal:TSEQuence <bit_pattern>

[:SOURce]:RADio:GSM:SLOT0|1|2|3|4|5|6|7:NORMal:TSEQuence?

[:SOURce]:RADio:GSM:SLOT0|1|2|3|4|5|6|7:SYNC:TSEQuence <bit_pattern>

[:SOURce]:RADio:GSM:SLOT0|1|2|3|4|5|6|7:SYNC:TSEQuence?

User File

Press this softkey to display the catalog of binary files stored in the signal generator's memory. You can select a custom file from this catalog for your data pattern. Scroll through the listed files and when your selection is highlighted, press the **Select File** softkey. If you have selected **User File** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **`UserFile`** is displayed in the **`Data`** field in the top line of the text area of the display. If you have selected **User File** for configuring the framed timeslot data fields, the file name you selected is displayed in either the **`Data`** field or the **E** field (encryption bits), both of which are located near the bottom of the text area of the display.

User's files should exactly fill the data fields in a framed transmission. (Create the files to fill an integer number of frames.) If the end of the user's file does not coincide with the end of a frame, data will be truncated in one of the following ways:

- Enough frames will be generated to transmit as much of the data pattern as will fit into complete frames. The remaining bits of the data pattern (which are too few to completely fill a frame) are truncated.
- If two files of unequal sizes are selected for the same framed transmission, enough frames will be generated to transmit as much of the data pattern of the largest file as will fit into complete frames. The remaining bits of the data pattern are truncated. The smaller file will be repeated as many times as necessary to completely fill these frames. Data will be truncated for the smaller file to coincide with the end of the last frame.
- If a user's file and a PN9 or PN15 file are selected for the same framed transmission and the user's file is shorter than the PN9/15, enough frames will be generated to transmit the PN9/15. The end of the PN9/15 data will coincide with the end of the last frame. The smaller user's file will be repeated as many times as necessary to completely fill these frames. Data will be truncated for the smaller file to coincide with the end of the last frame.
- If a user's file and a PN9 file are selected for the same framed transmission and the user's file is longer than the PN9, enough frames will be generated to transmit as much of the data pattern as will fit into complete frames. The remaining bits of the data pattern (which are too few to completely fill a frame) are truncated. The PN9 data will be repeated as many times as necessary to completely fill these frames.

Softkey Location: Press **Mode**, **GSM**, **Data**, **User File**
or press **Mode**, **GSM**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Normal**, **E**, **User File**

User File is also located in Configure Custom menu and in the E Menus found in the Configure Sync and Configure Access Menus.

Mode - NADC

Pressing this softkey reveals a menu of softkeys for generating data patterns that are formatted into a framed structure (where the data bits are located in fields defined by the NADC protocol) or for generating just the data pattern where the data sequence can be output a single time or repeatedly. These softkeys are described in this section in alphabetical order.

4 1's & 4 0's

Press this softkey to select a binary data pattern that consists of four ones followed by four zeroes. If you have selected **4 1's & 4 0's** in a pattern data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P4** (where "P" refers to Pattern and "4" refers to four ones and four zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **4 1's & 4 0's** in a framed data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. Also, **P4** is displayed in the **Data** field near the bottom of the text area of the display. A single output of a framed P4 data pattern consists of enough repetitions of four ones followed by four zeroes, followed by four ones and four zeroes, and so on, until the data fields in the timeslot are filled.

Softkey Location: Press **Mode**, **NADC**, **Data**, **Other Patterns**, **4 1's & 4 0's** or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **Data**, **Other Patterns**, **4 1's & 4 0's**

4 1's & 4 0's is also located in the Other Patterns menus found in the Down TCH menu, the Up Custom menu and the Down custom menu.

SCPI Commands:

[:SOURce]:RADio[:NADC]:DATA P4

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DCUStom P4

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DTCHannel[:DATA] P4

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UCUStom P4

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UTCHannel[:DATA] P4

8 1’s & 8 0’s

Press this softkey to select a binary data pattern that consists of eight ones followed by eight zeroes. If you have selected **8 1’s & 8 0’s** in a pattern data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P8** (where “P” refers to Pattern and “8” refers to eight ones and eight zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **8 1’s & 8 0’s** in a framed data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. Also, **P8** is displayed in the **Data** field near the bottom of the text area of the display. A single output of a framed P8 data pattern consists of enough repetitions of eight ones followed by eight zeroes, followed by eight ones and eight zeroes, and so on, until the data fields in the timeslot are filled.

Softkey Location: Press **Mode**, **NADC**, **Data**, **Other Patterns**, **8 1’s & 8 0’s**
or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **Data**, **Other Patterns**, **8 1’s & 8 0’s**

8 1’s & 8 0’s is also located in the Other Patterns menus found in the Down TCH menu, the Up Custom menu and the Down custom menu.

SCPI Commands:

[:SOURce]:RADio[:NADC]:DATA P8

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DCUStom P8

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DTCHannel[:DATA] P8

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UCUStom P8

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UTCHannel[:DATA] P8

16 1’s & 16 0’s

Press this softkey to select a binary data pattern that consists of sixteen ones followed by sixteen zeroes. If you have selected **16 1’s & 16 0’s** in a pattern data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P16** (where “P” refers to Pattern and “16” refers to sixteen ones and sixteen zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **16 1’s & 16 0’s** in a framed data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. Also, **P16** is displayed in the **Data** field near the bottom of the text area of the display. A single output of a framed P16 data pattern consists of enough repetitions of sixteen ones followed by sixteen zeroes, followed by sixteen ones and sixteen zeroes, and so on, until the data fields in the timeslot are filled.

Softkey Location: Press **Mode**, **NADC**, **Data**, **Other Patterns**, **16 1’s & 16 0’s** or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **Data**, **Other Patterns**, **16 1’s & 16 0’s**

16 1’s & 16 0’s is also located in the Other Patterns menus found in the Down TCH menu, the Up Custom menu and the Down custom menu.

SCPI Commands:

[:SOURce]:RADio[:NADC]:DATA P16

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DCUStom P16

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DTCHannel[:DATA] P16

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UCUStom P16

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UTCHannel[:DATA] P16

32 1’s & 32 0’s

Press this softkey to select a binary data pattern that consists of thirty-two ones followed by thirty-two zeroes. If you have selected **32 1’s & 32 0’s** in a pattern data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P32** (where “P” refers to Pattern and “32” refers to thirty-two ones and thirty-two zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **32 1’s & 32 0’s** in a framed data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P32** is displayed in the **Data** field near the bottom of the text area of the display. A single output of a framed P32 data pattern consists of enough repetitions of thirty-two ones followed by thirty-two zeroes, followed by thirty-two ones and thirty-two zeroes, and so on, until the data fields in the timeslot are filled.

Softkey Location: Press **Mode**, **NADC**, **Data**, **Other Patterns**, **32 1’s & 32 0’s** or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **Data**, **Other Patterns**, **32 1’s & 32 0’s**

32 1’s & 32 0’s is also located in the Other Patterns menus found in the Down TCH menu, the Up Custom menu and the Down custom menu.

SCPI Commands:

[:SOURce]:RADio[:NADC]:DATA P32

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DCUStom P32

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DTCHannel[:DATA] P32

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UCUStom P32

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UTCHannel[:DATA] P32

64 1’s & 64 0’s

Press this softkey to select a binary data pattern that consists of sixty-four ones followed by sixty-four zeroes. If you have selected **64 1’s & 64 0’s** in a pattern data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P64** (where “P” refers to Pattern and “64” refers to sixty-four ones and sixty-four zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **64 1’s & 64 0’s** in a framed data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P64** is displayed in the **Data** field near the bottom of the text area of the display. A single output of a framed P64 data pattern consists of enough repetitions of sixty-four ones followed by sixty-four zeroes, followed by sixty-four ones and sixty-four zeroes, and so on, until the data fields in the timeslot are filled.

Softkey Location: Press **Mode**, **NADC**, **Data**, **Other Patterns**, **64 1’s & 64 0’s** or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **Data**, **Other Patterns**, **64 1’s & 64 0’s**

64 1’s & 64 0’s is also located in the Other Patterns menus found in the Down TCH menu, the Up Custom menu and the Down custom menu.

SCPI Commands:

[:SOURce]:RADio[:NADC]:DATA P64

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DCUStom P64

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DTCHannel[:DATA] P64

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UCUStom P64

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UTCHannel[:DATA] P64

All Timeslots

Press this softkey to output a 1-bit pulse to the EVENT 1 rear panel connector that is synchronized to the first bit of each timeslot in a frame. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **All Timeslots**

SCPI Commands:

[:SOURce]:RADio[:NADC]:SOUT ALL

BBG Data Clock Ext Int

Press this softkey to select the internal data clock for the baseband generator or to select an externally-supplied data clock. A data clock or symbol clock input must be supplied when external mode is selected. For more information on input and output signals, refer to Chapter 7, “Operation”.

Softkey Location: Press **Mode**, **NADC**, **More (1 of 2)**, **Configure Hardware**, **BBG Data Clock Ext Int**

Status after Normal Preset: Int

SCPI Commands:

[:SOURce]:RADio[:NADC]:BBCLock INT[1]|EXTernal[1]

[:SOURce]:RADio[:NADC]:BBCLock?

Begin Frame

Press this softkey to output a 1-bit pulse to the EVENT 1 rear panel connector that is synchronized to the first bit of the first frame. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified. The number of trigger pulses generated depends on the framed data patterns selected:

- If a PN9 or PN15 data pattern is selected, a single frame is generated. The data fields of the frame are filled sequentially with the PRBS data. The synchronizing pulse occurs at the beginning of the frame each time it is transmitted.
- Any combination of external data and a PN9 data pattern will cause 511 frames to be generated. The synchronizing pulse occurs at the beginning of the first of the 511 frames each time that frame is transmitted.
- Any combination of external data and a PN15 data pattern will cause a discontinuous PN15. A discontinuous PN15 pattern consists of as many complete frames of PN15 data as can be generated. The remaining bits that do not completely fill a frame are truncated. The synchronizing pulse occurs at the beginning of the first frame each time that frame is transmitted.
- Any combination of user’s files and a PN15 data pattern will cause a discontinuous PN15. The synchronizing pulse occurs at the beginning of the first frame each time that frame is transmitted.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **Begin Frame**

SCPI Commands:

[:SOURce]:RADio[:NADC]:SOUT FRAMe

Begin Pattern

Press this softkey to output a 1-bit pulse to the EVENT 1 rear panel connector that is synchronized to the first bit of your unframed data pattern (**Data Format Pattern Framed** is set to **Pattern**), and for each repetition of the pattern. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified.

Softkey Location: Press **Mode**, **NADC**, **More (1 of 2)**, **Sync Out**, **Begin Pattern**

SCPI Commands:

[:SOURce]:RADio[:NADC]:SOUT FRAMe

Begin Timeslot

Press this softkey to output a 1-bit pulse to the EVENT 1 rear panel connector that is synchronized to the first bit of a selected timeslot. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified. Select the timeslot by pressing **Begin Timeslot**. The timeslot number for the synchronization signal becomes the active function. Enter a value using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. You can select timeslots 1, 2, or 3 if you are in NADC full-rate, or select timeslots 1 through 6 if you are in NADC half-rate.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **Begin Timeslot**

SCPI Commands:

[:SOURce]:RADio[:NADC]:SOUT SLOT

[:SOURce]:RADio[:NADC]:SOUT:SLOT <value>

[:SOURce]:RADio[:NADC]:SOUT:SLOT?

Bit Rate

There are two softkeys named **Bit Rate**. The first is a menu key (distinguished by an arrow pointing to the right). Pressing this softkey reveals a menu of choices for setting the transmission bit rate. In this menu, there is another softkey named **Bit Rate**. Press this softkey to set the bit rate to any value from 40 kbps through 75.5 kbps. Enter the desired value using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Mbps**, **kbps**, or **bps** terminator softkey.

Softkey Location: Press **Mode**, **NADC**, **More (1 of 2)**, **Modify Standard**, **Bit Rate**
or press **Mode**, **NADC**, **More (1 of 2)**, **Modify Standard**, **Bit Rate**, **Bit Rate**

Status after Normal Preset: 48.600 kbps

SCPI Commands:

[:SOURce]:RADio[:NADC]:BRATe <value>

[:SOURce]:RADio[:NADC]:BRATe?

Burst Shape

Pressing this softkey reveals a menu of choices for modifying the burst shape of the framed data. In this menu, you can change the rise and fall time of the burst, in bits, and you can change the rise and fall delay of the burst, in bits. A softkey is also provided to return the default burst shape values.

Softkey Location: Press **Mode**, **NADC**, **More (1 of 2)**, **Modify Standard**, **Burst Shape**

Bus

Press this softkey to use the HP-IB as the pattern trigger for a single output of an unframed data pattern or as the frame trigger for a single output of your framed data. Once selected, you can trigger a single event at any time by sending a trigger command over HP-IB (*TRG) or by asserting the HP-IB GET (group execute trigger) line.

Softkey Location: Press **Mode**, **NADC**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Bus**
or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Bus**

SCPI Commands:

[:SOURce]:RADio[:NADC:]TRIGger[:SOURce] BUS

CDVCC

Press this softkey to change the 12-bit coded digital verification color code (CDVCC). To enter a value (in hexadecimal), press **CDVCC**. The CDVCC value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and then press the **Enter** terminator softkey. The current value for CDVCC is displayed in the **CDVCC** field near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **CDVCC**

CDVCC is also located in the Configure Down TCH menu.

Status after Normal Preset: 000

SCPI Commands:

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DTCHannel:CDVCcode <bit_pattern>

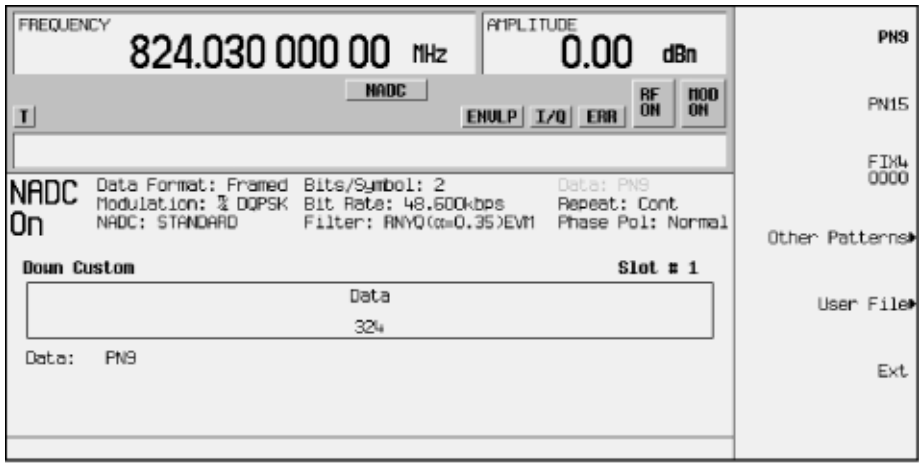
[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DTCHannel:CDVCcode?

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UTCHannel:CDVCcode <bit_pattern>

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UTCHannel:CDVCcode?

Configure Down Custom

Pressing this softkey reveals a menu of softkeys for selecting the data pattern for a downlink custom timeslot. The following figure shows an example of the display graphics for a downlink custom timeslot.



pk797a

In this example:

- **`Data: PN9`** - Indicates that the data selection for this custom timeslot is PN9. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.

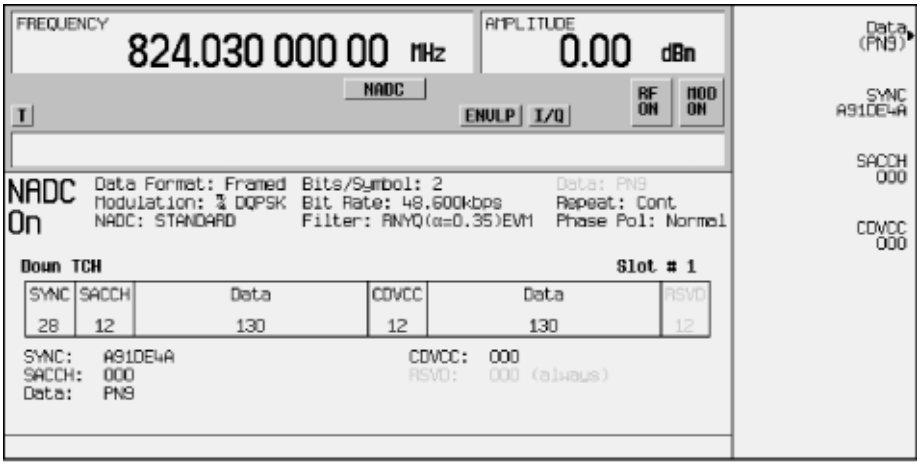
Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Down Custom**, **Configure Down Custom**

SCPI Commands:

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DCUStom?

Configure Down TCH

Pressing this softkey reveals a menu of softkeys for configuring a timeslot as a downlink traffic channel. The following figure shows an example of display graphics for a downlink traffic channel timeslot. The visual representation of the timeslot shows each field of the timeslot as it is defined by the NADC standard.



pk798a

In this example:

- **SYNC: A91DE4A** - Indicates that the synchronization word is set to hexadecimal A91DE4A. Press the **SYNC** softkey in the Configure Down TCH menu to change the contents of the synchronization word field.
- **SACCH: 000** - Indicates that the slow associated control channel is set to hexadecimal 000. Press the **SACCH** softkey in the Configure Down TCH menu to change the contents of the slow associated control channel field.
- **Data: PN9** - Indicates that the data selection for this down traffic channel is PN9. Press the **Data** softkey in the Configure Down TCH menu to change the data selection. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.
- **CDVCC: 000** - Indicates that the coded digital verification color code is set to hexadecimal 000. Press the **CDVCC** softkey in the Configure Down TCH menu to change the contents of the coded digital verification color code field.
- **RSVD: 000 (always)** - Indicates that the reserved field is set to hexadecimal 000. The text in this field is grey, indicating that you cannot change the contents of the reserved field.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Down TCH**, **Configure Down TCH**

Configure Frame

This softkey will be used in the future for controlling the entire frame. At present, this softkey has no function.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Frame**

Configure Hardware

Pressing this softkey reveals a menu that allows you to set or select a particular latch or hardware configuration to meet your specific needs.

Softkey Location: Press **Mode**, **NADC**, **More (1 of 2)**, **Configure Hardware**

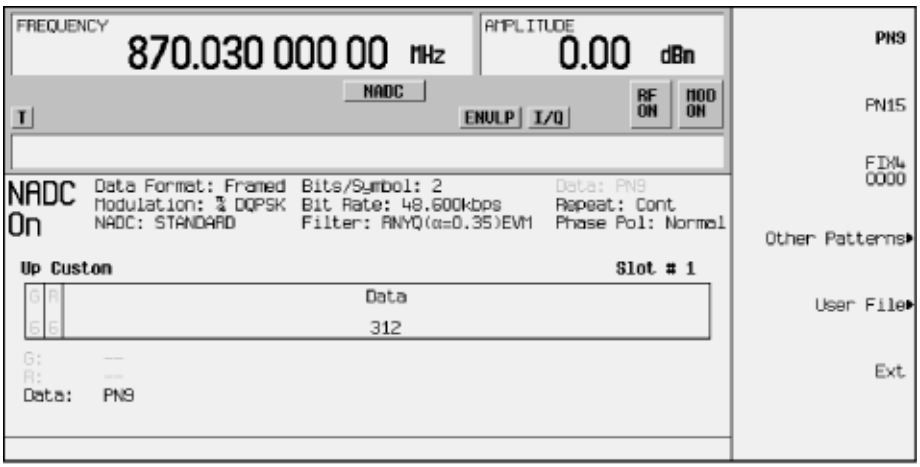
Configure Timeslot

Pressing this softkey reveals a menu of choices for configuring the timeslots. In this menu, set the timeslots to either full-rate or half-rate. Select which timeslots to turn on and choose from up or down traffic channels and uplink or downlink custom bursts. Then use the subsequent menus to configure the timeslots. This softkey is inactive until you set **Data Format Pattern Framed** to **Framed**.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**

Configure Up Custom

Pressing this softkey reveals a menu of softkeys for selecting the data pattern for an uplink custom timeslot. The following figure shows an example of the display graphics for a custom timeslot.



pk799a

In this example:

- **G: --** - Guard time is a 6-bit field. The text in this field is grey, indicating that you cannot change the contents of the guard time field.
- **R: --** - Ramp time is a 6-bit field. The text in this field is grey, indicating that you cannot change the contents of the ramp time field.
- **Data: PN9** - Indicates that the data selection for this custom timeslot is PN9. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.

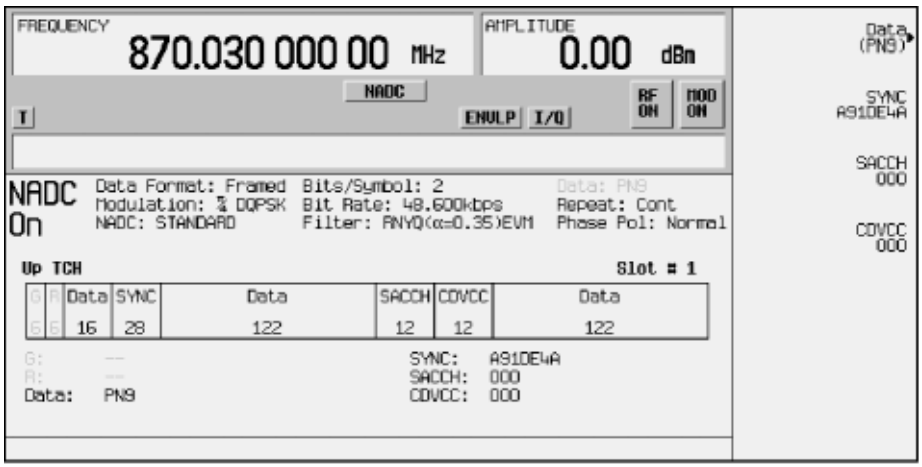
Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Up Custom**, **Configure Up Custom**

SCPI Commands:

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UCUStom?

Configure Up TCH

Pressing this softkey reveals a menu of softkeys for configuring a timeslot as an uplink traffic channel. The following figure shows an example of display graphics for an uplink traffic channel timeslot. The visual representation of the timeslot shows each field of the timeslot as it is defined by the NADC standard.



pk7100a

In this example:

- **G: --** - Guard time is a 6-bit field. The text in this field is grey, indicating that you cannot change the contents of the guard time field.
- **R: --** - Ramp time is a 6-bit field. The text in this field is grey, indicating that you cannot change the contents of the ramp time field.
- **Data: PN9** - Indicates that the data selection for this up traffic channel is PN9. Press the **Data** softkey in the Configure Up TCH menu to change the data selection. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.
- **SYNC: A91DE4A** - Indicates that the synchronization word is set to hexadecimal A91DE4A. Press the **SYNC** softkey in the Configure Up TCH menu to change the contents of the synchronization word field.
- **SACCH: 000** - Indicates that the slow associated control channel is set to hexadecimal 000. Press the **SACCH** softkey in the Configure Up TCH menu to change the contents of the slow associated control channel field.
- **CDVCC: 000** - Indicates that the coded digital verification color code is set to hexadecimal 000. Press the **CDVCC** softkey in the Configure Up TCH menu to change the contents of the coded digital verification color code field.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**

Data

Pressing this softkey reveals a menu of choices for internal data generation (PN9, PN15, fixed 4-bit repeating sequences, set patterns of ones and zeroes) or you can choose to supply your own data (download a binary file or input data using the DATA INPUT connector). This softkey is available in the NADC menu to select a data pattern for modulated transmissions that are not framed. With **NADC Off On** set to **On** and **Data Format Pattern Framed** set to **Pattern**, the signal generator then outputs either a single occurrence (**Pattern Repeat Single**) or a continuous stream (**Pattern Repeat Cont**) of your choice of data. This softkey is also available for timeslot configuration. Choose from the same menu of selections for configuring the timeslot data fields.

Softkey Location: Press **Mode**, **NADC**, **Data**
or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **Data**

Data is also located in the Configure Down TCH menu.

Status after Normal Preset: PN9

SCPI Commands:

[:SOURce]:RADio[:NADC]:DATA?

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DCUStom?

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DTCHannel[:DATA]?

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UCUStom?

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UTCHannel[:DATA]?

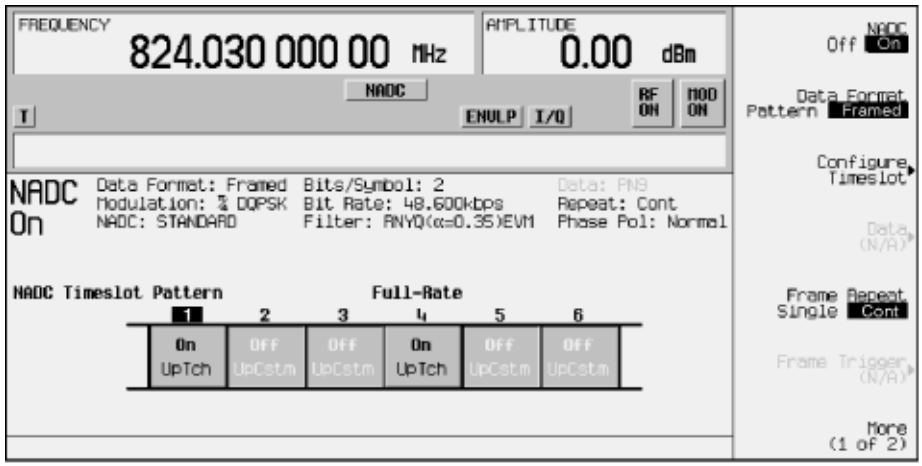
Data Format Pattern Framed

Press this softkey to toggle between **Data Format Pattern** and **Data Format Framed** modes. When you select **Framed** you will be transmitting your framed data pattern in an NADC format.

When you select **Data Format Pattern**, you will be transmitting a continuous stream of your selected data pattern. Select the data pattern using the **Data** softkey. The **Data** softkey is activated when you select **Data Format Pattern** and inactivated when you select **Data Format Framed**.

The **Data Format Pattern Framed** softkey is coupled to the **Burst Envelope Off On** softkey in the I/Q menu. At any time that NADC is enabled (**NADC Off On** is set to **On**) and **Data Format Framed** is selected, the **ENVLP** annunciator is turned on in the

display (indicating that **Burst Envelope On** is also selected). The following figure shows the display graphics that appear when the NADC menu is accessed, **Data Format Pattern Framed** is set to **Framed**, and you are not configuring a timeslot:



pk796a

In this example:

- **`NADC On`** - Indicates that NADC is enabled. This field changes to **`NADC Off`** when **NADC Off On** is set to **Off**.
- **`Data Format: Framed`** - Indicates that the data pattern is a framed transmission. This field changes to **`Data Format: Pattern`** when **Data Format Pattern Framed** is set to **Pattern** indicating that you are transmitting a continuous stream of your selected data pattern.
- **`Modulation: π/4DQPSK`** - Indicates that π/4DQPSK modulation is being internally generated.
- **`NADC: STANDARD`** - Indicates that the structure of the NADC transmission follows the standard as defined by the NADC protocol. This field changes to **`NADC: MODIFIED`** under the following circumstances:
  - filter is NYQ
  - filter alpha is changed
  - bit rate is changed
  - burst shape is changed
  - phase polarity is set to invert
- **`Bits/Symbol: 2`** - Indicates that 2 bits per symbol are required according to the

NADC standard.

- **`Bit Rate: 48.600kbps`** - The bit rate is set according to the NADC standard. This can be changed in the Bit Rate menu. A * next to the value indicates that it differs from the standard.
- **`Filter: RNYQ(α=0.35)EVM`** - Indicates that root Nyquist filter (root raised cosine) is selected, with an alpha of 0.35, and the filter is set for optimizing error vector magnitude. A * next to the alpha value indicates that it differs from the standard. If you select optimization for adjacent channel power, **`EVM`** toggles to **`ACP`**. This field changes to **`Filter: NYQ(α=0.35)`** if you select the Nyquist filter (raised cosine).
- **`Data: PN9`** - Indicates that a PN9 sequence has been selected for transmitting without framing. In this example, the text in this field is grey, indicating an inactive function (bursting is on for framed transmissions). Other selections for the data field include **`PN15`**, **`FIX4`**, **`UserFile`**, and **`Ext`** depending on your softkey setting.
- **`Repeat: Cont`** - Indicates that the data pattern repeat is set to continuous mode. If you select single mode, this field changes to **`Repeat: Single`**.
- **`Phase Pol: Normal`** - Indicates the direction of rotation of the phase modulation vector. If you select inverted mode, this field changes to **`Phase Pol: Invert`**.
- The visual representation of the NADC timeslot pattern shows, in this case, that timeslots 1 and 4 are on and configured as up traffic channels. Timeslots 2, 3, 5, and 6 are off and configured as uplink custom timeslots. The timeslot pattern is displayed only when **Data Format Pattern Framed** is set to **Framed**.
- NADC is set to **`Full-Rate`**. This field changes to **`Half-Rate`** when the **Rate Full Half** softkey is set to **Half**.

When you are in framed mode, you will be bursting the timeslots that you have turned on and there will be no RF carrier during the off timeslots. This is true for all uplink traffic channels and for uplink custom timeslots. However, if you have turned on any timeslot that you have configured as a down traffic channel, the RF signal is not turned off between timeslots and the off timeslots are transmitted as a continuous series of ones for the time period of the off timeslots. To configure the timeslots, press the **Configure Timeslot** softkey. The **Configure Timeslot** softkey is activated when you select **Data Format Framed** and is inactivated when you select **Data Format Pattern**.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**

Status after Normal Preset: Pattern

SCPI Commands:

[:SOURce]:RADio[:NADC]:BURSt[:STATe] ON|OFF|1|0

[:SOURce]:RADio[:NADC]:BURSt[:STATe]?

Down Custom

Press this softkey to select a downlink custom timeslot type for the active timeslot. A downlink custom timeslot is configured using an internally-generated data pattern, a downloaded sequence of bits stored in a user file, or by supplying external data. Downlink timeslots cannot be mixed with uplink timeslots. If you already have any timeslots designated as uplink, they will be changed to downlink when any other timeslot is designated as downlink. The downlink custom timeslot is provided for users' flexibility but it is not, however, a standard NADC timeslot type.

When you have selected **Down Custom** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your configuration.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Down Custom**

SCPI Commands:

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6[:TYPE] DCUStom

Down TCH

Press this softkey to select downlink traffic channel (base station to mobile) as the timeslot type for the active timeslot. Downlink timeslots cannot be mixed with uplink timeslots. If you already have any timeslots designated as uplink, they will be changed to downlink when any other timeslot is designated as downlink. When you select **Down TCH**, the frame pattern is output with continuous RF power. Power is on during off timeslots (according to the NADC standard) and a continuous pattern of binary ones is sent during off timeslots.

When you select **Down TCH** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Down TCH**

SCPI Commands:

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6[:TYPE] DTCH

Down TCH All

Press this softkey to select downlink traffic channel (base station to mobile) as the timeslot type for all timeslots. When you select **Down TCH All**, the frame pattern is output with continuous RF power. Power is on during off timeslots (according to the NADC standard) and a continuous pattern of binary ones is sent during off timeslots. When all of the timeslots are off, RF power is off.

When you select **Down TCH All**, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Down TCH All**

SCPI Commands:

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6[:TYPE] DTCH_ALL

Ext

Press this softkey in the data selection menus to select external data. With **Ext** selected, you should apply the data signal to the DATA INPUT connector. If you have selected **Ext** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **`Ext`** is displayed in the **`Data`** field in the top line of the text area of the display. If you have selected **Ext** for configuring the timeslot data fields, **EXT** is displayed in the **`Data`** field near the bottom of the text area of the display. In framed mode, the external data is gated to the data regions of the timeslot.

Another **Ext** softkey is located in the Frame Trigger and Pattern Trigger menus. Press **Ext** in either of these two menus to select external triggering for your data pattern. Apply a TTL input to the rear panel PATTERN TRIG IN connector to trigger your frame or pattern data.

Softkey Location: Press **Mode**, **NADC**, **Data**, **Ext**
or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **Data**, **Ext**
or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Down TCH**, **Configure Down TCH**, **Data**, **Ext**
or press **Mode**, **NADC**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Ext**
or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Ext**

SCPI Commands:

[:SOURce]:RADio[:NADC]:DATA EXTernal

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DCUStom EXTernal

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DTCHannel[:DATA] EXTernal

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UCUStom EXTernal

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UTCHannel[:DATA] EXTernal

[:SOURce]:RADio[:NADC]:TRIGger[:SOURce] EXTernal

Ext Data Clock Normal Symbol

Press this softkey to toggle the external data clock use between **Normal** and **Symbol**. When you select **Normal**, you must supply a signal (either a clock or a pulse) to the DATA CLOCK INPUT connector to clock the DATA and SYMBOL SYNC signals. (An unlock will occur if external data is selected and these signals are not supplied.) When you select **Symbol**, no signal is required at the DATA CLOCK INPUT connector. Instead, the data is clocked on both the rising and falling edges of the SYMBOL SYNC signal.

Softkey Location: Press **Mode**, **NADC**, **More (1 of 2)**, **Configure Hardware**, **Ext Data Clock Normal Symbol**

Status after Normal preset: Normal

SCPI Commands:

[:SOURce]:RADio[:NADC]:EDCLock SYMBol|NORMal

[:SOURce]:RADio[:NADC]:EDCLock?

Ext Delay Bits

Press this softkey to specify the number of bits for the external trigger delay. When **Ext Delay Off On** is set to **On**, a value greater than 0 will delay the transmission of the triggered data after the external trigger event by the number of bits specified. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. The range of values allowed is 0 through 65,535 bits. This softkey is inactive until the trigger selection is set to **Ext**.

Softkey Location: Press **Mode**, **NADC**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Ext**, **Ext Delay Bits**
or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Ext**, **Ext Delay Bits**

Status after Normal Preset: 0

SCPI Commands:

[:SOURce]:RADio[:NADC]:TRIGger[:SOURce]:EXTernal:DELay <value>

[:SOURce]:RADio[:NADC]:TRIGger[:SOURce]:EXTernal:DELay?

Ext Delay Off On

Press this softkey to toggle the external trigger delay on and off. When this function is turned on, the transmission of the triggered data will be delayed after the external trigger event by the number of bits specified by the **Ext Delay Bits** softkey. This function is only available when the trigger selection is set to **Ext**.

Softkey Location: Press **Mode**, **NADC**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Ext**, **Ext Delay Off On**
or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Ext**, **Ext Delay Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:RADio[:NADC]:TRIGger[:SOURce]:EXTernal:DELay:STATe ON|OFF|1|0

[:SOURce]:RADio[:NADC]:TRIGger[:SOURce]:EXTernal:DELay:STATe?

Fall Delay

Press this softkey to change the shape of the bursted RF signal by entering a falling edge delay. To change the fall delay, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0 through 63.50 bits.

Softkey Location: Press **Mode**, **NADC**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Fall Delay**

Status after Normal Preset: 9.00 bits

SCPI Commands:

[:SOURce]:RADio[:NADC]:BURSt:SHAPe:FALL:DELay <value>

[:SOURce]:RADio[:NADC]:BURSt:SHAPe:FALL:DELay?

[:SOURce]:RADio[:NADC]:BURSt:SHAPe:FDELay <value>

[:SOURce]:RADio[:NADC]:BURSt:SHAPe:FDELay?

Fall Time

Press this softkey to change the shape of the bursted RF signal by entering a falling edge time. To change the fall time, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0.05 through 30 bits.

Softkey Location: Press **Mode**, **NADC**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Fall Time**

Status after Normal Preset: 5.47 bits

SCPI Commands:

[:SOURce]:RADio[:NADC]:BURSt:SHAPe:FALL:TIME <value>

[:SOURce]:RADio[:NADC]:BURSt:SHAPe:FALL:TIME?

[:SOURce]:RADio[:NADC]:BURSt:SHAPe:FTIMe <value>

[:SOURce]:RADio[:NADC]:BURSt:SHAPe:FTIMe?

Filter

Pressing this softkey reveals a menu of choices for changing the filter selection between root Nyquist (root raised cosine) and Nyquist (raised cosine), for changing the default filter alpha, and for restoring the default filter alpha.

Softkey Location: Press **Mode**, **NADC**, **(More 1 of 2)**, **Modify Standard**, **Filter**

Filter Alpha

Press this softkey to change the filter alpha parameter. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. The range of values allowed is 0.30 through 0.60.

Softkey Location: Press **Mode**, **NADC**, **(More 1 of 2)**, **Modify Standard**, **Filter**, **Filter Alpha**

Status after Normal Preset: 0.35

SCPI Commands:

[:SOURce]:RADio[:NADC]:ALPHa <value>

[:SOURce]:RADio[:NADC]:ALPHa?

Filter RNYQ NYQ

Press this softkey to toggle the filter selection between root Nyquist (root raised cosine) and Nyquist (raised cosine). Notice that your filter selection is shown on the display in the **Filter** field.

Softkey Location: Press **Mode**, **NADC**, **More (1 of 2)**, **Modify Standard**, **Filter**, **Filter RNYQ NYQ**

Status after Normal Preset: RNYQ

SCPI Commands:

[:SOURce]:RADio[:NADC]:FILTer RNYQuist|NYQuist

[:SOURce]:RADio[:NADC]:FILTer?

FIX4

Press this softkey to select a 4-bit repeating sequence data pattern. Press **FIX4** and the 4-bit pattern becomes the active function. Enter your desired 4-bit pattern using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. If you have selected **FIX4** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **FIX4** is displayed in the **Data** field in the top line of the text area of the display. If you have selected **FIX4** for configuring the timeslot data fields, your 4-bit pattern is displayed in the **Data** field near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **NADC**, **Data**, **FIX4**
or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **Data**, **FIX4**

FIX4 is also located in the Configure Down Custom and Configure Up Custom menus and also in the Data menu found in the Configure Down TCH menu.

Status after Normal Preset: 0000

SCPI Commands:

[:SOURce]:RADio[:NADC]:DATA FIX4

[:SOURce]:RADio[:NADC]:DATA:FIX4 <0-15>

[:SOURce]:RADio[:NADC]:DATA:FIX4?

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DCUStom FIX4

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DCUStom:FIX4 <0-15>

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DCUStom:FIX4?

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DTCHannel[:DATA] FIX4

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DTCHannel[:DATA]:FIX4 <0-15>

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DTCHannel[:DATA]:FIX4?

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UCUStom FIX4

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UCUStom:FIX4 <0-15>

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UCUStom:FIX4?

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UTCHannel[:DATA] FIX4

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UTCHannel[:DATA]:FIX4 <0-15>

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UTCHannel[:DATA]:FIX4?

Frame Repeat Single Cont

Press this softkey to toggle between a single output of framed data and continuous transmission of frames. Selecting **Single** will output the following sequences:

- 4-Bit Patterns (FIX4) - A single frame is generated. The 4-bit pattern repeats until the data fields are completely filled. Each trigger transmits the same frame.
- Other Patterns (fixed patterns of equal quantities of ones and zeroes) - A single frame is generated. The selected pattern repeats until the data fields are completely filled. Each trigger transmits the same frame.
- PN9 - A single frame is generated. The data fields are filled with the leading bits of the PN9 sequence. A trigger causes the frame to be transmitted. The data fields of this frame are then filled sequentially with the next series of PN9 data bits. A trigger causes the frame to be transmitted. This process continues, transmitting the entire PN9 sequence frame by frame. The last bit of the PN9 sequence in a data field is immediately followed by the first bit of a second PN9 sequence.
- PN15 - A single frame is generated. The data fields are filled with the leading bits of the PN15 sequence. A trigger causes the frame to be transmitted. The data fields of this frame are then filled sequentially with the next series of PN15 data bits. A trigger causes the frame to be transmitted. This process continues, transmitting the entire PN15 sequence frame by frame. The last bit of the PN15 sequence in a data field is immediately followed by the first bit of a second PN15 sequence.
- User File - The user’s file should have the appropriate data to fill an integer number of timeslots. If not, the remaining bits are truncated. Depending on the size of the file, more than one frame can possibly be generated.
- External Data - External data is clocked into the data fields of the timeslot. A single frame is generated.

Combinations of these data patterns may cause some patterns to be truncated. Refer to Chapter 7, “Operation” for the details of the data dependencies.

Selecting **Cont** with framed data causes the frames to be transmitted continuously.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**

Status after Normal Preset: Continuous

SCPI Commands:

[:SOURce]:RADio[:NADC]:REPeat SINGle|CONTinuous

[:SOURce]:RADio[:NADC]:REPeat?

Frame Trigger

Pressing this softkey reveals a menu of choices for triggering your framed pattern. You can choose to trigger using the front panel **Trigger** key, an external trigger supplied to the PATTERN TRIG IN connector, or by a *TRG command or GET (group execute trigger) signal sent over HP-IB. This softkey is inactive until **Data Format Pattern Framed** is set to **Framed** and **Frame Repeat Single Cont** is set to **Single**.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**

Status after Normal Preset: Trigger Key

SCPI Commands:

[:SOURce]:RADio[:NADC]:TRIGger[:SOURce]?

Goto Bottom Row

Press this softkey to move the selection bar to the bottom row of file names in the Goto Row menu that is accessed from the User File menu.

Softkey Location: Press **Mode**, **NADC**, **Data**, **User File**, **Goto Row**, **Goto Bottom Row** or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **Data**, **User File**, **Goto Row**, **Goto Bottom Row**

Goto Middle Row

Press this softkey to move the selection bar to the middle row of file names in the Goto Row menu that is accessed from the User File menu.

Softkey Location: Press **Mode**, **NADC**, **Data**, **User File**, **Goto Row**, **Goto Middle Row** or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **Data**, **User File**, **Goto Row**, **Goto Middle Row**

Goto Row

Pressing this softkey reveals a menu of softkeys that help you move the selection bar through the rows of file names in the User File menu. You can also go to a specific row by rotating the front panel knob, using the up and down arrow keys, or entering the row number with the numeric keypad. Once the desired row number is displayed, press the **Enter** terminator softkey.

Softkey Location: Press **Mode**, **NADC**, **Data**, **User File**, **Goto Row** or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **Data**, **User File**, **Goto Row**

Goto Top Row

Press this softkey to move the selection bar to the top row of file names in the Goto Row menu that is accessed from the User File menu.

Softkey Location: Press **Mode**, **NADC**, **Data**, **User File**, **Goto Row**, **Goto Top Row** or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **Data**, **User File**, **Goto Row**, **Goto Top Row**

Modify Standard

Pressing this softkey reveals a menu of choices for modifying the standard transmission in the following ways:

- changing the filter from root Nyquist to Nyquist
- changing the filter alpha
- changing the transmission bit rate
- changing the burst rising edge time and delay
- changing the burst falling edge time and delay
- inverting the phase polarity

Softkey Location: Press **Mode**, **NADC**, **(More 1 of 2)**, **Modify Standard**

NADC Off On

Press this softkey to enable the NADC communications standard. Setting **NADC Off On** to **On** sets up the internal hardware to generate a signal that follows the NADC standard. The internal I/Q modulator generates π/4DQPSK digital modulation and the **NADC** and **I/Q** annunciators are turned on in the display. Although the digital modulation is enabled with this softkey, the RF carrier is modulated by the enabled modulation only when you have also set **Mod On/Off** to **On**.

Setting **NADC Off On** to **On** presets the following softkeys in the I/Q menu: **I/Q Off On** is set to **On** and **I/Q Source** is set to **Int I/Q**. You can override these selections in the I/Q menu.

Softkey Location: Press **Mode**, **NADC**, **NADC Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:RADio[:NADC][:STATe] ON|OFF|1|0

[:SOURce]:RADio[:NADC][:STATe]?

Optimize RNYQ For EVM ACP

Press this softkey to optimize the root Nyquist filter for minimized error vector magnitude (select **EVM**) or for minimized adjacent channel power (select **ACP**). The EVM selection provides the most ideal passband. The ACP selection improves stopband rejection.

Softkey Location: Press **Mode**, **NADC**, **(More 1 of 2)**, **Configure Hardware**, **Optimize RNYQ For EVM ACP**

Status after Normal Preset: EVM

SCPI Commands:

[:SOURce]:RADio[:NADC]:CHANnel EVM|ACP

[:SOURce]:RADio[:NADC]:CHANnel?

Other Patterns

Pressing this softkey reveals a menu of data pattern selections. Each of the selections in this menu is a pattern of equal quantities of ones and zeroes (such as four ones and four zeroes).

Softkey Location: Press **Mode**, **NADC**, **Data**, **Other Patterns**
or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **Data**, **Other Patterns**

Other Patterns is also located in the Down Custom and Up Custom menus and also in the Data menu found in the Configure Down TCH menu.

Page Down

Press this softkey to move down one page at a time in the displayed catalog of files.

Softkey Location: Press **Mode**, **NADC**, **Data**, **User File**, **Page Down**
or press **Mode**, **NADC**, **Data**, **User File**, **Goto Row**, **Page Down**
or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **Data**, **User File**, **Page Down**
or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **Data**, **User File**, **Goto Row**, **Page Down**

Page Down is also located in the User File menus found in the Configure Down Custom, Configure Up Custom. and Configure Down TCH menus.

Page Up

Press this softkey to move up one page at a time in the displayed catalog of files.

Softkey Location: Press **Mode**, **NADC**, **Data**, **User File**, **Page Up**
or press **Mode**, **NADC**, **Data**, **User File**, **Goto Row**, **Page Up**
or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **Data**, **User File**, **Page Up**
or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **Data**, **User File**, **Goto Row**, **Page Up**

Page Up is also located in the User File menus found in the Configure Down Custom, Configure Up Custom. and Configure Down TCH menus.

Pattern Repeat Single Cont

Set this softkey to **Single** to output one occurrence of a modulated data pattern that is not framed. Select the trigger event for the output using the **Pattern Trigger** softkey. Toggle to **Cont** to output a continuous stream of your data pattern.

Softkey Location: Press **Mode**, **NADC**, **Pattern Repeat Single Cont**

Status after Normal Preset: Continuous

SCPI Commands:

[:SOURce]:RADio[:NADC]:REPeat SINGle|CONTinuous

[:SOURce]:RADio[:NADC]:REPeat?

Pattern Trigger

Pressing this softkey reveals a menu of choices for triggering a modulated data pattern that is not framed. You can choose to trigger using the front panel **Trigger** key, an external trigger supplied to the PATTERN TRIG IN connector, or by a *TRG command or GET (group execute trigger) signal sent over HP-IB. This softkey is inactive until **Pattern Repeat Single Cont** is set to **Single**.

Softkey Location: Press **Mode**, **NADC**, **Pattern Repeat Single Cont**, **Pattern Trigger**

Status after Normal Preset: Trigger Key

SCPI Commands:

[:SOURce]:RADio[:NADC]:TRIGger[:SOURce]?

Phase Polarity Normal Invert

Press this softkey to reverse the direction of rotation of the phase modulation vector. Choose **Invert** and the in-phase component will lag the quadrature-phase component by 90° in the resulting modulation. The inverted selection also applies to the I OUT and Q OUT signals.

Softkey Location: Press **Mode**, **NADC**, **More (1 of 2)**, **Modify Standard**, **Phase Polarity Normal Invert**

Status after Normal Preset: Normal

SCPI Commands:

[:SOURce]:RADio[:NADC]:POLarity[:ALL] NORMal|INVerted

[:SOURce]:RADio[:NADC]:POLarity[:ALL]?

PN9

Press this softkey to select the PN9 pseudorandom bit pattern. If you have selected **PN9** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **PN9** is displayed in the **Data** field in the top line of the text area of the display. If you have selected **PN9** for configuring the framed timeslot data fields, **PN9** is displayed in the **Data** field located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **NADC**, **Data**, **PN9**
or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **Data**, **PN9**

PN9 is also located in the Down Custom and Up Custom menus and also in the Data menu found in the Configure Down TCH menu.

SCPI Commands:

[:SOURce]:RADio[:NADC]:DATA PN9

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DCUStom PN9

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DTCHannel[:DATA] PN9

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UCUStom PN9

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UTCHannel[:DATA] PN9

PN9 Mode Normal Quick
Option 1EH Only

Press this softkey to toggle between normal and quick PN9 modes. A single output of a framed normal PN9 data pattern consists of enough frames so that the end of the PN9 sequence corresponds with the end of a frame. A single output of a framed quick PN9 data pattern consists of one entire PN9 sequence plus enough of a second PN9 sequence to fill the remaining data fields in the current frame. The second PN9 sequence is, therefore, truncated.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **PN9 Mode Normal Quick**

Status after Normal Preset: Normal

SCPI Commands:

[:SOURce]:RADio[:NADC]:BURSt:PN9 NORMal|QUICk

[:SOURce]:RADio[:NADC]:BURSt:PN9?

PN15

Press this softkey to select the PN15 pseudorandom bit pattern. If you have selected **PN15** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **PN15** is displayed in the **Data** field in the top line of the text area of the display. If you have selected **PN15** for configuring the framed timeslot data fields, **PN15** is displayed in the **Data** field located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **NADC**, **Data**, **PN15**
or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **Data**, **PN15**

PN15 is also located in the Down Custom and Up Custom menus and also in the Data menu found in the Configure Down TCH menu.

SCPI Commands:

[:SOURce]:RADio[:NADC]:DATA PN15

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DCUStom PN15

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DTCHannel[:DATA] PN15

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UCUStom PN15

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UTCHannel[:DATA] PN15

Rate Full Half

Press this softkey to toggle between NADC full- or half-rate. When you select full-rate, timeslots 1, 2, and 3 are paired with timeslots 4, 5, and 6, respectively. Select half-rate for 6 individual timeslots. Notice that your selection, either full-rate or half-rate, is shown on the display directly above the timeslot pattern visual representation.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Rate Full Half**

Status after Normal Preset: Full-rate

SCPI Commands:

[:SOURce]:RADio[:NADC]:FRATe FULL|HALF

[:SOURce]:RADio[:NADC]:FRATe?

Restore Default Bit Rate

Press this softkey to reset the transmission bit rate to the default value (48.600 kbps). This softkey is a convenience feature for quickly resetting the bit rate. You can also change the bit rate by pressing the **Bit Rate** softkey.

Softkey Location: Press **Mode**, **NADC**, **(More 1 of 2)**, **Modify Standard**, **Bit Rate**, **Restore Default Bit Rate**

Restore Default Burst Shape

Press this softkey to reset the burst shape characteristics to their default values (rise time = 5.86 bits, rise delay = 9.00 bits, fall time = 5.47 bits, fall delay = 9.00 bits). This softkey is a convenience feature for quickly resetting the burst shape. You can also change each of the burst characteristics individually by using the **Rise Time**, **Rise Delay**, **Fall Time**, and **Fall Delay** softkeys in this menu.

Softkey Location: Press **Mode**, **NADC**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Restore Default Burst Shape**

Restore Default Filter Alpha

Press this softkey to reset the filter alpha parameter to its default value (0.35). This softkey is a convenience feature for quickly resetting the filter alpha. You can also change the bit rate by pressing the **Filter Alpha** softkey.

Softkey Location: Press **Mode**, **NADC**, **(More 1 of 2)**, **Modify Standard**, **Filter**, **Restore Default Filter Alpha**

Rise Delay

Press this softkey to change the shape of the bursted RF signal by entering a rising edge delay. To change the rise delay, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0 through 63.50 bits.

Softkey Location: Press **Mode**, **NADC**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Rise Delay**

Status after Normal Preset: 9.00 bits

SCPI Commands:

[:SOURce]:RADio[:NADC]:BURSt:SHAPe:RISE:DELay <value>

[:SOURce]:RADio[:NADC]:BURSt:SHAPe:RISE:DELay?

[:SOURce]:RADio[:NADC]:BURSt:SHAPe:RDELay <value>

[:SOURce]:RADio[:NADC]:BURSt:SHAPe:RDELay?

Rise Time

Press this softkey to change the shape of the bursted RF signal by entering a rising edge time. To change the rise time, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0.05 through 30 bits.

Softkey Location: Press **Mode**, **NADC**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Rise Time**

Status after Normal Preset: 5.86 bits

SCPI Commands:

[:SOURce]:RADio[:NADC]:BURSt:SHAPe:RISE:TIME <value>

[:SOURce]:RADio[:NADC]:BURSt:SHAPe:RISE:TIME?

[:SOURce]:RADio[:NADC]:BURSt:SHAPe:RTIMe <value>

[:SOURce]:RADio[:NADC]:BURSt:SHAPe:RTIMe?

SACCH

Press this softkey to change the 12-bit slow associated control channel (SACCH). The preset hexadecimal value (when normal preset is selected) for SACCH reflects the NADC standard, however you can enter a new value by pressing this softkey. To enter a value (in hexadecimal), press **SACCH**. The SACCH value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The current value for SACCH is displayed in the **SACCH** field near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **SACCH**

SACCH is also located in the Configure Down TCH menu.

Status after Normal Preset: 000

SCPI Commands:

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DTCHannel:SACChanel <bit_pattern>

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DTCHannel:SACChanel?

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UTCHannel:SACChanel <bit_pattern>

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UTCHannel:SACChanel?

Select File

Press this softkey to select a file in the displayed catalog of binary files. To make your selection, first scroll through the list, using the front panel knob or up and down arrow keys, until the desired file is highlighted. Press **Select File** and the highlighted file is specified as your data selection. If you have selected a custom file as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **`UserFile`** is displayed in the **`Data`** field in the top line of the text area of the display. If you have selected a custom file for configuring timeslot data fields, the file name you selected is displayed in the **`Data`** field near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **NADC**, **Data**, **User File**, **Select File** or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **Data**, **User File**, **Select File**

Select File is also located in the User File menus found in the Configure Down TCH, Configure Down Custom, and Configure Up Custom menus.

SCPI Commands:

[:SOURce]:RADio[:NADC]:DATA “file name”

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DCUStom “file name”

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DTCHannel[:DATA] “file name”

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UCUStom “file name”

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UTCHannel[:DATA] “file name”

SYNC

Press this softkey to change the 28-bit synchronization word. The preset hexadecimal value (when normal preset is selected) for **SYNC** reflects the NADC standard, however you can enter a new value by pressing this softkey. To enter a value (in hexadecimal), press **SYNC**. The synchronization word value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The current value for SYNC is displayed in the **SYNC** field near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **SYNC**

SYNC is also located in the Configure Down TCH menu.

Status after Normal Preset: A91DE4A

SCPI Commands:

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DTCHannel:SWORd <bit_pattern>

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:DTCHannel:SWORd?

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UTCHannel:SWORd <bit_pattern>

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:UTCHannel:SWORd?

Sync Out

Press this softkey to reveal a menu of choices for outputting a 1-bit synchronization signal to the EVENT 1 rear panel connector. In this menu you can choose to set the synchronization signal to occur at the beginning of a data pattern, at the beginning of a frame, at the beginning of a selected timeslot, or at the beginning of each timeslot in a frame.

Softkey Location: Press **Mode**, **NADC**, **More (1 of 2)**, **Sync Out**

Status after Normal Preset: Begin Pattern

SCPI Commands:

[:SOURce]:RADio[:NADC]:SOUT?

Sync Out Offset

Press this softkey to move the synchronization signal forward or back from the beginning of the data pattern, frame, or timeslot. To set the number of bits of offset, press **Sync Out Offset** and synchronization offset becomes the active function. Enter the desired value using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. The range of values allowed is –323 through +323 bits.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **Sync Out Offset**

Status after Normal Preset: 0 bits

SCPI Commands:

[:SOURce]:RADio[:NADC]:SOUT:OFFSet <value>

[:SOURce]:RADio[:NADC]:SOUT:OFFSet?

Timeslot

Press this softkey to select a timeslot to be configured. Choose any of the timeslots. Select from six timeslots if you are using half-rate, and three timeslots if you are using full-rate. Enter the timeslot number using the front panel knob, the up and down arrow keys, or enter the number using the numeric keypad and press the **Enter** terminator softkey.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot #**

Status after Normal Preset: 0

Timeslot Off On

Press this softkey to toggle the active timeslot on and off. For example, to turn on timeslot 2, select the timeslot by pressing the **Timeslot #** softkey in this same menu. Enter the number 2 to make timeslot 2 active. Then turn this timeslot on by toggling **Timeslot Off On** to **On**. Notice that the visual representation of the timeslot pattern now shows timeslot 2 turned on and, if you are in full-rate NADC, timeslot 5 will also be turned on.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Off On**

Status after Normal Preset: On (for timeslot 1)

SCPI Commands:

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:STATe ON|OFF|1|0

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6:STATe?

Timeslot Type

Pressing this softkey reveals a menu of choices for setting the timeslot type for the active timeslot. You can choose between uplink and downlink traffic channels (TCH), and uplink and downlink custom timeslots. You cannot, however, mix uplink and downlink timeslots in the same frame. When you have selected the type for the timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**

Status after Normal Preset: Up TCH (for timeslot 1)

SCPI Commands:

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6[:TYPE]?

Trigger Key

Press this softkey to select the front panel **Trigger** key as the pattern trigger for a single output of a modulated data transmission that is not framed (**Data Format Pattern Framed** is set to **Pattern**) or select the **Trigger** key as the frame trigger for a single output of your framed data. Once selected, you can trigger a single event at any time by pressing the **Trigger** key.

Softkey Location: Press **Mode**, **NADC**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Trigger Key**
or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Trigger Key**

SCPI Commands:

[:SOURce]:RADio[:NADC]:TRIGger[:SOURce] KEY

Up Custom

Press this softkey to select an uplink custom timeslot type for the active timeslot. A custom timeslot is configured using an internally-generated data pattern, a downloaded sequence of bits stored in a user file, or by supplying external data. Uplink timeslots cannot be mixed with downlink timeslots. If you already have any timeslots designated as downlink, they will be changed to uplink when any other timeslot is designated as uplink. The custom timeslot is provided for users' flexibility but it is not, however, a standard NADC timeslot type.

When you have selected **Up Custom** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your configuration.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Up Custom**

SCPI Commands:

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6[:TYPE] UCUStom

Up TCH

Press this softkey to select uplink traffic channel (mobile to base station) as the timeslot type for the active timeslot. Uplink timeslots cannot be mixed with downlink timeslots. If you already have any timeslots designated as downlink, they will be changed to uplink when any other timeslot is designated as uplink.

When you select **Up TCH** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Up TCH**

SCPI Commands:

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6[:TYPE] UTCH

Up TCH All

Press this softkey to select uplink traffic channel (mobile to base station) as the timeslot type for all timeslots. When you select **Up TCH**, the frame pattern is bursted with RF power turning off during off timeslots.

When you select **Up TCH All**, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Up TCH All**

SCPI Commands:

[:SOURce]:RADio[:NADC]:SLOT[1]|2|3|4|5|6[:TYPE] UTCH_ALL

User File

Press this softkey to display the catalog of binary files stored in the signal generator's memory. You can select a custom file from this catalog for your data pattern. Scroll through the listed files and when your selection is highlighted, press the **Select File** softkey. If you have selected **User File** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **`UserFile`** is displayed in the **`Data`** field in the top line of the text area of the display. If you have selected **User File** for configuring timeslot data fields, the file name you selected is displayed in the **`Data`** near the bottom of the text area of the display.

User's files should exactly fill the data fields in a framed transmission. (Create the files to fill an integer number of frames.) If the end of the user's file does not coincide with the end of a frame, data will be truncated in one of the following ways:

- Enough frames will be generated to transmit as much of the data pattern as will fit into complete frames. The remaining bits of the data pattern (which are too few to completely fill a frame) are truncated.
- If two files of unequal sizes are selected for the same framed transmission, enough frames will be generated to transmit as much of the data pattern of the largest file as will fit into complete frames. The remaining bits of the data pattern are truncated. The smaller file will be repeated as many times as necessary to completely fill these frames. Data will be truncated for the smaller file to coincide with the end of the last frame.
- If a user's file and a PN9 or PN15 file are selected for the same framed transmission and the user's file is shorter than the PN9/15, enough frames will be generated to transmit the PN9/15. The end of the PN9/15 data will coincide with the end of the last frame. The smaller user's file will be repeated as many times as necessary to completely fill these frames. Data will be truncated for the smaller file to coincide with the end of the last frame.
- If a user's file and a PN9 file are selected for the same framed transmission and the user's file is longer than the PN9, enough frames will be generated to transmit as much of the data pattern as will fit into complete frames. The remaining bits of the data pattern (which are too few to completely fill a frame) are truncated. The PN9 data will be repeated as many times as necessary to completely fill these frames.

Softkey Location: Press **Mode**, **NADC**, **Data**, **User File**
or press **Mode**, **NADC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **Data**, **User File**

User File is also located in the Configure Down Custom and Configure Up Custom menus, and in the Data menu found in the Configure Down TCH menu.

Mode - PDC

Pressing this softkey reveals a menu of softkeys for generating data patterns that are formatted into a framed structure (where the data bits are located in fields defined by the PDC protocol) or for generating just the data pattern where the data sequence can be output a single time or repeatedly. These softkeys are described in this section in alphabetical order.

4 1's & 4 0's

Press this softkey to select a binary data pattern that consists of four ones followed by four zeroes. If you have selected **4 1's & 4 0's** in a pattern data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P4** (where "P" refers to Pattern and "4" refers to four ones and four zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **4 1's & 4 0's** in a framed data transmission, both the **TCH** and the **Other Patterns** softkeys will show this selection. Also, **P4** is displayed in either the **Data** field or the **TCH** field, both of which are located near the bottom of the text area of the display. A single output of a framed P4 data pattern consists of enough repetitions of four ones followed by four zeroes, followed by four ones and four zeroes, and so on, until the data fields in the timeslot are filled.

Softkey Location: Press **Mode**, **PDC**, **Data**, **Other Patterns**, **4 1's & 4 0's**
or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **TCH**, **Other Patterns**, **4 1's & 4 0's**

4 1's & 4 0's is also located in the Other Patterns menus found in the Up Custom menu, the Down custom menu, and the Down TCH menu.

SCPI Commands:

[:SOURce]:RADio:PDC:DATA P4

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DCUStom P4

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DTCHannel[:TCHannel] P4

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UCUStom P4

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UTCHannel[:DATA] P4

8 1’s & 8 0’s

Press this softkey to select a binary data pattern that consists of eight ones followed by eight zeroes. If you have selected **8 1’s & 8 0’s** in a pattern data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P8** (where “P” refers to Pattern and “8” refers to eight ones and eight zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **8 1’s & 8 0’s** in a framed data transmission, both the **TCH** and the **Other Patterns** softkeys will show this selection. Also, **P8** is displayed in either the **Data** field or the **TCH** field, both of which are located near the bottom of the text area of the display. A single output of a framed P8 data pattern consists of enough repetitions of eight ones followed by eight zeroes, followed by eight ones and eight zeroes, and so on, until the data fields in the timeslot are filled.

Softkey Location: Press **Mode**, **PDC**, **Data**, **Other Patterns**, **8 1’s & 8 0’s**
or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **TCH**, **Other Patterns**, **8 1’s & 8 0’s**

8 1’s & 8 0’s is also located in the Other Patterns menus found in the Up Custom menu, the Down custom menu, and the Down TCH menu.

SCPI Commands:

[:SOURce]:RADio:PDC:DATA P8

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DCUStom P8

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DTCHannel[:TCHannel] P8

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UCUStom P8

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UTCHannel[:DATA] P8

16 1’s & 16 0’s

Press this softkey to select a binary data pattern that consists of sixteen ones followed by sixteen zeroes. If you have selected **16 1’s & 16 0’s** in a pattern data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P16** (where “P” refers to Pattern and “16” refers to sixteen ones and sixteen zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **16 1’s & 16 0’s** in a framed data transmission, both the **TCH** and the **Other Patterns** softkeys will show this selection. Also, **P16** is displayed in either the **Data** field or the **TCH** field, both of which are located near the bottom of the text area of the display. A single output of a framed P16 data pattern consists of enough repetitions of sixteen ones followed by sixteen zeroes, followed by sixteen ones and sixteen zeroes, and so on, until the data fields in the timeslot are filled.

Softkey Location: Press **Mode**, **PDC**, **Data**, **Other Patterns**, **16 1’s & 16 0’s** or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **TCH**, **Other Patterns**, **16 1’s & 16 0’s**

16 1’s & 16 0’s is also located in the Other Patterns menus found in the Up Custom menu, the Down custom menu, and the Down TCH menu.

SCPI Commands:

[:SOURce]:RADio:PDC:DATA P16

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DCUStom P16

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DTCHannel[:TCHannel] P16

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UCUStom P16

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UTCHannel[:DATA] P16

32 1’s & 32 0’s

Press this softkey to select a binary data pattern that consists of thirty-two ones followed by thirty-two zeroes. If you have selected **32 1’s & 32 0’s** in a pattern data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P32** (where “P” refers to Pattern and “32” refers to thirty-two ones and thirty-two zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **32 1’s & 32 0’s** in a framed data transmission, both the **TCH** and the **Other Patterns** softkeys will show this selection. In addition, **P32** is displayed in either the **Data** field or the **TCH** field, both of which are located near the bottom of the text area of the display. A single output of a framed P32 data pattern consists of enough repetitions of thirty-two ones followed by thirty-two zeroes, followed by thirty-two ones and thirty-two zeroes, and so on, until the data fields in the timeslot are filled.

Softkey Location: Press **Mode**, **PDC**, **Data**, **Other Patterns**, **32 1’s & 32 0’s** or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **TCH**, **Other Patterns**, **32 1’s & 32 0’s**

32 1’s & 32 0’s is also located in the Other Patterns menus found in the Up Custom menu, the Down custom menu, and the Down TCH menu.

SCPI Commands:

[:SOURce]:RADio:PDC:DATA P32

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DCUStom P32

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DTCHannel[:TCHannel] P32

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UCUStom P32

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UTCHannel[:DATA] P32

64 1’s & 64 0’s

Press this softkey to select a binary data pattern that consists of sixty-four ones followed by sixty-four zeroes. If you have selected **64 1’s & 64 0’s** in a pattern data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P64** (where “P” refers to Pattern and “64” refers to sixty-four ones and sixty-four zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **64 1’s & 64 0’s** in a framed data transmission, both the **TCH** and the **Other Patterns** softkeys will show this selection. In addition, **P64** is displayed in either the **Data** field or the **TCH** field, both of which are located near the bottom of the text area of the display. A single output of a framed P64 data pattern consists of enough repetitions of sixty-four ones followed by sixty-four zeroes, followed by sixty-four ones and sixty-four zeroes, and so on, until the data fields in the timeslot are filled.

Softkey Location: Press **Mode**, **PDC**, **Data**, **Other Patterns**, **64 1’s & 64 0’s** or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **TCH**, **Other Patterns**, **64 1’s & 64 0’s**

64 1’s & 64 0’s is also located in the Other Patterns menus found in the Up Custom menu, the Down custom menu, and the Down TCH menu.

SCPI Commands:

[:SOURce]:RADio:PDC:DATA P64

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DCUStom P64

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DTCHannel[:TCHannel] P64

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UCUStom P64

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UTCHannel[:DATA] P64

All Timeslots

Press this softkey to output a 1-bit pulse to the EVENT 1 rear panel connector that is synchronized to the first bit of each timeslot in a frame. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **All Timeslots**

SCPI Commands:

[:SOURce]:RADio:PDC:SOUT ALL

BBG Data Clock Ext Int

Press this softkey to select the internal data clock for the baseband generator or to select an externally-supplied data clock. A data clock or symbol clock input must be supplied when external mode is selected. For more information on input and output signals, refer to Chapter 7, “Operation”.

Softkey Location: Press **Mode**, **PDC**, **More (1 of 2)**, **Configure Hardware**, **BBG Data Clock Ext Int**

Status after Normal Preset: Int

SCPI Commands:

[:SOURce]:RADio:PDC:BBCLock INT[1]|EXTernal[1]

[:SOURce]:RADio:PDC:BBCLock?

Begin Frame

Press this softkey to output a 1-bit pulse to the EVENT 1 rear panel connector that is synchronized to the first bit of the first frame. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified. The number of trigger pulses generated depends on the framed data patterns selected:

- If a PN9 or PN15 data pattern is selected, a single frame is generated. The data fields of the frame are filled sequentially with the PRBS data. The synchronizing pulse occurs at the beginning of the frame each time it is transmitted.
- Any combination of external data and a PN9 data pattern will cause 511 frames to be generated. The synchronizing pulse occurs at the beginning of the first of the 511 frames each time that frame is transmitted.
- Any combination of external data and a PN15 data pattern will cause a discontinuous PN15. A discontinuous PN15 pattern consists of as many complete frames of PN15 data as can be generated. The remaining bits that do not completely fill a frame are truncated. The synchronizing pulse occurs at the beginning of the first frame each time that frame is transmitted.
- Any combination of user’s files and a PN15 data pattern will cause a discontinuous PN15. The synchronizing pulse occurs at the beginning of the first frame each time that frame is transmitted.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **Begin Frame**

SCPI Commands:

[:SOURce]:RADio:PDC:SOUT FRAME

Begin Pattern

Press this softkey to output a 1-bit pulse to the EVENT 1 rear panel connector that is synchronized to the first bit of your unframed data pattern (**Data Format Pattern Framed** is set to **Pattern**), and for each repetition of the pattern. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified.

Softkey Location: Press **Mode**, **PDC**, **More (1 of 2)**, **Sync Out**, **Begin Pattern**

SCPI Commands:

[:SOURce]:RADio:PDC:SOUT FRAME

Begin Timeslot

Press this softkey to output a 1-bit pulse to the EVENT 1 rear panel connector that is synchronized to the first bit of a selected timeslot. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified. Select the timeslot by pressing **Begin Timeslot**. The timeslot number for the synchronization signal becomes the active function. Enter a value using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. You can select timeslots 0, 1, or 2 if you are in PDC full-rate, or select timeslots 0 through 5, if you are in PDC half-rate.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **Begin Timeslot**

SCPI Commands:

[:SOURce]:RADio:PDC:SOUT SLOT

[:SOURce]:RADio:PDC:SOUT:SLOT <value>

[:SOURce]:RADio:PDC:SOUT:SLOT?

Bit Rate

There are two softkeys named **Bit Rate**. The first is a menu key (distinguished by an arrow pointing to the right). Pressing this softkey reveals a menu of choices for setting the transmission bit rate. In this menu, there is another softkey named **Bit Rate**. Press this softkey to set the bit rate to any value from 39.900 kbps through 75.5 kbps. Enter the desired value using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Mbps**, **kbps**, or **bps** terminator softkey.

Softkey Location: Press **Mode**, **PDC**, **More (1 of 2)**, **Modify Standard**, **Bit Rate**
or press **Mode**, **PDC**, **More (1 of 2)**, **Modify Standard**, **Bit Rate**, **Bit Rate**

Status after Normal Preset: 42.000 kbps

SCPI Commands:

[:SOURce]:RADio:PDC:BRATe <value>

[:SOURce]:RADio:PDC:BRATe?

Burst Shape

Pressing this softkey reveals a menu of choices for modifying the burst shape of the framed data. In this menu, you can change the rise and fall time of the burst, in bits, and you can change the rise and fall delay of the burst, in bits. A softkey is also provided to return the default burst shape values.

Softkey Location: Press **Mode**, **PDC**, **More (1 of 2)**, **Modify Standard**, **Burst Shape**

Bus

Press this softkey to use the HP-IB as the pattern trigger for a single output of your unframed data pattern or as the frame trigger for a single output of your framed data. Once selected, you can trigger a single event at any time by sending a trigger command over HP-IB (*TRG) or by asserting the HP-IB GET (group execute trigger) line.

Softkey Location: Press **Mode**, **PDC**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Bus**
or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Bus**

SCPI Commands:

[:SOURce]:RADio:PDC:TRIGger[:SOURce] BUS

CC

Press this softkey to change the 8-bit color code (CC). The preset hexadecimal value (when normal preset is selected) for CC reflects the PDC standard, however you can enter a new value by pressing this softkey. To enter a value (in hexadecimal), press **CC**. The CC value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The current value for CC is displayed in the **CC** field near the bottom line of the text area of the display.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **CC**

CC is also located in the Configure Down TCH and the Configure Up VOX menus.

Status after Normal Preset: 00

SCPI Commands:

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DTCHannel:CCODe <bit_pattern>

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DTCHannel:CCODe?

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UTCHannel:CCODe <bit_pattern>

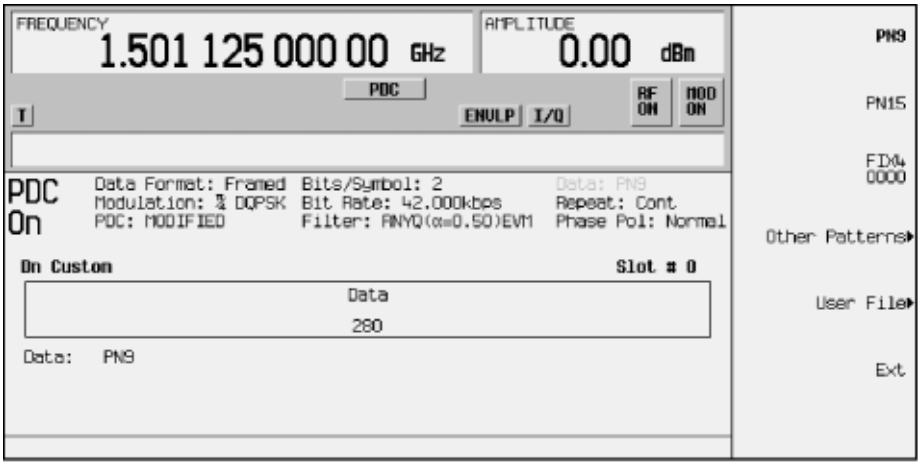
[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UTCHannel:CCODe?

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UVOX:CCODe <bit_pattern>

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UVOX:CCODe?

Configure Down Custom

Pressing this softkey reveals a menu of softkeys for selecting the data pattern for a downlink custom timeslot. The following figure shows an example of the display graphics for a downlink custom timeslot. The visual representation of the timeslot shows each field of the downlink custom timeslot.



pk7102a

In this example:

- **`Data: PN9`** - Indicates that the data selection for this custom timeslot is PN9. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.

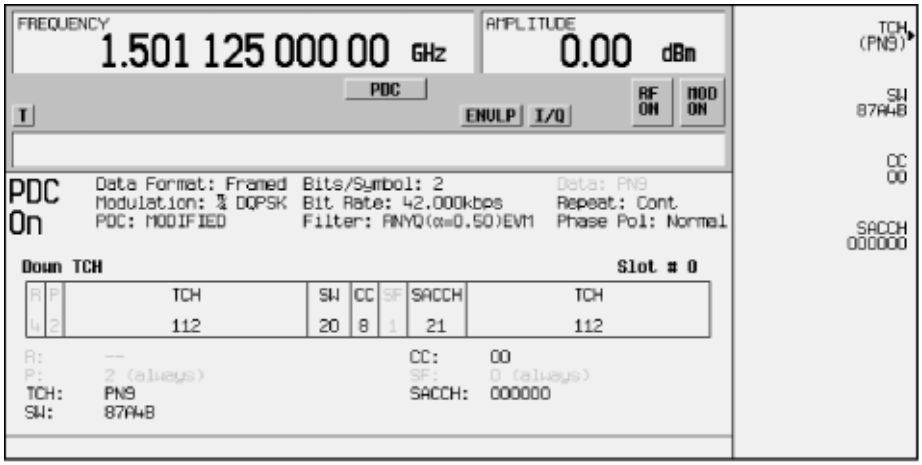
Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Down Custom**, **Configure Down Custom**

SCPI Commands:

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DCUStom?

Configure Down TCH

Pressing this softkey reveals a menu of softkeys for configuring a timeslot as a downlink traffic channel. The following figure shows an example of display graphics for a downlink traffic channel timeslot. The visual representation of the timeslot shows each field of the timeslot as it is defined by the PDC standard.



pk7103a

In this example:

- **R: --** - Ramp time is a 4-bit field. The text in this field is grey, indicating that you cannot change the contents of the ramp time field.
- **P: 2 (always)** - The preamble is a 2-bit field. The text in this field is grey, indicating that you cannot change the contents of the preamble field.
- **TCH: PN9** - Indicates that the data selection for this down traffic channel is PN9. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.
- **SW: 87A4B** - Indicates that the frame synchronization word is set to hexadecimal 87A4B. Press the **SW** softkey in the Configure Down TCH menu to change the contents of the synchronization word field.
- **CC: 00** - Indicates that the color code is set to 00. Press the **CC** softkey in the Configure Down TCH menu to change the contents of the color code field.
- **SF: 0 (always)** - Indicates that the steal flag is set to 0. The text in this field is grey, indicating that you cannot change contents of the steal flag field.
- **SACCH: 000000** - Indicates that the slow associated control channel is set to hexadecimal 000000. Press the **SACCH** softkey in the Configure Down TCH menu to

change the contents of the slow associated control channel field.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Down TCH**, **Configure Down TCH**

Configure Frame

This softkey will be used in the future for controlling the entire frame. At present, this softkey has no function.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Frame**

Configure Hardware

Pressing this softkey reveals a menu that allows you to set or select a particular latch or hardware configuration to meet your specific needs.

Softkey Location: Press **Mode**, **PDC**, **More (1 of 2)**, **Configure Hardware**

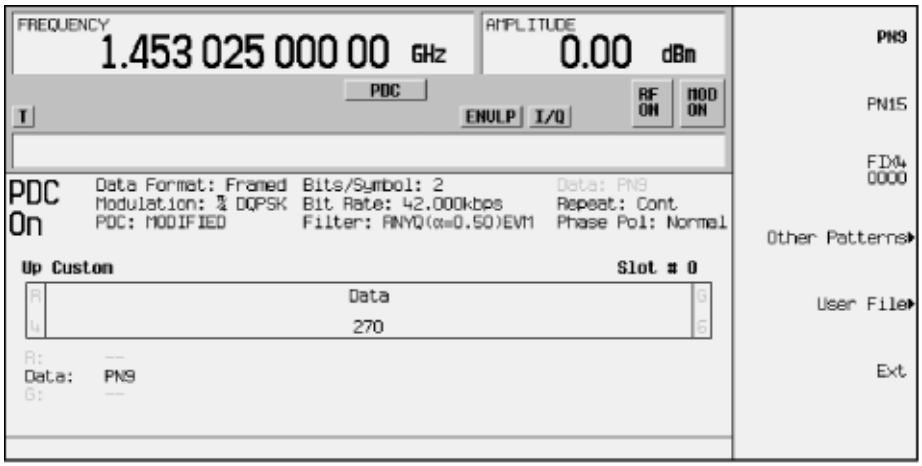
Configure Timeslot

Pressing this softkey reveals a menu of choices for configuring the timeslots. In this menu, set the timeslots to full-rate or half-rate. Select which timeslots to turn on and choose from uplink or downlink traffic channels, uplink vox, and uplink or downlink custom bursts. Then use the subsequent menus to configure the timeslots. This softkey is inactive until you set **Data Format Pattern Framed** to **Framed**.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**

Configure Up Custom

Pressing this softkey reveals a menu of softkeys for selecting the data pattern for an uplink custom timeslot. The following figure shows an example of the display graphics for an uplink custom timeslot. The visual representation of the timeslot shows each field of the uplink custom timeslot.



pk7104a

In this example:

- **R: --** - Ramp time is a 4-bit field. The text in this field is grey, indicating that you cannot change the contents of the ramp time field.
- **Data: PN9** - Indicates that the data selection for this custom timeslot is PN9. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.
- **G: --** - Guard time is a 6-bit field. The text in this field is grey, indicating that you cannot change the contents of the guard time field.

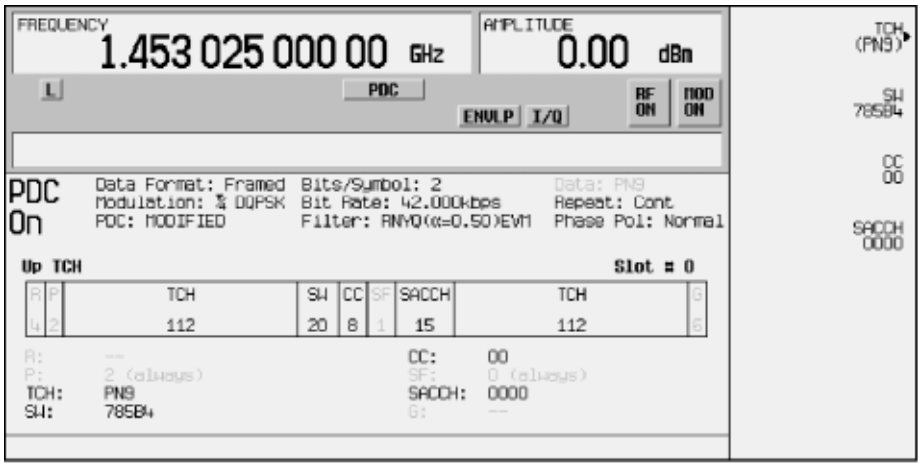
Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Custom**, **Configure Custom**

SCPI Commands:

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UCUStom?

Configure Up TCH

Pressing this softkey reveals a menu of softkeys for configuring a timeslot as an uplink traffic channel. The following figure shows an example of display graphics for an uplink traffic channel timeslot. The visual representation of the timeslot shows each field of the timeslot as it is defined by the PDC standard.



pk7105a

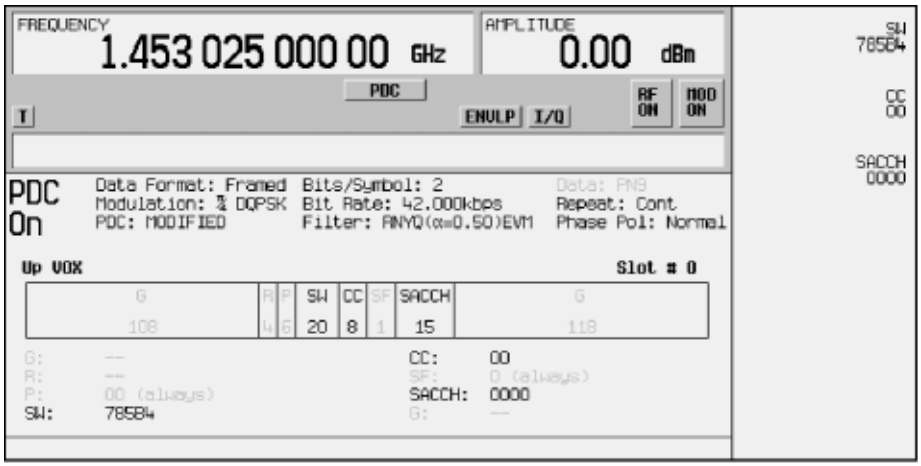
In this example:

- **R: --** - Ramp time is a 4-bit field. The text in this field is grey, indicating that you cannot change the contents of the ramp time field.
- **P: 2 (always)** - The preamble is a 2-bit field. The text in this field is grey, indicating that you cannot change contents of the preamble field.
- **TCH: PN9** - Indicates that the data selection for this uplink traffic channel is PN9. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.
- **SW: 785B4** - Indicates that the frame synchronization word is set to hexadecimal 785B4. Press the **SW** softkey in the Configure Up TCH menu to change the contents of the synchronization word field.
- **CC: 00** - Indicates that the color code is set to 00. Press the **CC** softkey in the Configure Up TCH menu to change the contents of the color code field.
- **SF: 0 (always)** - Indicates that the steal flag is set to 0. The text in this field is grey, indicating that you cannot change the steal flag.
- **SACCH: 0000** - Indicates that the slow associated control channel is set to 0000. Press the **SACCH** softkey in the Configure Up TCH menu to change the contents of the slow associated control channel field.
- **G: --** - Guard time is a 6-bit field. The text in this field is grey, indicating that you cannot change the contents of the guard time field.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**

Configure Up VOX

Pressing this softkey reveals a menu of softkeys for configuring an uplink VOX traffic channel. The following figure shows an example of display graphics for an uplink VOX timeslot. The visual representation of the timeslot shows each field of the timeslot as it is defined by the PDC standard.



pk7106a

In this example:

- **G: --** - There are two guard time fields. The guard time field at the beginning of the timeslot is a 108-bit field. The guard time field at the end of the timeslot is a 118-bit field. The text in this field is grey, indicating that you cannot change the contents of either guard time field.
- **R: --** - Ramp time is a 4-bit field. The text in this field is grey, indicating that you cannot change the contents of the ramp time field.
- **P: 2 (always)** - The preamble is a 2-bit field. The text in this field is grey, indicating that you cannot change contents of the preamble field.
- **SW: 785B4** - Indicates that the frame synchronization word is set to hexadecimal 785B4. Press the **SW** softkey in the Configure Up VOX menu to change the contents of the synchronization word field.
- **CC: 00** - Indicates that the color code is set to 00. Press the **CC** softkey in the Configure Up VOX menu to change the contents of the color code field.
- **SF: 0 (always)** - Indicates that the steal flag is set to 0. The text in this field is grey, indicating that you cannot change the steal flag.
- **SACCH: 0000** - Indicates that the slow associated control channel is set to 0000. Press

the **SACCH** softkey in the Configure Up VOX menu to change the contents of the slow associated control channel field.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Up VOX**, **Configure Up VOX**

Data

Pressing this softkey reveals a menu of choices for internal data generation (PN9, PN15, fixed 4-bit repeating sequences, set patterns of ones and zeroes) or you can choose to supply your own data (download a binary file or input data using the DATA INPUT connector). This softkey is available in the PDC menu to select a data pattern for modulated transmissions that are not framed. With **PDC Off On** set to **On** and **Data Format Pattern Framed** set to **Pattern**, the signal generator then outputs either a single occurrence (**Pattern Repeat Single**) or a continuous stream (**Pattern Repeat Cont**) of your choice of data.

For framed transmissions, use the **TCH** softkey for configuring the timeslot data fields.

Softkey Location: Press **Mode**, **PDC**, **Data**

Status after Normal Preset: PN9

SCPI Commands:

[:SOURce]:RADio:PDC:DATA?

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DCUStom?

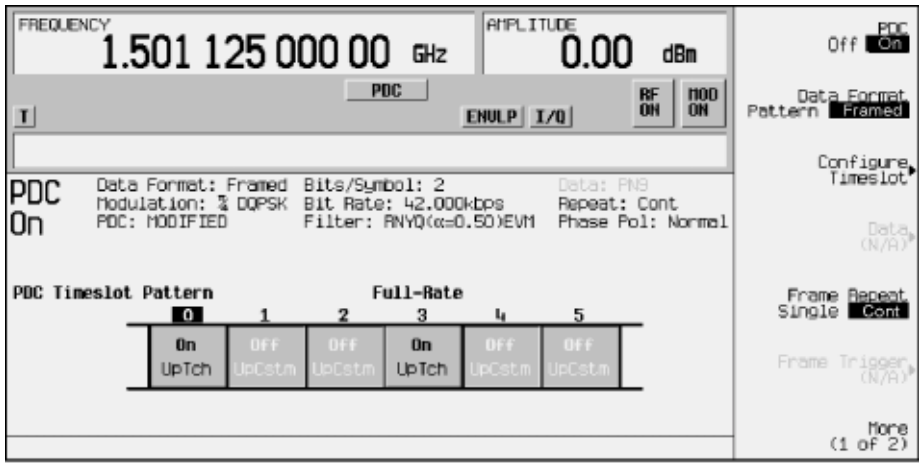
[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UCUStom?

Data Format Pattern Framed

Press this softkey to toggle between **Data Format Pattern** and **Data Format Framed** modes. When you select **Framed**, you will be transmitting your framed data pattern in a PDC format.

When you select **Data Format Pattern**, you will be transmitting a continuous stream of your selected data pattern. Select the data pattern using the **Data** softkey. The **Data** softkey is activated when you select **Data Format Pattern** and inactivated when you select **Data Format Framed**.

The **Data Format Pattern Framed** softkey is coupled to the **Burst Envelope Off On** softkey in the I/Q menu. At any time that PDC is enabled (**PDC Off On** is set to **On**) and **Data Format Framed** is selected, the **ENVLP** annunciator is turned on in the display (indicating that **Burst Envelope On** is also selected). The following figure shows the display graphics that appear when the PDC menu is accessed, **Data Format Pattern Framed** is set to **Framed**, and you are not configuring a timeslot:



pk7101a

In this example:

- **`PDC On`** - Indicates that PDC is enabled. This field changes to **`PDC Off`** when **PDC Off On** is set to **Off**.
- **`Data Format: Framed`** - Indicates that the data pattern is a framed transmission. This field changes to **`Data Format: Pattern`** when **Data Format Pattern Framed** is set to **Pattern** indicating that you are transmitting a continuous stream of your selected data pattern.
- **`Modulation: π/4DQPSK`** - Indicates that π/4DQPSK modulation is being internally generated.

- **PDC: STANDARD** - Indicates that the structure of the PDC transmission follows the standard as defined by the PDC protocol. This field changes to **PDC: MODIFIED** under the following circumstances:
  - filter is NYQ
  - filter alpha is changed
  - bit rate is changed
  - burst shape is changed
  - phase polarity is set to invert
- **Bit/Symbol: 2** - Indicates that 2 bits per symbol are required according to the PDC standard.
- **Bit Rate: 42.000kbps** - The bit rate is set according to PDC standard. This can be changed in the Bit Rate menu. A * next to the value indicates that it differs from the standard.
- **Filter: RNYQ (α=0.50)EVM** - Indicates that root Nyquist filter (root raised cosine) is selected, with an alpha of 0.50, and the filter is set for optimizing error vector magnitude. A * next to the alpha value indicates that it differs from the standard. If you select optimization for adjacent channel power, **EVM** toggles to **ACP**. This field changes to **Filter: NYQ(α=0.50)** if you select the Nyquist filter (raised cosine).
- **Data: PN9** - Indicates that a PN9 sequence has been selected for transmitting without framing. In this example, the text in this field is grey, indicating an inactive function (framed mode is on). Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.
- **Repeat: Cont** - Indicates that the data pattern repeat is set to continuous mode. If you select single mode, this field changes to **Repeat: Single**.
- **Phase Pol: Normal** - Indicates the direction of rotation of the phase modulation vector. If you select inverted mode, this field changes to **Phase Pol: Invert**.
- The visual representation of the PDC timeslot pattern shows, in this case, that timeslots 0 and 3 are on and configured as up traffic channels. Timeslots 1, 2, 4, and 5 are off and configured as uplink custom timeslots. The timeslot pattern is displayed only when **Data Format Pattern Framed** is set to **Framed**.
- PDC is set to **Full-Rate**. This field changes to **Half-Rate** when the **Rate Full Half** softkey is set to **Half**.

When you are in framed mode, you will be bursting the timeslots that you have turned on and there will be no RF carrier during the off timeslots. This is true for all uplink traffic channels and for uplink custom timeslots. However, if you have turned on any timeslot that you have configured as a downlink traffic channel, or as a downlink custom timeslot, the RF signal is not turned off between timeslots and the off timeslots are transmitted as a continuous series of ones for the time period of the off timeslots. To configure the timeslots, press the **Configure Timeslot** softkey. The **Configure Timeslot** softkey is activated when you select **Data Format Framed** and is inactivated when you select **Data Format Pattern**.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**

Status after Normal Preset: Pattern

SCPI Commands:

[:SOURce]:RADio:PDC:BURSt[:STATe] ON|OFF|1|0

[:SOURce]:RADio:PDC:BURSt[:STATe]?

Down Custom

Press this softkey to select a downlink custom timeslot type for the active timeslot. A custom timeslot is configured using an internally-generated data pattern, a downloaded sequence of bits stored in a user file, or by supplying external data. Downlink timeslots cannot be mixed with uplink timeslots. If you already have any timeslots designated as uplink, they will be changed to downlink when any other timeslot is designated as downlink. The custom timeslot is provided for users' flexibility but it is not a standard PDC timeslot.

When you have selected **Down Custom** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your configuration.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Down Custom**

SCPI Commands:

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5[:TYPE] DCUStom

Down TCH

Press this softkey to select downlink traffic channel (base station to mobile) as the timeslot type for the active timeslot. Downlink timeslots cannot be mixed with uplink timeslots. If you already have any timeslots designated as uplink, they will be changed to downlink when any other timeslot is designated as downlink. When you select **Down TCH**, the frame pattern is output with continuous RF power. Power is on during off timeslots (according to the PDC standard) and a continuous pattern of binary ones is sent during off timeslots.

When you select **Down TCH** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Down TCH**

SCPI Commands:

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5[:TYPE] DTCH

Down TCH All

Press this softkey to select downlink traffic channel (base station to mobile) as the timeslot type for all timeslots. When you select **Down TCH All**, the frame pattern is output with continuous RF power. Power is on during off timeslots (according to the PDC standard) and a continuous pattern of binary ones is sent during off timeslots. When all of the timeslots are off, RF power is off.

When you select **Down TCH All**, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Down TCH All**

SCPI Commands:

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5[:TYPE] DTCH_ALL

Ext

Press this softkey in the data selection menus to select external data. With **Ext** selected, you should apply the data signal to the DATA INPUT connector. If you have selected **Ext** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **Ext** is displayed in the **Data** field in the top line of the text area of the display. If you have selected **Ext** for configuring the timeslot data fields, **EXT** is displayed in either the **Data** field or the **TCH** field, both of which are located near the bottom of the text area of the display. In framed mode, the external data is gated to the data regions of the timeslot.

Another **Ext** softkey is located in the Frame Trigger and Pattern Trigger menus. Press **Ext** in either of these two menus to select external triggering for your data pattern. Apply a TTL input to the rear panel PATTERN TRIG IN connector to trigger your frame or pattern data.

Softkey Location: Press **Mode**, **PDC**, **Data**, **Ext**
or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **TCH**, **Ext**
or press **Mode**, **PDC**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Ext**
or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Ext**

Ext is also located in the Configure Up Custom menu, the Configure Down Custom menu and in the TCH Menu found in the Configure Down TCH menu.

SCPI Commands:

[:SOURce]:RADio:PDC:DATA EXTernal

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DCUStom EXTernal

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DTCHannel[:TCHannel] EXTernal

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UCUStom EXTernal

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UTCHannel[:TCHannel] EXTernal

[:SOURce]:RADio:PDC:TRIGger[:SOURce] EXTernal

Ext Data Clock Normal Symbol

Press this softkey to toggle the external data clock use between **Normal** and **Symbol**. When you select **Normal**, you must supply a signal (either a clock or a pulse) to the DATA CLOCK INPUT connector to clock the DATA and SYMBOL SYNC signals. (An unlock will occur if external data is selected and these signals are not supplied.) When you select **Symbol**, no signal is required at the DATA CLOCK INPUT connector. Instead, the data is clocked on both the rising and falling edges of the SYMBOL SYNC signal.

Softkey Location: Press **Mode**, **PDC**, **More (1 of 2)**, **Configure Hardware**, **Ext Data Clock Normal Symbol**

Status after Normal preset: Normal

SCPI Commands:

[:SOURce]:RADio:PDC:EDCLock SYMBol|NORMal

[:SOURce]:RADio:PDC:EDCLock?

Ext Delay Bits

Press this softkey to specify the number of bits for the external trigger delay. When **Ext Delay Off On** is set to **On**, a value greater than 0 will delay the transmission of the triggered data after the external trigger event by the number of bits specified. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. The range of values allowed is 0 through 65,535 bits. This softkey is inactive until the trigger selection is set to **Ext**.

Softkey Location: Press **Mode**, **PDC**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Ext**, **Ext Delay Bits**
or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Ext**, **Ext Delay Bits**

Status after Normal Preset: 0

SCPI Commands:

[:SOURce]:RADio:PDC:TRIGger[:SOURce]:EXTernal:DELay <value>

[:SOURce]:RADio:PDC:TRIGger[:SOURce]:EXTernal:DELay?

Ext Delay Off On

Press this softkey to toggle the external trigger delay on and off. When this function is turned on, the transmission of the triggered data will be delayed after the external trigger event by the number of bits specified by the **Ext Delay Bits** softkey. This function is only available when the trigger selection is set to **Ext**.

Softkey Location: Press **Mode**, **PDC**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Ext**, **Ext Delay Off On**
or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Ext**, **Ext Delay Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:RADio:PDC:TRIGger[:SOURce]:EXTernal:DELay:STATe ON|OFF|1|0

[:SOURce]:RADio:PDC:TRIGger[:SOURce]:EXTernal:DELay:STATe?

Fall Delay

Press this softkey to change the shape of the bursted RF signal by entering a falling edge delay. To change the fall delay, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0 through 63.50 bits.

Softkey Location: Press **Mode**, **PDC**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Fall Delay**

Status after Normal Preset: 9.50 bits

SCPI Commands:

[:SOURce]:RADio:PDC:BURSt:SHAPe:FALL:DELay <value>

[:SOURce]:RADio:PDC:BURSt:SHAPe:FALL:DELay?

[:SOURce]:RADio:PDC:BURSt:SHAPe:FDELay <value>

[:SOURce]:RADio:PDC:BURSt:SHAPe:FDELay?

Fall Time

Press this softkey to change the shape of the bursted RF signal by entering a falling edge time. To change the fall time, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0.05 through 30 bits.

Softkey Location: Press **Mode**, **PDC**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Fall Time**

Status after Normal Preset: 3.83 bits

SCPI Commands:

[:SOURce]:RADio:PDC:BURSt:SHAPe:FALL:TIME <value>

[:SOURce]:RADio:PDC:BURSt:SHAPe:FALL:TIME?

[:SOURce]:RADio:PDC:BURSt:SHAPe:FTIMe <value>

[:SOURce]:RADio:PDC:BURSt:SHAPe:FTIMe?

Filter

Pressing this softkey reveals a menu of choices for changing the filter selection between root Nyquist (root raised cosine) and Nyquist (raised cosine), for changing the default filter alpha, and for restoring the default filter alpha.

Softkey Location: Press **Mode**, **PDC**, **(More 1 of 2)**, **Modify Standard**, **Filter**

Filter Alpha

Press this softkey to change the filter alpha parameter. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. The range of values allowed is 0.30 through 0.60.

Softkey Location: Press **Mode**, **PDC**, **(More 1 of 2)**, **Modify Standard**, **Filter**, **Filter Alpha**

Status after Normal Preset: 0.50

SCPI Commands:

[:SOURce]:RADio:PDC:ALPHa <value>

[:SOURce]:RADio:PDC:ALPHa?

Filter RNYQ NYQ

Press this softkey to toggle the filter selection between Root Nyquist (root raised cosine) and Nyquist (raised cosine). Notice that your filter selection is shown on the display in the **Filter** field.

Softkey Location: **Mode**, **PDC**, **More (1 of 2)**, **Modify Standard**, **Filter**, **Filter RNYQ NYQ**

Status after Normal Preset: RNYQ

SCPI Commands:

[:SOURce]:RADio:PDC:FILTer RNYQuist|NYQuist

[:SOURce]:RADio:PDC:FILTer?

FIX4

Press this softkey to select a 4-bit repeating sequence data pattern. Press **FIX4** and the 4-bit pattern becomes the active function. Enter your desired 4-bit pattern using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. If you have selected **FIX4** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **FIX4** is displayed in the **Data** field in the top line of the text area of the display. If you have selected **FIX4** for configuring the timeslot data fields, your 4-bit pattern is displayed in either the **Data** field or the **TCH** field, both of which are located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **PDC**, **Data**, **FIX4**
or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **TCH**, **FIX4**

FIX4 is also located in the Configure Down Custom and Configure Up Custom menus, and in the TCH menu found in the Configure Down TCH menu.

Status after Normal Preset: 0000

SCPI Commands:

[:SOURce]:RADio:PDC:DATA FIX4

[:SOURce]:RADio:PDC:DATA:FIX4 <0-15>

[:SOURce]:RADio:PDC:DATA:FIX4?

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DCUStom FIX4

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DCUStom:FIX4 <0-15>

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DCUStom:FIX4?

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DTCHannel[:TCHannel] FIX4

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DTCHannel[:TCHannel]:FIX4 <0-15>

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DTCHannel[:TCHannel]:FIX4?

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UCUStom FIX4

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UCUStom:FIX4 <0-15>

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UCUStom:FIX4?

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UTCHannel[:TCHannel] FIX4

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UTCHannel[:TCHannel]:FIX4 <0-15>

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UTCHannel[:TCHannel]:FIX4?

Frame Repeat Single Cont

Press this softkey to toggle between a single output of framed data and continuous transmission of frames. Selecting **Single** will output the following sequences:

- 4-Bit Patterns (FIX4) - A single frame is generated. The 4-bit pattern repeats until the data fields are completely filled. Each trigger transmits the same frame.
- Other Patterns (fixed patterns of equal quantities of ones and zeroes) - A single frame is generated. The selected pattern repeats until the data fields are completely filled. Each trigger transmits the same frame.
- PN9 - A single frame is generated. The data fields are filled with the leading bits of the PN9 sequence. A trigger causes the frame to be transmitted. The data fields of this frame are then filled sequentially with the next series of PN9 data bits. A trigger causes the frame to be transmitted. This process continues, transmitting the entire PN9 sequence frame by frame. The last bit of the PN9 sequence in a data field is immediately followed by the first bit of a second PN9 sequence.
- PN15 - A single frame is generated. The data fields are filled with the leading bits of the PN15 sequence. A trigger causes the frame to be transmitted. The data fields of this frame are then filled sequentially with the next series of PN15 data bits. A trigger causes the frame to be transmitted. This process continues, transmitting the entire PN15 sequence frame by frame. The last bit of the PN15 sequence in a data field is immediately followed by the first bit of a second PN15 sequence.
- User File - The user's file should have the appropriate data to fill an integer number of timeslots. If not, the remaining bits are truncated. Depending on the size of the file, more than one frame can possibly be generated.
- External Data - External data is clocked into the data fields of the timeslot. A single frame is generated.

Combinations of these data patterns may cause some patterns to be truncated. Refer to Chapter 7, "Operation" for the details of the data dependencies.

Selecting **Cont** with framed data causes the frames to be transmitted continuously.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**

Status after Normal Preset: Continuous

SCPI Commands:

[:SOURce]:RADio:PDC:REPeat SINGle|CONTinuous

[:SOURce]:RADio:PDC:REPeat?

Frame Trigger

Pressing this softkey reveals a menu of choices for triggering your framed pattern. You can choose to trigger using the front panel **Trigger** key, an external trigger supplied to the PATTERN TRIG IN connector, or by a *TRG command or GET (group execute trigger) signal sent over HP-IB. This softkey is inactive until **Data Format Pattern Framed** is set to **Framed** and **Frame Repeat Single Cont** is set to **Single**.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**

Status after Normal Preset: Trigger Key

SCPI Commands:

[:SOURce]:RADio:PDC:TRIGger[:SOURce]?

Goto Bottom Row

Press this softkey to move the selection bar to the bottom row of file names in the Goto Row menu that is accessed from the User File menu.

Softkey Location: Press **Mode**, **PDC**, **Data**, **User File, Goto Row**, **Goto Bottom Row** or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **TCH**, **User File**, **Goto Row**, **Goto Bottom Row**

Goto Middle Row

Press this softkey to move the selection bar to the middle row of file names in the Goto Row menu that is accessed from the User File menu.

Softkey Location: Press **Mode**, **PDC**, **Data**, **User File, Goto Row**, **Goto Middle Row** or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **TCH**, **User File**, **Goto Row**, **Goto Middle Row**

Goto Row

Pressing this softkey reveals a menu of softkeys that help you move the selection bar through the rows of file names in the User File menu. You can also go to a specific row by rotating the front panel knob, using the up and down arrow keys, or entering the row number with the numeric keypad. Once the desired row number is displayed, press the **Enter** terminator softkey.

Softkey Location: Press **Mode**, **PDC**, **Data**, **User File, Goto Row** or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **TCH**, **User File**, **Goto Row**

Goto Top Row

Press this softkey to move the selection bar to the top row of file names in the Goto Row menu that is accessed from the User File menu.

Softkey Location: Press **Mode**, **PDC**, **Data**, **User File, Goto Row**, **Goto Top Row** or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **TCH**, **User File**, **Goto Row**, **Goto Top Row**

Modify Standard

Pressing this softkey reveals a menu of choices for modifying the standard transmission in the following ways:

- changing the filter from root Nyquist to Nyquist
- changing the filter alpha
- changing the transmission bit rate
- changing the burst rising edge time and delay
- changing the burst falling edge time and delay
- inverting the phase polarity

Softkey Location: Press **Mode**, **PDC**, **(More 1 of 2)**, **Modify Standard**

Optimize RNYQ For EVM ACP

Press this softkey to optimize the root Nyquist filter for minimized error vector magnitude (select **EVM**) or for minimized adjacent channel power (select **ACP**). The EVM selection provides the most ideal passband. The ACP selection improves stopband rejection.

Softkey Location: Press **Mode**, **PDC**, **(More 1 of 2)**, **Configure Hardware**, **Optimize RNYQ For EVM ACP**

Status after Normal Preset: EVM

SCPI Commands:

[:SOURce]:RADio:PDC:CHANnel EVM|ACP

[:SOURce]:RADio:PDC:CHANnel?

Other Patterns

Pressing this softkey reveals a menu of data pattern selections. Each of the selections in this menu is a pattern of equal quantities of ones and zeroes (such as four ones and four zeroes).

Softkey Location: Press **Mode**, **PDC**, **Data**, **Other Patterns**
or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **TCH**, **Other Patterns**

Other Patterns is also located in the Configure Down Custom and Configure Up Custom menus, and in the TCH menu found in the Configure Down TCH menu.

Page Down

Press this softkey to move down one page at a time in the displayed catalog of files.

Softkey Location: Press **Mode**, **PDC**, **Data**, **User File**, **Page Down**
or press **Mode**, **PDC**, **Data**, **User File**, **Goto Row**, **Page Down**
or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **TCH**, **User File**, **Page Down**
or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **TCH**, **User File**, **Goto Row**, **Page Down**

Page Down is also located in the User File menus found in the Configure Down Custom, Configure Up Custom, and Configure Down TCH menus.

Page Up

Press this softkey to move up one page at a time in the displayed catalog of files.

Softkey Location: Press **Mode**, **PDC**, **Data**, **User File**, **Page Up**
or press **Mode**, **PDC**, **Data**, **User File**, **Goto Row**, **Page Up**
or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **TCH**, **User File**, **Page Up**
or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **TCH**, **User File**, **Goto Row**, **Page Up**

Page Up is also located in the User File menus found in the Configure Down Custom, Configure Up Custom, and Configure Down TCH menus.

Pattern Repeat Single Cont

Set this softkey to **Single** to output one occurrence of a modulated data pattern that is not framed. Select the trigger event for the output using the **Pattern Trigger** softkey. Toggle to **Cont** to output a continuous stream of your data pattern.

Softkey Location: Press **Mode**, **PDC**, **Pattern Repeat Single Cont**

Status after Normal Preset: Continuous

SCPI Commands:

[:SOURce]:RADio:PDC:REPeat SINGle|CONTinuous

[:SOURce]:RADio:PDC:REPeat?

Pattern Trigger

Pressing this softkey reveals a menu of choices for triggering a modulated data pattern that is not framed. You can choose to trigger using the front panel **Trigger** key, an external trigger supplied to the PATTERN TRIG IN connector, or by a *TRG command or GET (group execute trigger) signal sent over HP-IB. This softkey is inactive until **Pattern Repeat Single Cont** is set to **Single**.

Softkey Location: Press **Mode**, **PDC**, **Pattern Repeat Single Cont**, **Pattern Trigger**

Status after Normal Preset: Trigger Key

SCPI Commands:

[:SOURce]:RADio:PDC:TRIGger[:SOURce]?

PDC Off On

Press this softkey to enable the PDC communications standard. Setting **PDC Off On** to **On** sets up the internal hardware to generate a signal that follows the PDC standard. The internal I/Q modulator generates π/4DQPSK digital modulation and the **PDC** and **I/Q** annunciators are turned on in the display. Although the digital modulation is enabled with this softkey, the RF carrier is modulated by the enabled modulation only when you have also set **Mod On/Off** to **On**.

Setting **PDC Off On** to **On** presets the following softkeys in the I/Q menu: **I/Q Off On** is set to **On** and **I/Q Source** is set to **Int I/Q**. You can override these selections in the I/Q menu.

Softkey Location: Press **Mode**, **PDC**, **PDC Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:RADio:PDC[:STATe] ON|OFF|1|0

[:SOURce]:RADio:PDC[:STATe]?

Phase Polarity Normal Invert

Press this softkey to reverse the direction of rotation of the phase modulation vector. Choose **Invert** and the in-phase component will lag the quadrature-phase component by 90° in the resulting modulation. The inverted selection also applies to the I OUT and Q OUT signals.

Softkey Location: Press **Mode**, **PDC**, **More (1 of 2)**, **Modify Standard**, **Phase Polarity Normal Invert**

Status after Normal Preset: Normal

SCPI Commands:

[:SOURce]:RADio:PDC:POLarity[:ALL] NORMal|INVerted

[:SOURce]:RADio:PDC:POLarity[:ALL]?

PN9

Press this softkey to select the PN9 pseudorandom bit pattern. If you have selected **PN9** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **PN9** is displayed in the **Data** field in the top line of the text area of the display. If you have selected **PN9** for configuring the framed timeslot data fields, **PN9** is displayed in the **Data** field or the **TCH** field, both of which are located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **PDC**, **Data**, **PN9**
or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **TCH**, **PN9**

PN9 is also located in the Configure Down Custom and Configure Up Custom menus, and in the TCH menu found in the Configure Down TCH menu.

SCPI Commands:

[:SOURce]:RADio:PDC:DATA PN9

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DCUStom PN9

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DTCHannel[:TCHannel] PN9

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UCUStom PN9

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UTCHannel[:TCHannel] PN9

PN9 Mode Normal Quick
Option 1EH Only

Press this softkey to toggle between normal and quick PN9 modes. A single output of a framed normal PN9 data pattern consists of enough frames so that the end of the PN9 sequence corresponds with the end of a frame. A single output of a framed quick PN9 data pattern consists of one entire PN9 sequence plus enough of a second PN9 sequence to fill the remaining data fields in the current frame. The second PN9 sequence is, therefore, truncated.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **PN9 Mode Normal Quick**

Status after Normal Preset: Normal

SCPI Commands:

[:SOURce]:RADio:PDC:BURSt:PN9 NORMal|QUICk

[:SOURce]:RADio:PDC:BURSt:PN9?

PN15

Press this softkey to select the PN15 pseudorandom bit pattern. If you have selected **PN15** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **PN15** is displayed in the **Data** field in the top line of the text area of the display. If you have selected **PN15** for configuring the framed timeslot data fields, **PN15** is displayed in the **Data** field or the **TCH** field, both of which are located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **PDC**, **Data**, **PN15**
or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **TCH**, **PN15**

PN15 is also located in the Configure Down Custom and Configure Up Custom menus, and in the TCH menu found in the Configure Down TCH menu.

SCPI Commands:

[:SOURce]:RADio:PDC:DATA PN15

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DCUStom PN15

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DTCHannel[:TCHannel] PN15

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UCUStom PN15

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UTCHannel[:TCHannel] PN15

Rate Full Half

Press this softkey to toggle between PDC full- or half-rate. When you select full-rate, timeslots 0, 1, and 2 are paired with timeslots 3, 4, and 5, respectively. Select half-rate for 6 individual timeslots. Notice that your selection, either full-rate or half-rate, is shown on the display directly above the timeslot pattern visual representation.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Rate Full Half**

Status after Normal Preset: Full-rate

SCPI Commands:

[:SOURce]:RADio:PDC:FRATe FULL|HALF

[:SOURce]:RADio:PDC:FRATe?

Restore Default Bit Rate

Press this softkey to reset the transmission bit rate to the default value (42.000 kbps). This softkey is a convenience feature for quickly resetting the bit rate. You can also change the bit rate by pressing the **Bit Rate** softkey.

Softkey Location: Press **Mode**, **PDC**, **(More 1 of 2)**, **Modify Standard**, **Bit Rate**, **Restore Default Bit Rate**

Restore Default Burst Shape

Press this softkey to reset the burst shape characteristics to their default values (rise time = 5.47 bits, rise delay = 8.00 bits, fall time = 3.83 bits, fall delay = 9.50 bits). This softkey is a convenience feature for quickly resetting the burst shape. You can also change each of the burst characteristics individually by using the **Rise Time**, **Rise Delay**, **Fall Time**, and **Fall Delay** softkeys in this menu.

Softkey Location: Press **Mode**, **PDC**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Restore Default Burst Shape**

Restore Default Filter Alpha

Press this softkey to reset the filter alpha parameter to its default value (0.50). This softkey is a convenience feature for quickly resetting the filter alpha. You can also change the bit rate by pressing the **Filter Alpha** softkey.

Softkey Location: Press **Mode**, **PDC**, **(More 1 of 2)**, **Modify Standard**, **Filter**, **Restore Default Filter Alpha**

Rise Delay

Press this softkey to change the shape of the bursted RF signal by entering a rising edge delay. To change the rise delay, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0 through 63.50 bits.

Softkey Location: Press **Mode**, **PDC**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Rise Delay**

Status after Normal Preset: 8.00 bits

SCPI Commands:

[:SOURce]:RADio:PDC:BURSt:SHAPe:RISE:DELay <value>

[:SOURce]:RADio:PDC:BURSt:SHAPe:RISE:DELay?

[:SOURce]:RADio:PDC:BURSt:SHAPe:RDELay <value>

[:SOURce]:RADio:PDC:BURSt:SHAPe:RDELay?

Rise Time

Press this softkey to change the shape of the bursted RF signal by entering a rising edge time. To change the rise time, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0.05 through 30 bits.

Softkey Location: Press **Mode**, **PDC**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Rise Time**

Status after Normal Preset: 5.47 bits

SCPI Commands:

[:SOURce]:RADio:PDC:BURSt:SHAPe:RISE:TIME <value>

[:SOURce]:RADio:PDC:BURSt:SHAPe:RISE:TIME?

[:SOURce]:RADio:PDC:BURSt:SHAPe:RTIMe <value>

[:SOURce]:RADio:PDC:BURSt:SHAPe:RTIMe?

SACCH

Press this softkey to change the slow associated control channel (SACCH). The preset hexadecimal value (when normal preset is selected) for SACCH reflects the PDC standard, however you can enter a new value by pressing this softkey. To enter a value (in hexadecimal), press **SACCH**. The SACCH value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The current value for SACCH is displayed in the **SACCH** field near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **SACCH**

SACCH is also located in the Configure Down TCH and Configure Up VOX menus.

Status after Normal Preset: 0000 (Up TCH, and Up VOX), 000000 (Dn TCH)

SCPI Commands:

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DTCHannel:SACChannel <bit_pattern>

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DTCHannel:SACChannel?

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UTCHannel:SACChannel <bit_pattern>

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UTCHannel:SACChannel?

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UVOX:SACChannel <bit_pattern>

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UVOX:SACChannel?

Select File

Press this softkey to select a file in the displayed catalog of binary files. To make your selection, first scroll through the list, using the front panel knob or up and down arrow keys, until the desired file is highlighted. Press **Select File** and the highlighted file is specified as your data selection. If you have selected a custom file as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **`UserFile`** is displayed in the **`Data`** field in the top line of the text area of the display. If you have selected a custom file for configuring timeslot data fields, the file name you selected is displayed in the **`Data`** field or the **`TCH`** field, both of which are located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **PDC**, **Data**, **User File**, **Select File**
or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **TCH**, **User File**, **Select File**

Select File is also located in the User File menus found in the Configure Down TCH, Configure Down Custom, and Configure Up Custom menus.

SCPI Commands:

[:SOURce]:RADio:PDC:DATA “file name”

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DCUStom “file name”

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DTCHannel[:TCHannel] “file name”

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UCUStom “file name”

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UTCHannel[:TCHannel] “file name”

SW

Press this softkey to change the 20-bit frame synchronization word. The preset hexadecimal value (when normal preset is selected) for SW reflects the PDC standard, however you can enter a new value by pressing this softkey. To enter a value (in hexadecimal), press **SW**. The SW value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The current value for SW is displayed in the **SW** field near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **SW**

SW is also located in the Configure Down TCH and Configure Up VOX menus.

Status after Normal Preset: 785B4 (Up TCH and Up VOX), 87A4B (Dn TCH)

SCPI Commands:

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DTCHannel:SWORd <bit_pattern>

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DTCHannel:SWORd?

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UTCHannel:SWORd <bit_pattern>

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UTCHannel:SWORd?

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UVOX:SWORd <bit_pattern>

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UVOX:SWORd?

Sync Out

Press this softkey to reveal a menu of choices for outputting a 1-bit synchronization signal to the EVENT 1 rear panel connector. In this menu you can choose to set the synchronization signal to occur at the beginning of a data pattern, at the beginning of a frame, at the beginning of a selected timeslot, or at the beginning of each timeslot in a frame.

Softkey Location: Press **Mode**, **PDC**, **More (1 of 2)**, **Sync Out**

Status after Normal Preset: Begin Pattern

SCPI Commands:

[:SOURce]:RADio:PDC:SOUT?

Sync Out Offset

Press this softkey to move the synchronization signal forward or back from the beginning of the data pattern, frame, or timeslot. To set the number of bits of offset, press **Sync Out Offset** and synchronization offset becomes the active function. Enter the desired value using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. The range of values allowed is –323 through +323 bits.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **Sync Out Offset**

Status after Normal Preset: 0 bits

SCPI Commands:

[:SOURce]:RADio:PDC:SOUT:OFFSet <value>

[:SOURce]:RADio:PDC:SOUT:OFFSet?

TCH

Pressing this softkey reveals a menu of choices for internal data generation (PN9, PN15, fixed, 4-bit repeating sequences, set patterns of ones and zeroes) or you can choose to supply your own data (download a binary file or input data using the DATA INPUT connector) for configuring the timeslot TCH fields.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **TCH**
or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Down TCH**, **Configure Down TCH**, **TCH**

Status after Normal Preset: PN9

SCPI Commands:

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:DTCHannel[:TCHannel]?

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:UTCHannel[:TCHannel]?

Timeslot

Press this softkey to select a timeslot to be configured. Choose any of the timeslots. Select from six timeslots if you are using half-rate, and three timeslots if you are using full-rate. Enter the timeslot number using the front panel knob, the up and down arrow keys, or enter the number using the numeric keypad and press the **Enter** terminator softkey.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot #**

Status after Normal Preset: 0

Timeslot Off On

Press this softkey to toggle the active timeslot on and off. For example, to turn on timeslot 2, select the timeslot by pressing the **Timeslot #** softkey in this same menu. Enter the number 2 to make timeslot 2 active. Then turn this timeslot on by toggling **Timeslot Off On** to **On**. Notice that the visual representation of the timeslot pattern now shows timeslot 2 turned on and, if you are in full-rate PDC, timeslot 5 will also be turned on.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Off On**

Status after Normal Preset: On (for timeslot 0)

SCPI Commands:

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:STATe ON|OFF|1|0

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5:STATe?

Timeslot Type

Pressing this softkey reveals a menu of choices for setting the timeslot type for the active timeslot. You can choose to set any timeslot to be an uplink or downlink traffic channel (TCH), an uplink voice activated transmission channel (VOX), or an uplink or downlink custom timeslot. You cannot, however, mix uplink and downlink timeslots in the same frame. When you have selected the type for the timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**

Status after Normal Preset: Up TCH (for timeslot 0)

SCPI Commands:

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5[:TYPE]?

Trigger Key

Press this softkey to select the front panel **Trigger** key as the pattern trigger for a single output of a modulated data transmission that is not framed (**Data Format Pattern Framed** is set to **Pattern**) or select the **Trigger** key as the frame trigger for a single output of your framed data. Once selected, you can trigger a single event at any time by pressing the **Trigger** key.

Softkey Location: Press **Mode**, **PDC**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Trigger Key**
or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Trigger Key**

SCPI Commands:

[:SOURce]:RADio:PDC:TRIGger[:SOURce] KEY

Up Custom

Press this softkey to select an uplink custom timeslot type for the active timeslot. An uplink custom timeslot is configured using an internally-generated data pattern, a downloaded sequence of bits stored in a user file, or by supplying external data. Uplink timeslots cannot be mixed with downlink timeslots. If you already have any timeslots designated as downlink, they will be changed to uplink when any other timeslot is designated as uplink. The uplink custom timeslot is provided for users' flexibility but it is not a standard PDC timeslot.

When you have selected **Up Custom** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your configuration.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Up Custom**

SCPI Commands:

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5[:TYPE] UCUStom

Up TCH

Press this softkey to select uplink traffic channel (mobile to base station) as the timeslot type for the active timeslot. Uplink timeslots cannot be mixed with downlink timeslots. If you already have any timeslots designated as downlink, they will be changed to uplink when any other timeslot is designated as uplink.

When you select **Up TCH** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Up TCH**

SCPI Commands:

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5[:TYPE] UTCH

Up TCH All

Press this softkey to select uplink traffic channel (mobile to base station) as the timeslot type for all timeslots.

When you select **Up TCH All**, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Up TCH All**

SCPI Commands:

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5[:TYPE] UTCH_ALL

Up VOX

Press this softkey to select uplink voice activated transmission channel as the timeslot type for the active timeslot.

When you select **Up VOX** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Up VOX**

SCPI Commands:

[:SOURce]:RADio:PDC:SLOT0|[1]|2|3|4|5[:TYPE] UVOX

User File

Press this softkey to display the catalog of binary files stored in the signal generator's memory. You can select a custom file from this catalog for your data pattern. Scroll through the listed files and when your selection is highlighted, press the **Select File** softkey. If you have selected **User File** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **`UserFile`** is displayed in the **`Data`** field in the top line of the text area of the display. If you have selected **User File** for configuring timeslot data fields, the file name you selected is displayed in the **`Data`** field or the **`TCH`** field, both of which are located near the bottom of the text area of the display.

User's files should exactly fill the data fields in a framed transmission. (Create the files to fill an integer number of frames.) If the end of the user's file does not coincide with the end of a frame, data will be truncated in one of the following ways:

- Enough frames will be generated to transmit as much of the data pattern as will fit into complete frames. The remaining bits of the data pattern (which are too few to completely fill a frame) are truncated.
- If two files of unequal sizes are selected for the same framed transmission, enough frames will be generated to transmit as much of the data pattern of the largest file as will fit into complete frames. The remaining bits of the data pattern are truncated. The smaller file will be repeated as many times as necessary to completely fill these frames. Data will be truncated for the smaller file to coincide with the end of the last frame.
- If a user's file and a PN9 or PN15 file are selected for the same framed transmission and the user's file is shorter than the PN9/15, enough frames will be generated to transmit the PN9/15. The end of the PN9/15 data will coincide with the end of the last frame. The smaller user's file will be repeated as many times as necessary to completely fill these frames. Data will be truncated for the smaller file to coincide with the end of the last frame.
- If a user's file and a PN9 file are selected for the same framed transmission and the user's file is longer than the PN9, enough frames will be generated to transmit as much of the data pattern as will fit into complete frames. The remaining bits of the data pattern (which are too few to completely fill a frame) are truncated. The PN9 data will be repeated as many times as necessary to completely fill these frames.

Softkey Location: Press **Mode**, **PDC**, **Data**, **User File**
or press **Mode**, **PDC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up TCH**, **TCH**, **User File**

User File is also located in the Configure Down Custom and Configure Up Custom menus, and in the TCH menu found in the Configure Down TCH menu.

Mode - PHS

Pressing this softkey reveals a menu of softkeys for generating data patterns that are formatted into a framed structure (where the data bits are located in fields defined by the PHS protocol) or for generating just the data pattern where the data sequence can be output a single time or repeatedly. These softkeys are described in this section in alphabetical order.

4 1's & 4 0's

Press this softkey to select a binary data pattern that consists of four ones followed by four zeroes. If you have selected **4 1's & 4 0's** in a pattern data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P4** (where "P" refers to Pattern and "4" refers to four ones and four zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **4 1's & 4 0's** in a framed data transmission, both the **TCH** and the **Other Patterns** softkeys will show this selection. Also, **P4** is displayed in either the **Data** field or the **TCH** field, both of which are located near the bottom of the text area of the display. A single output of a framed P4 data pattern consists of enough repetitions of four ones followed by four zeroes, followed by four ones and four zeroes, and so on, until the data fields in the timeslot are filled.

Softkey Location: Press **Mode**, **PHS**, **Data**, **Other Patterns**, **4 1's & 4 0's**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**, **TCH**, **Other Patterns**, **4 1's & 4 0's**

4 1's & 4 0's is also located in the Other Patterns menus found in the uplink and downlink Configure Custom menus and the uplink Configure TCH menu.

SCPI Commands:

[:SOURce]:RADio:PHS:DATA P4

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:CUSTom P4

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:TCHannel[:TCHannel] P4

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:CUSTom P4

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:TCHannel[:TCHannel] P4

8 1’s & 8 0’s

Press this softkey to select a binary data pattern that consists of eight ones followed by eight zeroes. If you have selected **8 1’s & 8 0’s** in a pattern data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P8** (where “P” refers to Pattern and “8” refers to eight ones and eight zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **8 1’s & 8 0’s** in a framed data transmission, both the **TCH** and the **Other Patterns** softkeys will show this selection. Also, **P8** is displayed in either the **Data** field or the **TCH** field, both of which are located near the bottom of the text area of the display. A single output of a framed P8 data pattern consists of enough repetitions of eight ones followed by eight zeroes, followed by eight ones and eight zeroes, and so on, until the data fields in the timeslot are filled.

Softkey Location: Press **Mode**, **PHS**, **Data**, **Other Patterns**, **8 1’s & 8 0’s**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**, **TCH**, **Other Patterns**, **8 1’s & 8 0’s**

8 1’s & 8 0’s is also located in the Other Patterns menus found in the uplink and downlink Configure Custom menus and the uplink Configure TCH menu.

SCPI Commands:

[:SOURce]:RADio:PHS:DATA P8

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:CUSTom P8

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:TCHannel[:TCHannel] P8

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:CUSTom P8

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:TCHannel[:TCHannel] P8

16 1’s & 16 0’s

Press this softkey to select a binary data pattern that consists of sixteen ones followed by sixteen zeroes. If you have selected **16 1’s & 16 0’s** in a pattern data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P16** (where “P” refers to Pattern and “16” refers to sixteen ones and sixteen zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **16 1’s & 16 0’s** in a framed data transmission, both the **TCH** and the **Other Patterns** softkeys will show this selection. Also, **P16** is displayed in either the **Data** field or the **TCH** field, both of which are located near the bottom of the text area of the display. A single output of a framed P16 data pattern consists of enough repetitions of sixteen ones followed by sixteen zeroes, followed by sixteen ones and sixteen zeroes, and so on, until the data fields in the timeslot are filled.

Softkey Location: Press **Mode**, **PHS**, **Data**, **Other Patterns**, **16 1’s & 16 0’s** or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**, **TCH**, **Other Patterns**, **16 1’s & 16 0’s**

16 1’s & 16 0’s is also located in the Other Patterns menus found in the uplink and downlink Configure Custom menus and the uplink Configure TCH menu.

SCPI Commands:

[:SOURce]:RADio:PHS:DATA P16

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:CUSTom P16

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:TCHannel[:TCHannel] P16

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:CUSTom P16

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:TCHannel[:TCHannel] P16

32 1’s & 32 0’s

Press this softkey to select a binary data pattern that consists of thirty-two ones followed by thirty-two zeroes. If you have selected **32 1’s & 32 0’s** in a pattern data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P32** (where “P” refers to Pattern and “32” refers to thirty-two ones and thirty-two zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **32 1’s & 32 0’s** in a framed data transmission, both the **TCH** and the **Other Patterns** softkeys will show this selection. In addition, **P32** is displayed in either the **Data** field or the **TCH** field, both of which are located near the bottom of the text area of the display. A single output of a framed P32 data pattern consists of enough repetitions of thirty-two ones followed by thirty-two zeroes, followed by thirty-two ones and thirty-two zeroes, and so on, until the data fields in the timeslot are filled.

Softkey Location: Press **Mode**, **PHS**, **Data**, **Other Patterns**, **32 1’s & 32 0’s** or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**, **TCH**, **Other Patterns**, **32 1’s & 32 0’s**

32 1’s & 32 0’s is also located in the Other Patterns menus found in the uplink and downlink Configure Custom menus and the uplink Configure TCH menu.

SCPI Commands:

[:SOURce]:RADio:PHS:DATA P32

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:CUSTom P32

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:TCHannel[:TCHannel] P32

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:CUSTom P32

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:TCHannel[:TCHannel] P32

64 1’s & 64 0’s

Press this softkey to select a binary data pattern that consists of sixty-four ones followed by sixty-four zeroes. If you have selected **64 1’s & 64 0’s** in a pattern data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P64** (where “P” refers to Pattern and “64” refers to sixty-four ones and sixty-four zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **64 1’s & 64 0’s** in a framed data transmission, both the **TCH** and the **Other Patterns** softkeys will show this selection. In addition, **P64** is displayed in either the **Data** field or the **TCH** field, both of which are located near the bottom of the text area of the display. A single output of a framed P64 data pattern consists of enough repetitions of sixty-four ones followed by sixty-four zeroes, followed by sixty-four ones and sixty-four zeroes, and so on, until the data fields in the timeslot are filled.

Softkey Location: Press **Mode**, **PHS**, **Data**, **Other Patterns**, **64 1’s & 64 0’s** or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**, **TCH**, **Other Patterns**, **64 1’s & 64 0’s**

64 1’s & 64 0’s is also located in the Other Patterns menus found in the uplink and downlink Configure Custom menus and the uplink Configure TCH menu.

SCPI Commands:

[:SOURce]:RADio:PHS:DATA P64

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:CUSTom P64

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:TCHannel[:TCHannel] P64

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:CUSTom P64

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:TCHannel[:TCHannel] P64

All Timeslots

Press this softkey to output a 1-bit pulse to the EVENT 1 rear panel connector that is synchronized to the first bit of each timeslot in a frame. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **All Timeslots**

SCPI Commands:

[:SOURce]:RADio:PHS:SOUT ALL

BBG Data Clock Ext Int

Press this softkey to select the internal data clock for the baseband generator or to select an externally-supplied data clock. A data clock or symbol clock input must be supplied when external mode is selected. For more information on input and output signals, refer to Chapter 7, “Operation”.

Softkey Location: Press **Mode**, **PHS**, **More (1 of 2)**, **Configure Hardware**, **BBG Data Clock Ext Int**

Status after Normal Preset: Int

SCPI Commands:

[:SOURce]:RADio:PHS:BBCLock INT[1]|EXTernal[1]

[:SOURce]:RADio:PHS:BBCLock?

Begin Frame

Press this softkey to output a 1-bit pulse to the EVENT 1 rear panel connector that is synchronized to the first bit of the first frame. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified. The number of trigger pulses generated depends on the framed data patterns selected:

- If a PN9 or PN15 data pattern is selected, a single frame is generated. The data fields of the frame are filled sequentially with the PRBS data. The synchronizing pulse occurs at the beginning of the frame each time it is transmitted.
- Any combination of external data and a PN9 data pattern will cause 511 frames to be generated. The synchronizing pulse occurs at the beginning of the first of the 511 frames each time that frame is transmitted.
- Any combination of external data and a PN15 data pattern will cause a discontinuous PN15. A discontinuous PN15 pattern consists of as many complete frames of PN15 data as can be generated. The remaining bits that do not completely fill a frame are truncated. The synchronizing pulse occurs at the beginning of the first frame each time that frame is transmitted.
- Any combination of user’s files and a PN15 data pattern will cause a discontinuous PN15. The synchronizing pulse occurs at the beginning of the first frame each time that frame is transmitted.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **Begin Frame**

SCPI Commands:

[:SOURce]:RADio:PHS:SOUT FRAME

Begin Pattern

Press this softkey to output a 1-bit pulse to the EVENT 1 rear panel connector that is synchronized to the first bit of your unframed data pattern (**Data Format Pattern Framed** is set to **Pattern**), and for each repetition of the pattern. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified.

Softkey Location: Press **Mode**, **PHS**, **More (1 of 2)**, **Sync Out**, **Begin Pattern**

SCPI Commands:

[:SOURce]:RADio:PHS:SOUT FRAME

Begin Timeslot

Press this softkey to output a 1-bit signal to the EVENT 1 rear panel connector that is synchronized to the first bit of a selected timeslot. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified. Select the timeslot by pressing **Begin Timeslot**. The timeslot number for the synchronization signal becomes the active function. Enter a value using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **Begin Timeslot**

SCPI Commands:

[:SOURce]:RADio:PHS:SOUT SLOT

[:SOURce]:RADio:PHS:SOUT:SLOT <value>

[:SOURce]:RADio:PHS:SOUT:SLOT?

Bit Rate

There are two softkeys named **Bit Rate**. The first is a menu key (distinguished by an arrow pointing to the right). Pressing this softkey reveals a menu of choices for setting the transmission bit rate. In this menu, there is another softkey named **Bit Rate**. Press this softkey to set the bit rate to any value from 320.000 kbps through 605.000 kbps. Enter the desired value using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Mbps**, **kbps**, or **bps** terminator softkey.

Softkey Location: Press **Mode**, **PHS**, **More (1 of 2)**, **Modify Standard**, **Bit Rate**
or press **Mode**, **PHS**, **More (1 of 2)**, **Modify Standard**, **Bit Rate**, **Bit Rate**

Status after Normal Preset: 384.000 kbps

SCPI Commands:

[:SOURce]:RADio:PHS:BRATe <value>

[:SOURce]:RADio:PHS:BRATe?

Burst Shape

Pressing this softkey reveals a menu of choices for modifying the burst shape of the framed data. In this menu, you can change the rise and fall time of the burst, in bits, and you can change the rise and fall delay of the burst, in bits. A softkey is also provided to return the default burst shape values.

Softkey Location: Press **Mode**, **PHS**, **More (1 of 2)**, **Modify Standard**, **Burst Shape**

Bus

Press this softkey to use the HP-IB as the pattern trigger for a single output of your unframed data pattern or as the frame trigger for a single output of your framed data. Once selected, you can trigger a single event at any time by sending a trigger command over HP-IB (*TRG) or by asserting the HP-IB GET (group execute trigger) line.

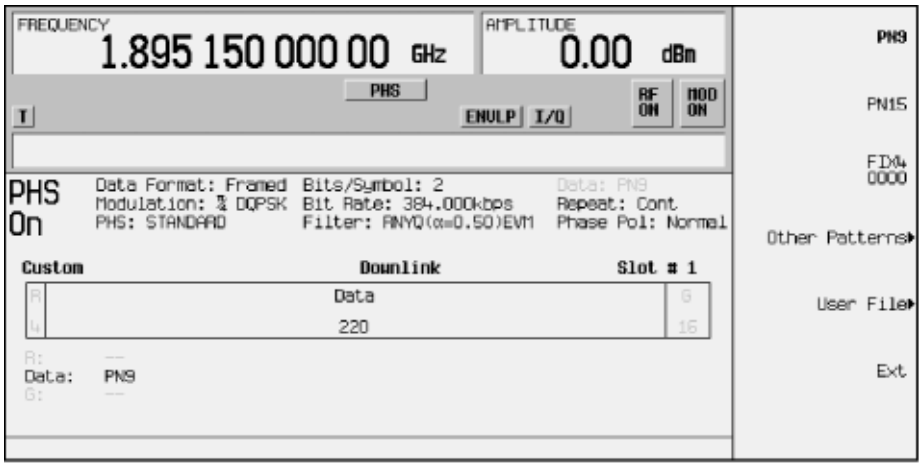
Softkey Location: Press **Mode**, **PHS**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Bus**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Bus**

SCPI Commands:

[:SOURce]:RADio:PHS:TRIGger[:SOURce] BUS

Configure Custom

Pressing this softkey reveals a menu of softkeys for selecting the data pattern for a custom timeslot. The following figure shows an example of display graphics for a downlink custom timeslot. The visual representation of the timeslot shows each field of the custom timeslot.



pk7108a

In this example:

- **R: --** - Ramp time is a 4-bit field. The text in this field is grey, indicating that you cannot change the contents of the ramp time field.
- **Data: PN9** - Indicates that the data selection for this custom timeslot is PN9. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.
- **G: --** - Guard time is a 16-bit field. The text in this field is grey, indicating that you cannot change the contents of the guard time field.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Custom**, **Configure Custom**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Control Channel Dnlink Uplink**, **Timeslot Type**, **Custom**, **Configure Custom**

SCPI Commands:

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:CUSTom?

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:CUSTom?

Configure Frame

Pressing this softkey reveals a menu for enabling scramble capability and setting the scramble seed.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Frame**

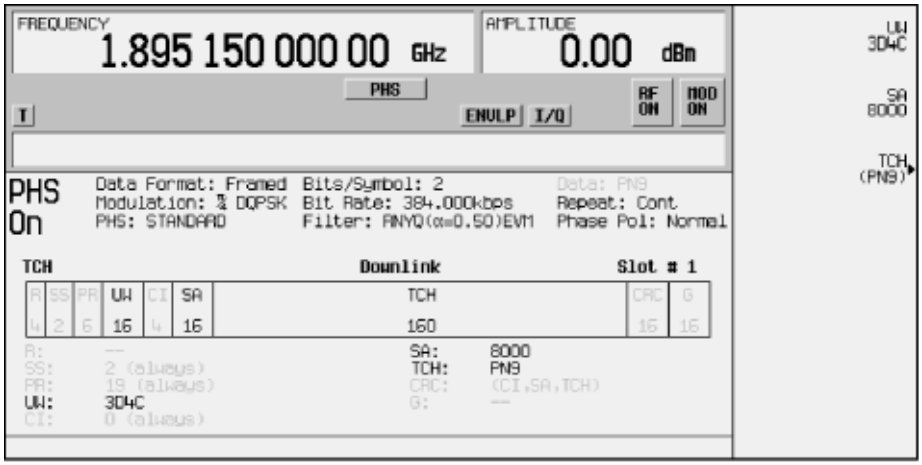
Configure Hardware

Pressing this softkey reveals a menu that allows you to set or select a particular latch or hardware configuration to meet your specific needs.

Softkey Location: Press **Mode**, **PHS**, **More (1 of 2)**, **Configure Hardware**

Configure TCH

Pressing this softkey reveals a menu of softkeys for configuring a timeslot as a traffic channel. The following figure shows an example of display graphics for a downlink traffic channel timeslot. (The uplink traffic channel timeslot is not identical.) The visual representation of the timeslot shows each field of the timeslot as it is defined by the PHS standard.



pk7109a

In this example:

- **R: --** - Ramp time is a 4-bit field. The text in this field is grey, indicating that you cannot change the contents of the ramp time field.

- **SS: 2 (always)** - The start symbol is a 2-bit field. The text in this field is grey, indicating that you cannot change the contents of the start symbol field.
- **PR: 19(always)** - The preamble is a 6-bit field. The text in this field is grey, indicating that you cannot change the contents of the preamble field.
- **UW: 3D4C** - Indicates that the unique word is set to hexadecimal 3D4C. Press the **UW** softkey in the Configure TCH menu to change the contents of the unique word field.
- **CI: 0(always)** - The channel identifier is a 4-bit field. The text in this field is grey, indicating that you cannot change the contents of the channel identifier field.
- **SA: 8000** - Indicates that the slow associated control channel is set to hexadecimal 8000. Press the **SA** softkey in the Configure TCH menu to change the contents of the slow associated control channel field.
- **TCH: PN9** - Indicates that the data selection for this traffic channel is PN9. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.
- **CRC: (CI, SA, TCH)** - Indicates that a cyclic redundancy check is performed on the channel identifier, the slow associated control channel, and the data fields. The text in this field is grey, indicating that you cannot change the CRC.
- **G: --** - Guard time is a 16-bit field. The text in this field is grey, indicating that you cannot change the contents of the guard time field.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Control Channel Dnlink Uplink**, **Configure TCH**

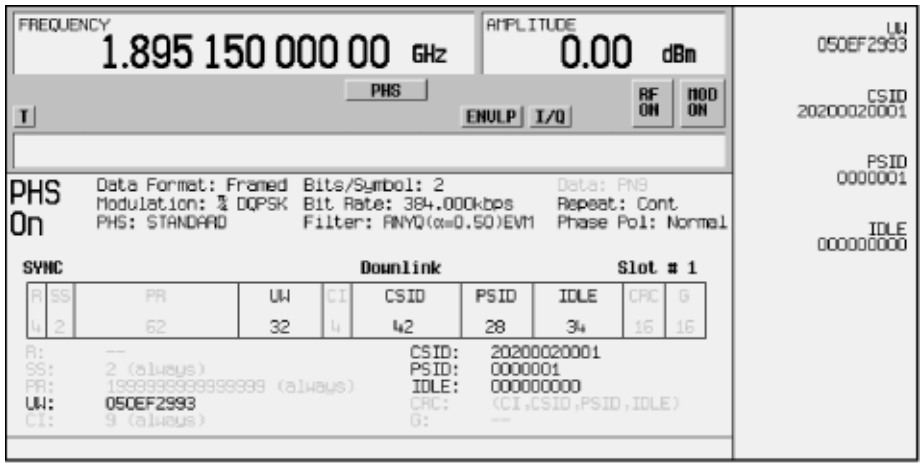
Configure Timeslot

Pressing this softkey reveals a menu of choices for configuring the timeslots. In this menu, configure the timeslots as uplink or downlink. Select which timeslots to turn on and choose from traffic channel, synchronization burst, and custom burst. Then use the subsequent menus to configure the timeslots. Scramble capability is also available in this menu. This softkey is inactive until you set **Data Format Pattern Framed** to **Framed**.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**

Configure SYNC

Pressing this softkey reveals a menu of softkeys for configuring a timeslot as a synchronization burst. The following figure shows an example of display graphics for a downlink synchronization burst timeslot. (The uplink synchronization burst timeslot is not identical.) The visual representation of the timeslot shows each field of the timeslot as it is defined by the PHS standard.



pk7110a

In this example:

- **R: --** - Ramp time is a 4-bit field. The text in this field is grey, indicating that you cannot change the contents of the ramp time field.
- **SS: 2 (always)** - The start symbol is a 2-bit field. The text in this field is grey, indicating that you cannot change the contents of the start symbol field.
- **PR: 1999999999999999(always)** - The preamble is a 62-bit field. The text in this field is grey, indicating that you cannot change the contents of the preamble field.
- **UW: 050EF2993** - Indicates that the unique word is set to hexadecimal 050EF2993. Press the **UW** softkey in the Configure SYNC menu to change the contents of the unique word field.
- **CI: 9(always)** - The channel identifier is a 4-bit field. The text in this field is grey, indicating that you cannot change the contents of the channel identifier field.
- **CSID: 20200020001** - Indicates that the cell station identification code is set to hexadecimal 20200020001. Press the **CSID** softkey in the Configure SYNC menu to change the contents of the cell station identification code field.
- **PSID: 0000001** - Indicates that the personal station identification code is set to

hexadecimal 0000001. Press the **PSID** softkey in the Configure SYNC menu to change the contents of the personal station identification code field.

- **`IDLE: 000000000`** - Indicates that the idle bit is set to hexadecimal 000000000. Press the **IDLE** softkey in the Configure SYNC menu to change the contents of the idle bit field.
- **`CRC: (CI, CSID, PSID, IDLE)`** - Indicates that a cyclic redundancy check is performed on the channel identifier, the cell station identification code, the personal station identification code, and the idle bit fields. The text in this field is grey, indicating that you cannot change the CRC.
- **`G: --`** - Guard time is a 16-bit field. The text in this field is grey, indicating that you cannot change the contents of the guard time field.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **SYNC**, **Configure SYNC**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Control Channel Dnlink Uplink**, **Timeslot Type**, **SYNC**, **Configure SYNC**

Control Channel Dnlink Uplink

Press this softkey to toggle between configuring uplink and downlink channels. Select the downlink timeslots, 1 through 4, by pressing **Control Channel Dnlink**. Any changes you make to timeslots will be applied to whichever of these timeslots is turned on. To activate the uplink timeslots, 1 through 4, press **Control Channel Uplink**.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Control Channel Dnlink Uplink**

Status after Normal Preset: Dnlink

CSID

Press this softkey to change the 42-bit cell station identification code (CSID). The preset hexadecimal value (when normal preset is selected) for CSID reflects the PHS standard, however you can enter a new value by pressing this softkey. To enter a value (in hexadecimal), press **CSID**. The CSID value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The current value for CSID is displayed in the **CSID** field near the bottom of the text area of the display.

Status after Factory Preset: 20200020001

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **SYNC**, **Configure SYNC**, **CSID**

CSID is also located in the uplink Configure SYNC menu.

SCPI Commands:

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:SCHannel:CSID <bit_pattern>

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:SCHannel:CSID?

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:SCHannel:CSID <bit_pattern>

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:SCHannel:CSID?

Custom

Press this softkey to select a custom timeslot type for the active timeslot. A custom timeslot is configured using an internally-generated data pattern, a downloaded sequence of bits stored in a user file, or by supplying external data. The custom timeslot is provided for users' flexibility but it is not a standard PHS timeslot type.

When you have selected **Custom** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your configuration.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Custom**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Control Channel Dnlink Uplink**, **Timeslot Type**, **Custom**

SCPI Commands:

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4[:TYPE] CUSTom

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4[:TYPE] CUSTom

Data

Pressing this softkey reveals a menu of choices for internal data generation (PN9, PN15, fixed 4-bit repeating sequences, set patterns of ones and zeroes) or you can choose to supply your own data (download a binary file or input data using the DATA INPUT connector). This softkey is available in the PHS menu to select a data pattern for modulated transmissions that are not framed. With **PHS Off On** set to **On** and **Data Format Pattern Framed** set to **Pattern**, the signal generator then outputs either a single occurrence (**Pattern Repeat Single**) or a continuous stream (**Pattern Repeat Cont**) of your choice of data.

For framed transmissions, use the **TCH** softkey for configuring the traffic channel timeslot data field, or the **Configure Custom** softkey for configuring the custom data field.

Softkey Location: Press **Mode**, **PHS**, **Data**

Status after Normal Preset: PN9

SCPI Commands:

[:SOURce]:RADio:PHS:DATA?

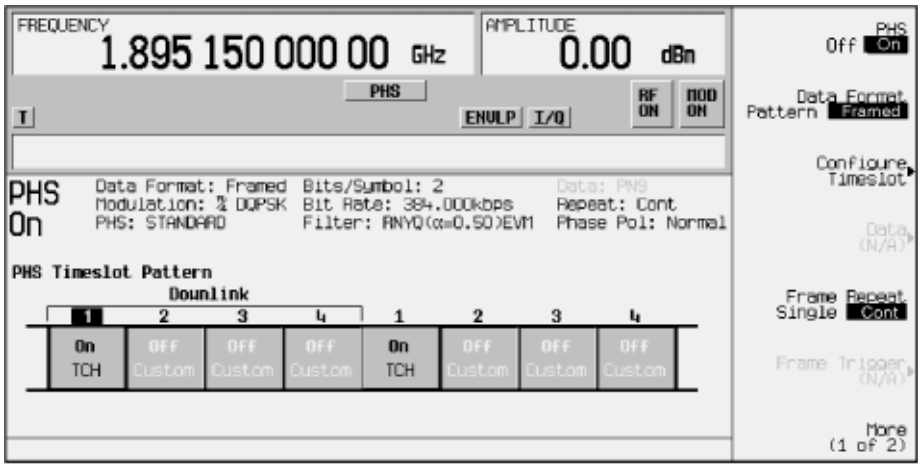
[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:TCHannel[:TCHannel]?

Data Format Pattern Framed

Press this softkey to toggle between **Data Format Pattern** and **Data Format Framed** modes. When you select **Framed**, you will be transmitting your framed data pattern in a PHS format.

When you select **Data Format Pattern**, you will be transmitting a continuous stream of your selected data pattern. Select the data pattern using the **Data** softkey. The **Data** softkey is activated when you select **Data Format Pattern** and inactivated when you select **Data Format Framed**.

The **Data Format Pattern Framed** softkey is coupled to the **Burst Envelope Off On** softkey in the I/Q menu. At any time that PHS is enabled (**PHS Off On** is set to **On**) and **Data Format Framed** is selected, the **ENVLP** annunciator is turned on in the display (indicating that **Burst Envelope On** is also selected). The following figure shows the display graphics that appear when the PHS menu is accessed, **Data Format Pattern Framed** is set to **Framed**, and you are not configuring a timeslot:



pk7107a

In this example:

- **PHS On** - Indicates that PHS is enabled. This field changes to **PHS Off** when **PHS Off On** is set to **Off**.
- **Data Format: Framed** - Indicates that the data pattern is a framed transmission. This field changes to **Data Format: Pattern** when **Data Format Pattern Framed** is set to **Pattern** indicating that you are transmitting a continuous stream of your selected data pattern.
- **Modulation: π/4DQPSK** - Indicates that π/4DQPSK modulation is being internally generated.
- **PHS: STANDARD** - Indicates that the structure of the PHS transmission follows the standard as defined by the PHS protocol. This field changes to **PHS: MODIFIED** under the following circumstances:
  - filter is NYQ
  - filter alpha is changed
  - bit rate is changed
  - burst shape is changed
  - phase polarity is set to invert
- **Bit/Symbol: 2** - Indicates that 2 bits per symbol are required according to the PHS standard.
- **Bit Rate: 384.000kbps** - The bit rate is set according to the PHS standard. This can be changed in the Bit Rate menu. A * next to the value indicates that it differs from the standard.

- **`Filter: RNYQ (α=0.50)EVM`** - Indicates that root Nyquist filter (root raised cosine) is selected, with an alpha of 0.50, and the filter is set for optimizing error vector magnitude. A * next to the alpha value indicates that it differs from the standard. If you select optimization for adjacent channel power, **`EVM`** toggles to **`ACP`**. This field changes to **`Filter: NYQ(α=0.50)`** if you select the Nyquist filter (raised cosine).
- **`Data: PN9`** - Indicates that a PN9 sequence has been selected for transmitting without framing. In this example, the text in this field is grey, indicating an inactive function (framed mode is on). Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.
- **`Repeat: Cont`** - Indicates that the data pattern repeat is set to continuous mode. If you select single mode, this field changes to **`Repeat: Single`**.
- **`Phase Pol: Normal`** - Indicates the direction of rotation of the phase modulation vector. If you select inverted mode, this field changes to **`Phase Pol: Invert`**.
- The visual representation of the PHS timeslot pattern shows, in this case, that the downlink channel timeslots are active (any configuration changes will apply to the downlink timeslot that is turned on). The timeslot pattern is displayed only when **Data Format Pattern Framed** is set to **Framed**.

To configure the timeslots, press the **Configure Timeslot** softkey. The **Configure Timeslot** softkey is activated when you select **Data Format Framed** and is inactivated when you select **Data Format Pattern**.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**

Status after Normal Preset: Pattern

SCPI Commands:

[:SOURce]:RADio:PHS:BURSt[:STATe] ON|OFF|1|0

[:SOURce]:RADio:PHS:BURSt[:STATe]?

Ext

Press this softkey in the data selection menus to select external data. With **Ext** selected, you should apply the data signal to the DATA INPUT connector. If you have selected **Ext** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **Ext** is displayed in the **Data** field in the top line of the text area of the display. If you have selected **Ext** for configuring the timeslot data fields, **EXT** is displayed in either the **Data** field or the **TCH** field, both of which are located near the bottom of the text area of the display. In framed mode, the external data is gated to the data regions of the timeslot.

Another **Ext** softkey is located in the Frame Trigger and Pattern Trigger menus. Press **Ext** in either of these two menus to select external triggering for your data pattern. Apply a TTL input to the rear panel PATTERN TRIG IN connector to trigger your frame or pattern data.

Softkey Location: Press **Mode**, **PHS**, **Data**, **Ext**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**, **TCH**, **Ext**
or press **Mode**, **PHS**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Ext**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Ext**

Ext is also located in the Data menu found in the uplink Configure TCH menu and in the downlink and uplink Configure Custom menus.

SCPI Commands:

[:SOURce]:RADio:PHS:DATA EXTernal

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:CUSTom EXTernal

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:TCHannel[:TCHannel] EXTernal

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:CUSTom EXTernal

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:TCHannel[:TCHannel] EXTernal

[:SOURce]:RADio:PHS:TRIGger[:SOURce] EXTernal

Ext Data Clock Normal Symbol

Press this softkey to toggle the external data clock use between **Normal** and **Symbol**. When you select **Normal**, you must supply a signal (either a clock or a pulse) to the DATA CLOCK INPUT connector to clock the DATA and SYMBOL SYNC signals. (An unlock will occur if external data is selected and these signals are not supplied.) When you select **Symbol**, no signal is required at the DATA CLOCK INPUT connector. Instead, the data is clocked on both the rising and falling edges of the SYMBOL SYNC signal.

Softkey Location: Press **Mode**, **PHS**, **More (1 of 2)**, **Configure Hardware**, **Ext Data Clock Normal Symbol**

Status after Normal preset: Normal

SCPI Commands:

[:SOURce]:RADio:PHS:EDCLock SYMBol|NORMal

[:SOURce]:RADio:PHS:EDCLock?

Ext Delay Bits

Press this softkey to specify the number of bits for the external trigger delay. When **Ext Delay Off On** is set to **On**, a value greater than 0 will delay the transmission of the triggered data after the external trigger event by the number of bits specified. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. The range of values allowed is 0 through 65,535 bits. This softkey is inactive until the trigger selection is set to **Ext**.

Softkey Location: Press **Mode**, **PHS**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Ext**, **Ext Delay Bits**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Ext**, **Ext Delay Bits**

Status after Normal Preset: 0

SCPI Commands:

[:SOURce]:RADio:PHS:TRIGger[:SOURce]:EXTernal:DELay <value>

[:SOURce]:RADio:PHS:TRIGger[:SOURce]:EXTernal:DELay?

Ext Delay Off On

Press this softkey to toggle the external trigger delay on and off. When this function is turned on, the transmission of the triggered data will be delayed after the external trigger event by the number of bits specified by the **Ext Delay Bits** softkey. This function is only available when the trigger selection is set to **Ext**.

Softkey Location: Press **Mode**, **PHS**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Ext**, **Ext Delay Off On**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Ext**, **Ext Delay Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:RADio:PHS:TRIGger[:SOURce]:EXTernal:DELay:STATe ON|OFF|1|0

[:SOURce]:RADio:PHS:TRIGger[:SOURce]:EXTernal:DELay:STATe?

Fall Delay

Press this softkey to change the shape of the bursted RF signal by entering a falling edge delay. To change the fall delay, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0 through 63.50 bits.

Softkey Location: Press **Mode**, **PHS**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Fall Delay**

Status after Normal Preset: 8.50 bits

SCPI Commands:

[:SOURce]:RADio:PHS:BURSt:SHAPe:FALL:DELay <value>

[:SOURce]:RADio:PHS:BURSt:SHAPe:FALL:DELay?

[:SOURce]:RADio:PHS:BURSt:SHAPe:FDELay <value>

[:SOURce]:RADio:PHS:BURSt:SHAPe:FDELay?

Fall Time

Press this softkey to change the shape of the bursted RF signal by entering a falling edge time. To change the fall time, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0.40 through 30 bits.

Softkey Location: Press **Mode**, **PHS**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Fall Time**

Status after Normal Preset: 4.54 bits

SCPI Commands:

[:SOURce]:RADio:PHS:BURSt:SHAPe:FALL:TIME <value>

[:SOURce]:RADio:PHS:BURSt:SHAPe:FALL:TIME?

[:SOURce]:RADio:PHS:BURSt:SHAPe:FTIMe <value>

[:SOURce]:RADio:PHS:BURSt:SHAPe:FTIMe?

Filter

Pressing this softkey reveals a menu of choices for changing the filter selection between root Nyquist (root raised cosine) and Nyquist (raised cosine), for changing the default filter alpha, and for restoring the default filter alpha.

Softkey Location: Press **Mode**, **PHS**, **(More 1 of 2)**, **Modify Standard**, **Filter**

Filter Alpha

Press this softkey to change the filter alpha parameter. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. The range of values allowed is 0.30 through 0.60.

Softkey Location: Press **Mode**, **PHS**, **(More 1 of 2)**, **Modify Standard**, **Filter**, **Filter Alpha**

Status after Normal Preset: 0.50

SCPI Commands:

[:SOURce]:RADio:PHS:ALPHa <value>

[:SOURce]:RADio:PHS:ALPHa?

Filter RNYQ NYQ

Press this softkey to toggle the filter selection between Root Nyquist (root raised cosine) and Nyquist (raised cosine). Notice that your filter selection is shown on the display in the **Filter** field.

Softkey Location: **Mode**, **PHS**, **More (1 of 2)**, **Modify Standard**, **Filter**, **Filter RNYQ NYQ**

Status after Normal Preset: RNYQ

SCPI Commands:

[:SOURce]:RADio:PHS:FILTer RNYQuist|NYQuist

[:SOURce]:RADio:PHS:FILTer?

FIX4

Press this softkey to select a 4-bit repeating sequence data pattern. Press **FIX4** and the 4-bit pattern becomes the active function. Enter your desired 4-bit pattern using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. If you have selected **FIX4** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **FIX4** is displayed in the **Data** field in the top line of the text area of the display. If you have selected **FIX4** for configuring the timeslot data fields, your 4-bit pattern is displayed in either the **Data** field or the **TCH** field, both of which are located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **PHS**, **Data**, **FIX4**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**, **TCH**, **FIX4**

FIX4 is also located in the Data menu found in the uplink Configure TCH menu and in the downlink and uplink Configure Custom menus.

Status after Normal Preset: 0000

SCPI Commands:

[:SOURce]:RADio:PHS:DATA FIX4

[:SOURce]:RADio:PHS:DATA:FIX4 <0-15>

[:SOURce]:RADio:PHS:DATA:FIX4?

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:CUSTom FIX4

[:SOURce]:RADio:PHS:DLINK:SLOT[1]|2|3|4:CUSTom:FIX4 <0-15>

[:SOURce]:RADio:PHS:DLINK:SLOT[1]|2|3|4:CUSTom:FIX4?

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:TCHannel[:TCHannel] FIX4

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:TCHannel[:TCHannel]:FIX4 <0-15>

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:TCHannel[:TCHannel]:FIX4?

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:CUSTom FIX4

[:SOURce]:RADio:PHS:ULINK:SLOT[1]|2|3|4:CUSTom:FIX4 <0-15>

[:SOURce]:RADio:PHS:ULINK:SLOT[1]|2|3|4:CUSTom:FIX4?

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:TCHannel[:TCHannel] FIX4

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:TCHannel[:TCHannel]:FIX4 <0-15>

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:TCHannel[:TCHannel]:FIX4?

Frame Repeat Single Cont

Press this softkey to toggle between a single output of framed data and continuous transmission of frames. Selecting **Single** will output the following sequences:

- 4-Bit Patterns (FIX4) - A single frame is generated. The 4-bit pattern repeats until the data fields are completely filled. Each trigger transmits the same frame.
- Other Patterns (fixed patterns of equal quantities of ones and zeroes) - A single frame is generated. The selected pattern repeats until the data fields are completely filled. Each trigger transmits the same frame.
- PN9 - A single frame is generated. The data fields are filled with the leading bits of the PN9 sequence. A trigger causes the frame to be transmitted. The data fields of this frame are then filled sequentially with the next series of PN9 data bits. A trigger causes the frame to be transmitted. This process continues, transmitting the entire PN9 sequence frame by frame. The last bit of the PN9 sequence in a data field is immediately followed by the first bit of a second PN9 sequence.
- PN15 - A single frame is generated. The data fields are filled with the leading bits of the PN15 sequence. A trigger causes the frame to be transmitted. The data fields of this frame are then filled sequentially with the next series of PN15 data bits. A trigger causes the frame to be transmitted. This process continues, transmitting the entire PN15 sequence frame by frame. The last bit of the PN15 sequence in a data field is immediately followed by the first bit of a second PN15 sequence.
- User File - The user's file should have the appropriate data to fill an integer number of timeslots. If not, the remaining bits are truncated. Depending on the size of the file, more than one frame can possibly be generated.
- External Data - External data is clocked into the data fields of the timeslot. A single frame is generated.

Combinations of these data patterns may cause some patterns to be truncated. Refer to Chapter 7, "Operation" for the details of the data dependencies.

Selecting **Cont** with framed data causes the frames to be transmitted continuously.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**

Status after Normal Preset: Continuous

SCPI Commands:

[:SOURce]:RADio:PHS:REPeat SINGle|CONTinuous

[:SOURce]:RADio:PHS:REPeat?

Frame Trigger

Pressing this softkey reveals a menu of choices for triggering your framed pattern. You can choose to trigger using the front panel **Trigger** key, an external trigger supplied to the PATTERN TRIG IN connector, or by a *TRG command or GET (group execute trigger) signal sent over HP-IB. This softkey is inactive until **Data Format Pattern Framed** is set to **Framed** and **Frame Repeat Single Cont** is set to **Single**.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**

Status after Normal Preset: Trigger Key

SCPI Commands:

[:SOURce]:RADio:PHS:TRIGger[:SOURce]?

Goto Bottom Row

Press this softkey to move the selection bar to the bottom row of file names in the Goto Row menu that is accessed from the User File menu.

Softkey Location: Press **Mode**, **PHS**, **Data**, **User File, Goto Row**, **Goto Bottom Row** or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**, **TCH**, **User File**, **Goto Row**, **Goto Bottom Row**

Goto Middle Row

Press this softkey to move the selection bar to the middle row of file names in the Goto Row menu that is accessed from the User File menu.

Softkey Location: Press **Mode**, **PHS**, **Data**, **User File, Goto Row**, **Goto Middle Row** or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**, **TCH**, **User File**, **Goto Row**, **Goto Middle Row**

Goto Row

Pressing this softkey reveals a menu of softkeys that help you move the selection bar through the rows of file names in the User File menu. You can also go to a specific row by rotating the front panel knob, using the up and down arrow keys, or entering the row number with the numeric keypad. Once the desired row number is displayed, press the **Enter** terminator softkey.

Softkey Location: Press **Mode**, **PHS**, **Data**, **User File, Goto Row** or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**, **TCH**, **User File**, **Goto Row**

Goto Top Row

Press this softkey to move the selection bar to the top row of file names in the Goto Row menu that is accessed from the User File menu.

Softkey Location: Press **Mode**, **PHS**, **Data**, **User File, Goto Row**, **Goto Top Row** or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**, **TCH**, **User File**, **Goto Row**, **Goto Top Row**

IDLE

Press this softkey to change the 34-bit idle message (IDLE). The preset hexadecimal value (when normal preset is selected) for IDLE reflects the PHS standard, however you can enter a new value by pressing this softkey. To enter a value (in hexadecimal), press **IDLE**. The IDLE value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The current value for IDLE is displayed in the **IDLE** field near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **SYNC**, **Configure SYNC**, **IDLE** or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Control channel Dnlink Uplin**k, **Timeslot Type**, **SYNC**, **Configure SYNC**, **IDLE**

Status after Normal Preset: 000000000

SCPI Commands:

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:SCHannel:IDLE <bit_pattern>

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:SCHannel:IDLE?

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:SCHannel:IDLE <bit_pattern>

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:SCHannel:IDLE?

Modify Standard

Pressing this softkey reveals a menu of choices for modifying the standard transmission in the following ways:

- changing the filter from root Nyquist to Nyquist
- changing the filter alpha
- changing the transmission bit rate
- changing the burst rising edge time and delay
- changing the burst falling edge time and delay
- inverting the phase polarity

Softkey Location: Press **Mode**, **PHS**, **(More 1 of 2)**, **Modify Standard**

Optimize RNYQ For EVM ACP

Press this softkey to optimize the root Nyquist filter for minimized error vector magnitude (select **EVM**) or for minimized adjacent channel power (select **ACP**). The EVM selection provides the most ideal passband. The ACP selection improves stopband rejection.

Softkey Location: Press **Mode**, **PHS**, **(More 1 of 2)**, **Configure Hardware**, **Optimize RNYQ For EVM ACP**

Status after Normal Preset: EVM

SCPI Commands:

[:SOURce]:RADio:PHS:CHANnel EVM|ACP

[:SOURce]:RADio:PHS:CHANnel?

Other Patterns

Pressing this softkey reveals a menu of data pattern selections. Each of the selections in this menu is a pattern of equal quantities of ones and zeroes (such as four ones and four zeroes).

Softkey Location: Press **Mode**, **PHS**, **Data**, **Other Patterns**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**, **TCH**, **Other Patterns**

Other Patterns is also located in the Data menu found in the uplink Configure TCH menu and in the downlink and uplink Configure Custom menus.

Page Down

Press this softkey to move down one page at a time in the displayed catalog of files.

Softkey Location: Press **Mode**, **PHS**, **Data**, **User File**, **Page Down**
or press **Mode**, **PHS**, **Data**, **User File**, **Goto Row**, **Page Down**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**, **TCH**, **User File**, **Page Down**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**, **TCH**, **User File**, **Goto Row**, **Page Down**

Page Down is also located in the User File menus found in the Data menu, the uplink Configure TCH menu, and in the downlink and uplink Configure Custom menus.

Page Up

Press this softkey to move up one page at a time in the displayed catalog of files.

Softkey Location: Press **Mode**, **PHS**, **Data**, **User File**, **Page Up**
or press **Mode**, **PHS**, **Data**, **User File**, **Goto Row**, **Page Up**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**, **TCH**, **User File**, **Page Up**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**, **TCH**, **User File**, **Goto Row**, **Page Up**

Page Up is also located in the User File menus found in the Data menu, the uplink Configure TCH menu, and in the downlink and uplink Configure Custom menus.

Pattern Repeat Single Cont

Set this softkey to **Single** to output one occurrence of a modulated data pattern that is not framed. Select the trigger event for the output using the **Pattern Trigger** softkey. Toggle to **Cont** to output a continuous stream of your data pattern.

Softkey Location: Press **Mode**, **PHS**, **Pattern Repeat Single Cont**

Status after Normal Preset: Continuous

SCPI Commands:

[:SOURce]:RADio:PHS:REPeat SINGle|CONTinuous

[:SOURce]:RADio:PHS:REPeat?

Pattern Trigger

Pressing this softkey reveals a menu of choices for triggering a modulated data pattern that is not framed. You can choose to trigger using the front panel **Trigger** key, an external trigger supplied to the PATTERN TRIG IN connector, or by a *TRG command or GET (group execute trigger) signal sent over HP-IB. This softkey is inactive until **Pattern Repeat Single Cont** is set to **Single**.

Softkey Location: Press **Mode**, **PHS**, **Pattern Repeat Single Cont**, **Pattern Trigger**

Status after Normal Preset: Trigger Key

SCPI Commands:

[:SOURce]:RADio:PHS:TRIGger[:SOURce]?

Phase Polarity Normal Invert

Press this softkey to reverse the direction of rotation of the phase modulation vector. Choose **Invert** and the in-phase component will lag the quadrature-phase component by 90° in the resulting modulation. The inverted selection also applies to the I OUT and Q OUT signals.

Softkey Location: Press **Mode**, **PHS**, **More (1 of 2)**, **Modify Standard**, **Phase Polarity Normal Invert**

Status after Normal Preset: Normal

SCPI Commands:

[:SOURce]:RADio:PHS:POLarity[:ALL] NORMal|INVerted

[:SOURce]:RADio:PHS:POLarity[:ALL]?

PHS Off On

Press this softkey to enable the PHS communications standard. Setting **PHS Off On** to **On** sets up the internal hardware to generate the structure that follows the PHS standard. The internal I/Q modulator generates π/4DQPSK digital modulation and the **PHS** and **I/Q** annunciators are turned on in the display. Although the digital modulation is enabled with this softkey, the RF carrier is modulated by the enabled modulation only when you have also set **Mod On/Off** to **On**.

Setting **PHS Off On** to **On** presets the following softkeys in the I/Q menu: **I/Q Off On** is set to **On** and **I/Q Source** is set to **Int I/Q**. You can override these selections in the I/Q menu.

Softkey Location: Press **Mode**, **PHS**, **PHS Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:RADio:PHS[:STATe] ON|OFF|1|0

[:SOURce]:RADio:PHS[:STATe]?

PN9

Press this softkey to select the PN9 pseudorandom bit pattern. If you have selected **PN9** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **PN9** is displayed in the **Data** field in the top line of the text area of the display. If you have selected **PN9** for configuring the framed timeslot data fields, **PN9** is displayed in the **Data** field or the **TCH** field, both of which are located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **PHS**, **Data**, **PN9**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**, **TCH**, **PN9**

PN9 is also located in the Data menu found in the uplink Configure TCH menu and in the downlink and uplink Configure Custom menus.

SCPI Commands:

[:SOURce]:RADio:PHS:DATA PN9

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:CUSTom PN9

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:TCHannel[:TCHannel] PN9

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:CUSTom PN9

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:TCHannel[:TCHannel] PN9

PN9 Mode Normal Quick
Option 1EH Only

Press this softkey to toggle between normal and quick PN9 modes. A single output of a framed normal PN9 data pattern consists of enough frames so that the end of the PN9 sequence corresponds with the end of a frame. A single output of a framed quick PN9 data pattern consists of one entire PN9 sequence plus enough of a second PN9 sequence to fill the remaining data fields in the current frame. The second PN9 sequence is, therefore, truncated.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **PN9 Mode Normal Quick**

Status after Normal Preset: Normal

SCPI Commands:

[:SOURce]:RADio:PHS:BURSt:PN9 NORMal|QUICk

[:SOURce]:RADio:PHS:BURSt:PN9?

PN15

Press this softkey to select the PN15 pseudorandom bit pattern. If you have selected **PN15** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **PN15** is displayed in the **Data** field in the top line of the text area of the display. If you have selected **PN15** for configuring the framed timeslot data fields, **PN15** is displayed in the **Data** field or the **TCH** field, both of which are located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **PHS**, **Data**, **PN15**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**, **TCH**, **PN15**

PN15 is also located in the Data menu found in the uplink Configure TCH menu and in the downlink and uplink Configure Custom menus.

SCPI Commands:

[:SOURce]:RADio:PHS:DATA PN15

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:CUSTom PN15

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:TCHannel[:TCHannel] PN15

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:CUSTom PN15

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:TCHannel[:TCHannel] PN15

PSID

Press this softkey to change the 28-bit personal station identification code (PSID). The preset hexadecimal value (when normal preset is selected) for PSID reflects the PHS standard, however you can enter a new value by pressing this softkey. To enter a value (in hexadecimal), press **PSID**. The PSID value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The current value for PSID is displayed in the **PSID** field near the bottom of the text area of the display.

Status after Factory Preset: 0000001

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **SYNC**, **Configure SYNC**, **PSID**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Control Channel Dnlink Uplink**, **Timeslot Type**, **SYNC**, **Configure SYNC**, **PSID**

SCPI Commands:

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:SCHannel:PSID <bit_pattern>

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:SCHannel:PSID?

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:SCHannel:PSID <bit_pattern>

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:SCHannel:PSID?

Restore Default Bit Rate

Press this softkey to reset the transmission bit rate to the default value (384.000 kbps). This softkey is a convenience feature for quickly resetting the bit rate. You can also change the bit rate by pressing the **Bit Rate** softkey.

Softkey Location: Press **Mode**, **PHS**, **(More 1 of 2)**, **Modify Standard**, **Bit Rate**, **Restore Default Bit Rate**

Restore Default Burst Shape

Press this softkey to reset the burst shape characteristics to their default values (rise time = 4.98 bits, rise delay = 6.50 bits, fall time = 4.54 bits, fall delay = 8.50 bits). This softkey is a convenience feature for quickly resetting the burst shape. You can also change each of the burst characteristics individually by using the **Rise Time**, **Rise Delay**, **Fall Time**, and **Fall Delay** softkeys in this menu.

Softkey Location: Press **Mode**, **PHS**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Restore Default Burst Shape**

Restore Default Filter Alpha

Press this softkey to reset the filter alpha parameter to its default value (0.50). This softkey is a convenience feature for quickly resetting the filter alpha. You can also change the bit rate by pressing the **Filter Alpha** softkey.

Softkey Location: Press **Mode**, **PHS**, **(More 1 of 2)**, **Modify Standard**, **Filter**, **Restore Default Filter Alpha**

Rise Delay

Press this softkey to change the shape of the bursted RF signal by entering a rising edge delay. To change the rise delay, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0 through 63.50 bits.

Softkey Location: Press **Mode**, **PDC**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Rise Delay**

Status after Normal Preset: 6.50 bits

SCPI Commands:

[:SOURce]:RADio:PHS:BURSt:SHAPe:RISE:DELay <value>

[:SOURce]:RADio:PHS:BURSt:SHAPe:RISE:DELay?

[:SOURce]:RADio:PHS:BURSt:SHAPe:RDELay <value>

[:SOURce]:RADio:PHS:BURSt:SHAPe:RDELay?

Rise Time

Press this softkey to change the shape of the bursted RF signal by entering a rising edge time. To change the rise time, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0.40 through 30 bits.

Softkey Location: Press **Mode**, **PHS**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Rise Time**

Status after Normal Preset: 4.98 bits

SCPI Commands:

[:SOURce]:RADio:PHS:BURSt:SHAPe:RISE:TIME <value>

[:SOURce]:RADio:PHS:BURSt:SHAPe:RISE:TIME?

[:SOURce]:RADio:PHS:BURSt:SHAPe:RTIMe <value>

[:SOURce]:RADio:PHS:BURSt:SHAPe:RTIMe?

SA

Press this softkey to change the 16-bit slow associated control channel (SACCH). The preset hexadecimal value (when normal preset is selected) for SACCH reflects the PHS standard, however you can enter a new value by pressing this softkey. To enter a value (in hexadecimal), press **SA**. The SACCH value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The current value for SACCH is displayed in the **SA** field near the bottom of the text area of the display.

Status after Factory Preset: 8000

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**, **SA**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Control Channel Dnlink Uplink**, **Configure TCH**, **SA**

SCPI Commands:

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:TCHannel:SACChannel <bit_pattern>

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:TCHannel:SACChannel?

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:TCHannel:SACChannel <bit_pattern>

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:TCHannel:SACChannel?

Scramble Off On

Press this softkey to enable the scramble capability. When **Scramble Off On** is set to **On**, the data in the related fields will be scrambled using the seed value set with the **Scramble Seed** softkey.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Frame**, **Scramble Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:RADio:PHS:BURSt:SCRamble[:STATe] ON|OFF|1|0

[:SOURce]:RADio:PHS:BURSt:SCRamble[:STATe]?

Scramble Seed

Press this softkey to set the scramble seed value. The scramble seed specifies the starting point in the PRBS generator for the scramble. To enter a value (in hexadecimal), press **Scramble Seed**. The scramble seed value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The range of values allowed is hexadecimal 000 through 3FF.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Frame**, **Scramble Seed**

Status after Normal Preset: 3FF

SCPI Commands:

[:SOURce]:RADio:PHS:BURSt:SCRamble:SEED <10-bit val>

[:SOURce]:RADio:PHS:BURSt:SCRamble:SEED?

Select File

Press this softkey to select a file in the displayed catalog of binary files. To make your selection, first scroll through the list, using the front panel knob or up and down arrow keys, until the desired file is highlighted. Press **Select File** and the highlighted file is specified as your data selection. If you have selected a custom file as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **`UserFile`** is displayed in the **`Data`** field in the top line of the text area of the display. If you have selected a custom file for configuring timeslot data fields, the file name you selected is displayed in the **`Data`** field or the **`TCH`** field, both of which are located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **PHS**, **Data**, **User File**, **Select File**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**, **TCH**, **User File**, **Select File**

Select File is also located in the User File menus found in the uplink Configure TCH menu and in the downlink and uplink Configure Custom menus.

SCPI Commands:

[:SOURce]:RADio:PHS:DATA “file name”

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:CUSTom “file name”

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:TCHannel[:TCHannel] “file name”

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:CUSTom “file name”

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:TCHannel[:TCHannel] “file name”

SYNC

Press this softkey to select up synchronization burst as the timeslot type for the active timeslot.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **SYNC**, **Configure SYNC**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Control Channel Dnlink Uplink**, **Timeslot Type**, **SYNC**, **Configure SYNC**

SCPI Commands:

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4[:TYPE] SYNC

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4[:TYPE] SYNC

Sync Out

Press this softkey to reveal a menu of choices for outputting a 1-bit synchronization signal to the EVENT 1 rear panel connector. In this menu you can choose to set the synchronization signal to occur at the beginning of a data pattern, at the beginning of a frame, at the beginning of a selected timeslot, or at the beginning of each timeslot in a frame.

Softkey Location: Press **Mode**, **PHS**, **More (1 of 2)**, **Sync Out**

Status after Normal Preset: Begin Pattern

SCPI Commands:

[:SOURce]:RADio:PHS:SOUT?

Sync Out Offset

Press this softkey to move the synchronization signal forward or back from the beginning of the data pattern, frame, or timeslot. To set the number of bits of offset, press **Sync Out Offset** and synchronization offset becomes the active function. Enter the desired value using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. The range of values allowed is –239 through +239 bits.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **Sync Out Offset**

Status after Normal Preset: 0 bits

SCPI Commands:

[:SOURce]:RADio:PHS:SOUT:OFFSet <value>

[:SOURce]:RADio:PHS:SOUT:OFFSet?

TCH

There are two softkeys named **TCH**. The first is a selection in the Timeslot Type menu. Press this softkey to select traffic channel as the timeslot type for the active timeslot. When you have selected **TCH** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your configuration.

The second **TCH** softkey is located in the downlink Configure TCH menu. Pressing this softkey reveals a menu of choices for internal data generation (PN9, PN15, fixed, 4-bit repeating sequences, set patterns of ones and zeroes) or you can choose to supply your own data (download a binary file or input data using the DATA INPUT connector) for configuring the timeslot TCH fields.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**, **TCH**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **TCH**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Control Channel Dnlink Uplink**, **Timeslot Type**, **TCH**

Status after Normal Preset: PN9

SCPI Commands:

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:TCHannel[:TCHannel]?

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4[:TYPE] TCH

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4[:TYPE] TCH

TCH All

Press this softkey to select traffic channel as the timeslot type for all timeslots. (Your selection will apply to all the timeslots in either the uplink or the downlink channel depending on which you have activated with the **Control Channel Dnlink Uplink** softkey.)

When you select **Up TCH All**, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **TCH All**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Control Channel Dnlink Uplink**, **Timeslot Type**, **TCH All**

SCPI Commands:

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4[:TYPE] TCH_ALL

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4[:TYPE] TCH_ALL

Timeslot

Press this softkey to select a timeslot to be configured. Choose any of the four timeslots. (Your selection will apply to the timeslots in either the uplink or the downlink channel depending on which you have activated with the **Control Channel Dnlink Uplink** softkey.) Enter the timeslot number using the front panel knob, the up and down arrow keys, or enter the number using the numeric keypad and press the **Enter** terminator softkey.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot #**

Timeslot Off On

Press this softkey to toggle the active timeslot on and off. For example, to turn on timeslot 2, select the timeslot by pressing the **Timeslot #** softkey in this same menu. Enter the number 2 to make timeslot 2 active. Then turn this timeslot on by toggling **Timeslot Off On** to **On**. Notice that the visual representation of the timeslot pattern now shows timeslot 2 turned on in either the uplink or the downlink channel depending on which you have activated with the **Control Channel Dnlink Uplink** softkey.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Off On**

Status after Normal Preset: On (for timeslot 1)

SCPI Commands:

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:STATe ON|OFF|1|0

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:STATe?

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:STATe ON|OFF|1|0

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:STATe?

Timeslot Type

Pressing this softkey reveals a menu of choices for setting the timeslot type for the active timeslot. You can choose to set any timeslot to be a traffic channel (TCH), synchronization burst (SYNC), or a custom timeslot. When you have selected the type for the timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Control Channel Dnlink Uplink**, **Timeslot Type**

Status after Normal Preset: TCH (for downlink timeslot 1)

SCPI Commands:

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4[:TYPE]?

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4[:TYPE]?

Trigger Key

Press this softkey to select the front panel **Trigger** key as the pattern trigger for a single output of a modulated data transmission that is not framed (**Data Format Pattern Framed** is set to **Pattern**) or select the **Trigger** key as the frame trigger for a single output of your framed data. Once selected, you can trigger a single event at any time by pressing the **Trigger** key.

Softkey Location: Press **Mode**, **PHS**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Trigger Key**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Trigger Key**

SCPI Commands:

[:SOURce]:RADio:PHS:TRIGger[:SOURce] KEY

User File

Press this softkey to display the catalog of binary files stored in the signal generator's memory. You can select a custom file from this catalog for your data pattern. Scroll through the listed files and when your selection is highlighted, press the **Select File** softkey. If you have selected **User File** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **`UserFile`** is displayed in the **`Data`** field in the top line of the text area of the display. If you have selected **User File** for configuring timeslot data fields, the file name you selected is displayed in the **`Data`** field or the **`TCH`** field, both of which are located near the bottom of the text area of the display.

User's files should exactly fill the data fields in a framed transmission. (Create the files to fill an integer number of frames.) If the end of the user's file does not coincide with the end of a frame, data will be truncated in one of the following ways:

- Enough frames will be generated to transmit as much of the data pattern as will fit into complete frames. The remaining bits of the data pattern (which are too few to completely fill a frame) are truncated.
- If two files of unequal sizes are selected for the same framed transmission, enough frames will be generated to transmit as much of the data pattern of the largest file as will fit into complete frames. The remaining bits of the data pattern are truncated. The smaller file will be repeated as many times as necessary to completely fill these frames. Data will be truncated for the smaller file to coincide with the end of the last frame.
- If a user's file and a PN9 or PN15 file are selected for the same framed transmission and the user's file is shorter than the PN9/15, enough frames will be generated to transmit the PN9/15. The end of the PN9/15 data will coincide with the end of the last frame. The smaller user's file will be repeated as many times as necessary to completely fill these frames. Data will be truncated for the smaller file to coincide with the end of the last frame.
- If a user's file and a PN9 file are selected for the same framed transmission and the user's file is longer than the PN9, enough frames will be generated to transmit as much of the data pattern as will fit into complete frames. The remaining bits of the data pattern (which are too few to completely fill a frame) are truncated. The PN9 data will be repeated as many times as necessary to completely fill these frames.

Softkey Location: Press **Mode**, **PHS**, **Data**, **User File**
or press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**, **TCH**, **User File**

User File is also located in the Data menu found in the uplink Configure TCH menu and in the downlink and uplink Configure Custom menus.

UW

Press this softkey to change the unique word (UW). The preset hexadecimal value (when normal preset is selected) for UW reflects the PHS standard, however you can enter a new value by pressing this softkey. To enter a value (in hexadecimal), press **UW**. The UW value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The current value for UW is displayed in the **UW** field near the bottom of the text area of the display.

Status after Factory Preset: 3D4C (downlink TCH), E149 (uplink TCH), 050EF2993 (downlink SYNC), B899AF0 (uplink SYNC)

Softkey Location: Press **Mode**, **PHS**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure TCH**, **UW**

UW is also located in the uplink Configure TCH menu and in the downlink and uplink Configure SYNC menus.

SCPI Commands:

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:SCHannel:UWORd <bit_pattern>

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:SCHannel:UWORd?

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:TCHannel:UWORd <bit_pattern>

[:SOURce]:RADio:PHS:DLINk:SLOT[1]|2|3|4:TCHannel:UWORd?

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:SCHannel:UWORd <bit_pattern>

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:SCHannel:UWORd?

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:TCHannel:UWORd <bit_pattern>

[:SOURce]:RADio:PHS:ULINk:SLOT[1]|2|3|4:TCHannel:UWORd?

Mode - TETRA

Pressing this softkey reveals a menu of softkeys for generating data patterns that are formatted into a framed structure (where the data bits are located in fields defined by the TETRA protocol) or for generating just the data pattern where the data sequence can be output a single time or repeatedly. These softkeys are described in this section in alphabetical order.

4 1's & 4 0's

Press this softkey to select a binary data pattern that consists of four ones followed by four zeroes. If you have selected **4 1's & 4 0's** in a pattern data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P4** (where "P" refers to Pattern and "4" refers to four ones and four zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **4 1's & 4 0's** in a framed data transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. Also, **P4** is displayed in the **Data** field located near the bottom of the text area of the display. A single output of a framed P4 data pattern consists of enough repetitions of four ones followed by four zeroes, followed by four ones and four zeroes, and so on, until the data fields in the timeslot are filled.

Softkey Location: Press **Mode**, **TETRA**, **Data**, **Other Patterns**, **4 1's & 4 0's** or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up Normal**, **Data**, **Other Patterns**, **4 1's & 4 0's**

4 1's & 4 0's is also located in the Other Patterns menus found in every other TETRA configure timeslot type menu.

SCPI Commands:

[:SOURce]:RADio:TETRa:DATA P4

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:CUSTom P4

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCCustom P4

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCNormal[:DATA] P4

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCSync[:DATA] P4

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDCustom[:DATA] P4

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDNormal[:DATA] P4

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDSync[:DATA] P4

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC1[:DATA] P4

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC2[:DATA] P4

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UNORmal[:DATA] P4

8 1’s & 8 0’s

Press this softkey to select a binary data pattern that consists of eight ones followed by eight zeroes. If you have selected **8 1’s & 8 0’s** and the data format is output as a pattern only, not framed data, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P8** (where “P” refers to Pattern and “8” refers to eight ones and eight zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **8 1’s & 8 0’s** and the data format is a framed transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. Also, **P8** is displayed in the **Data** field located near the bottom of the text area of the display. A single output of a framed P8 data pattern consists of enough repetitions of eight ones followed by eight zeroes, followed by eight ones and eight zeroes, and so on, until the data fields in the timeslot are filled.

Softkey Location: Press **Mode**, **TETRA**, **Data**, **Other Patterns**, **8 1’s & 8 0’s** or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up Normal**, **Data**, **Other Patterns**, **8 1’s & 8 0’s**

8 1’s & 8 0’s is also located in the Other Patterns menus found in every other TETRA configure timeslot type menu.

SCPI Commands:

[:SOURce]:RADio:TETRa:DATA P8

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:CUSTom P8

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCCustom P8

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCNormal[:DATA] P8

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCSync[:DATA] P8

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDCustom[:DATA] P8

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDNormal[:DATA] P8

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDSync[:DATA] P8

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC1[:DATA] P8

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC2[:DATA] P8

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UNORmal[:DATA] P8

16 1’s & 16 0’s

Press this softkey to select a binary data pattern that consists of sixteen ones followed by sixteen zeroes. If you have selected **16 1’s & 16 0’s** and the data format is output as a pattern only, not framed data, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P16** (where “P” refers to Pattern and “16” refers to sixteen ones and sixteen zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **16 1’s & 16 0’s** and the data format is a framed transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. Also, **P16** is displayed in the **Data** field located near the bottom of the text area of the display. A single output of a framed P16 data pattern consists of enough repetitions of sixteen ones followed by sixteen zeroes, followed by sixteen ones and sixteen zeroes, and so on, until the data fields in the timeslot are filled.

Softkey Location: Press **Mode**, **TETRA**, **Data**, **Other Patterns**, **16 1’s & 16 0’s** or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up Normal**, **Data**, **Other Patterns**, **16 1’s & 16 0’s**

16 1’s & 16 0’s is also located in the Other Patterns menus found in every other TETRA configure timeslot type menu.

SCPI Commands:

[:SOURce]:RADio:TETRa:DATA P16

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:CUSTom P16

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCCustom P16

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCNormal[:DATA] P16

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCSync[:DATA] P16

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDCustom[:DATA] P16

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDNormal[:DATA] P16

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDSync[:DATA] P16

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC1[:DATA] P16

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC2[:DATA] P16

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UNORmal[:DATA] P16

32 1’s & 32 0’s

Press this softkey to select a binary data pattern that consists of thirty-two ones followed by thirty-two zeroes. If you have selected **32 1’s & 32 0’s** and the data format is output as a pattern only, not framed data, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P32** (where “P” refers to Pattern and “32” refers to thirty-two ones and thirty-two zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **32 1’s & 32 0’s** and the data format is a framed transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P32** is displayed in the **Data** field located near the bottom of the text area of the display. A single output of a framed P32 data pattern consists of enough repetitions of thirty-two ones followed by thirty-two zeroes, followed by thirty-two ones and thirty-two zeroes, and so on, until the data fields in the timeslot are filled.

Softkey Location: Press **Mode**, **TETRA**, **Data**, **Other Patterns**, **32 1’s & 32 0’s** or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up Normal**, **Data**, **Other Patterns**, **32 1’s & 32 0’s**

32 1’s & 32 0’s is also located in the Other Patterns menus found in every other TETRA configure timeslot type menu.

SCPI Commands:

[:SOURce]:RADio:TETRa:DATA P32

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:CUSTom P32

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCCustom P32

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCNormal[:DATA] P32

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCSync[:DATA] P32

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDCustom[:DATA] P32

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDNormal[:DATA] P32

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDSync[:DATA] P32

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC1[:DATA] P32

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC2[:DATA] P32

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UNORmal[:DATA] P32

64 1’s & 64 0’s

Press this softkey to select a binary data pattern that consists of sixty-four ones followed by sixty-four zeroes. If you have selected **64 1’s & 64 0’s** and the data format is output as a pattern only, not framed data, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P64** (where “P” refers to Pattern and “64” refers to sixty-four ones and sixty-four zeroes) is displayed in the **Data** field in the top line of the text area of the display. If you have selected **64 1’s & 64 0’s** and the data format is a framed transmission, both the **Data** and the **Other Patterns** softkeys will show this selection. In addition, **P64** is displayed in the **Data** field located near the bottom of the text area of the display. A single output of a framed P64 data pattern consists of enough repetitions of sixty-four ones followed by sixty-four zeroes, followed by sixty-four ones and sixty-four zeroes, and so on, until the data fields in the timeslot are filled.

Softkey Location: Press **Mode**, **TETRA**, **Data**, **Other Patterns**, **64 1’s & 64 0’s** or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up Normal**, **Data**, **Other Patterns**, **64 1’s & 64 0’s**

64 1’s & 64 0’s is also located in the Other Patterns menus found in every other TETRA configure timeslot type menu.

SCPI Commands:

[:SOURce]:RADio:TETRa:DATA P64

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:CUSTom P64

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCCustom P64

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCNormal[:DATA] P64

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCSync[:DATA] P64

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDCustom[:DATA] P64

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDNormal[:DATA] P64

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDSync[:DATA] P64

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC1[:DATA] P64

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC2[:DATA] P64

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UNORmal[:DATA] P64

All Timeslots

Press this softkey to output a 1-bit pulse to the EVENT 1 rear panel connector that is synchronized to the first bit of each timeslot in a frame. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **All Timeslots**

SCPI Commands:

[:SOURce]:RADio:TETRa:SOUT ALL

B

Press this softkey to change the 30-bit broadcast bits (B) value. To enter a value (in hexadecimal), press **B**. The broadcast bits value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The current value for broadcast bits is displayed in the **B** field near the bottom of the text area of the display.

Status after Factory Preset: 00000000

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2)**, **Dn Sync Cont**, **Configure Dn Sync Cont**, **B1**
or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2)**, **Dn Sync Disc**, **Configure Dn Sync Disc**, **B1**

SCPI Commands:

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCSync:B <30 bit value>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCSync:B?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDSync:B <30 bit value>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDSync:B?

B1

Press this softkey to change the 14-bit broadcast bits (B1) value. To enter a value (in hexadecimal), press **B1**. The broadcast bits value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The current value for broadcast bits is displayed in the **B1** field near the bottom of the text area of the display.

Status after Factory Preset: 0000

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2)**, **Dn Normal Cont**, **Configure Dn Normal Cont**, **B1**
or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2)**, **Dn Normal Disc**, **Configure Dn Normal Disc**, **B1**

SCPI Commands:

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCNormal:B1 <14 bit value>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCNormal:B1?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDNormal:B1 <14 bit value>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDNormal:B1?

B2

Press this softkey to change the 16-bit broadcast bits (B2) value. To enter a value (in hexadecimal), press **B2**. The broadcast bits value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The current value for broadcast bits is displayed in the **B2** field near the bottom of the text area of the display.

Status after Factory Preset: 0000

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2)**, **Dn Normal Cont**, **Configure Dn Normal Cont**, **B2**
or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2)**, **Dn Normal Disc**, **Configure Dn Normal Disc**, **B2**

SCPI Commands:

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCNormal:B2 <16 bit value>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCNormal:B2?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDNormal:B2 <16 bit value>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDNormal:B2?

BBG Data Clock Ext Int

Press this softkey to select the internal data clock for the baseband generator or to select an externally-supplied data clock. A data clock or symbol clock input must be supplied when external mode is selected. For more information on input and output signals, refer to Chapter 7, “Operation”.

Softkey Location: Press **Mode**, **TETRA**, **More (1 of 2)**, **Configure Hardware**, **BBG Data Clock Ext Int**

Status after Normal Preset: Int

SCPI Commands:

[:SOURce]:RADio:TETRa:BBCLock INT[1]|EXTernal[1]

[:SOURce]:RADio:TETRa:BBCLock?

Begin Frame

Press this softkey to output a 1-bit pulse to the EVENT 1 rear panel connector that is synchronized to the first bit of the first frame. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified. The number of trigger pulses generated depends on the framed data patterns selected:

- If a PN9 or PN15 data pattern is selected, a single frame is generated. The data fields of the frame are filled sequentially with the PRBS data. The synchronizing pulse occurs at the beginning of the frame each time it is transmitted.
- Any combination of external data and a PN9 data pattern will cause 511 frames to be generated. The synchronizing pulse occurs at the beginning of the first of the 511 frames each time that frame is transmitted.
- Any combination of external data and a PN15 data pattern will cause a discontinuous PN15. A discontinuous PN15 pattern consists of as many complete frames of PN15 data as can be generated. The remaining bits that do not completely fill a frame are truncated. The synchronizing pulse occurs at the beginning of the first frame each time that frame is transmitted.
- Any combination of user’s files and a PN15 data pattern will cause a discontinuous PN15. The synchronizing pulse occurs at the beginning of the first frame each time that frame is transmitted.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **Begin Frame**

SCPI Commands:

[:SOURce]:RADio:TETRa:SOUT FRAME

Begin Pattern

Press this softkey to output a 1-bit pulse to the EVENT 1 rear panel connector that is synchronized to the first bit of your unframed data pattern (**Data Format Pattern Framed** is set to **Pattern**), and for each repetition of the pattern. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified.

Softkey Location: Press **Mode**, **TETRA**, **More (1 of 2)**, **Sync Out**, **Begin Pattern**

SCPI Commands:

[:SOURce]:RADio:TETRa:SOUT FRAME

Begin Timeslot

Press this softkey to output a 1-bit signal to the EVENT 1 rear panel connector that is synchronized to the first bit of a selected timeslot. If you have entered a value for **Sync Out Offset**, the synchronizing pulse is offset by the number of bits specified. Select the timeslot by pressing **Begin Timeslot**. The timeslot number for the synchronization signal becomes the active function. Enter a value using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **Begin Timeslot**

SCPI Commands:

[:SOURce]:RADio:TETRa:SOUT SLOT

[:SOURce]:RADio:TETRa:SOUT:SLOT <1 - 4>

[:SOURce]:RADio:TETRa:SOUT:SLOT?

Bit Rate

There are two softkeys named **Bit Rate**. The first is a menu key (distinguished by an arrow pointing to the right). Pressing this softkey reveals a menu of choices for setting the transmission bit rate. In this menu, there is another softkey named **Bit Rate**. Press this softkey to set the bit rate to any value from 31.000 kbps through 37.800 kbps. Enter the desired value using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Mbps**, **kbps**, or **bps** terminator softkey.

Softkey Location: Press **Mode**, **TETRA**, **More (1 of 2)**, **Modify Standard**, **Bit Rate**
or press **Mode**, **TETRA**, **More (1 of 2)**, **Modify Standard**, **Bit Rate**, **Bit Rate**

Status after Normal Preset: 36.000 kbps

SCPI Commands:

[:SOURce]:RADio:TETRa:BRATe <value>

[:SOURce]:RADio:TETRa:BRATe?

Burst Shape

Pressing this softkey reveals a menu of choices for modifying the burst shape of the framed data. In this menu, you can change the rise and fall time of the burst, in bits, and you can change the rise and fall delay of the burst, in bits. A softkey is also provided to return the default burst shape values.

Softkey Location: Press **Mode**, **TETRA**, **More (1 of 2)**, **Modify Standard**, **Burst Shape**

Bus

Press this softkey to use the HP-IB as the pattern trigger for a single output of your unframed data pattern or as the frame trigger for a single output of your framed data. Once selected, you can trigger a single event at any time by sending a trigger command over HP-IB (*TRG) or by asserting the HP-IB GET (group execute trigger) line.

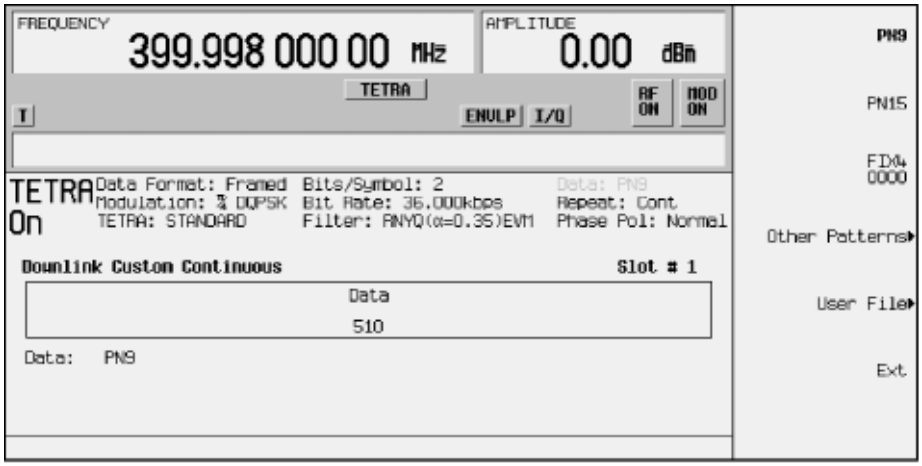
Softkey Location: Press **Mode**, **TETRA**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Bus**
or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Bus**

SCPI Commands:

[:SOURce]:RADio:TETRa:TRIGger[:SOURce] BUS

Configure Dn Custom Cont

Pressing this softkey reveals a menu of softkeys for selecting the data pattern for a continuous downlink custom timeslot. The following figure shows an example of display graphics for a continuous downlink custom timeslot. The visual representation of the timeslot shows each field of the timeslot.



pk7118a

In this example:

- **`Data: PN9`** - Indicates that the data selection for this custom timeslot is PN9. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.

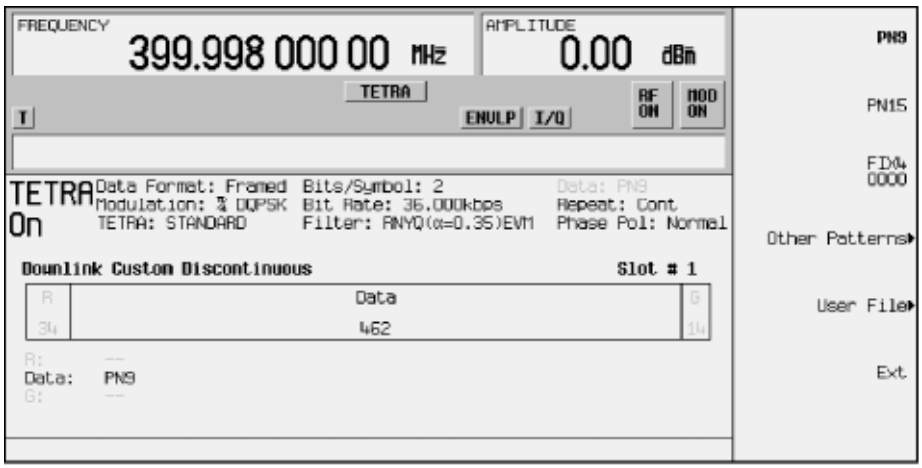
Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2)**, **Dn Custom Cont**, **Configure Dn Custom Cont**

SCPI Commands:

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCCustom?

Configure Dn Custom Disc

Pressing this softkey reveals a menu of softkeys for selecting the data pattern for a discontinuous downlink custom timeslot. The following figure shows an example of display graphics for a discontinuous downlink custom timeslot. The visual representation of the timeslot shows each field of the timeslot.



pk7121a

In this example:

- **R: --** - Ramp time is a 34-bit field. The text in this field is grey, indicating that you cannot change the contents of the ramp time field.
- **Data: PN9** - Indicates that the data selection for this custom timeslot is PN9. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.
- **G: --** - Guard time is a 14-bit field. The text in this field is grey, indicating that you cannot change the contents of the guard time field.

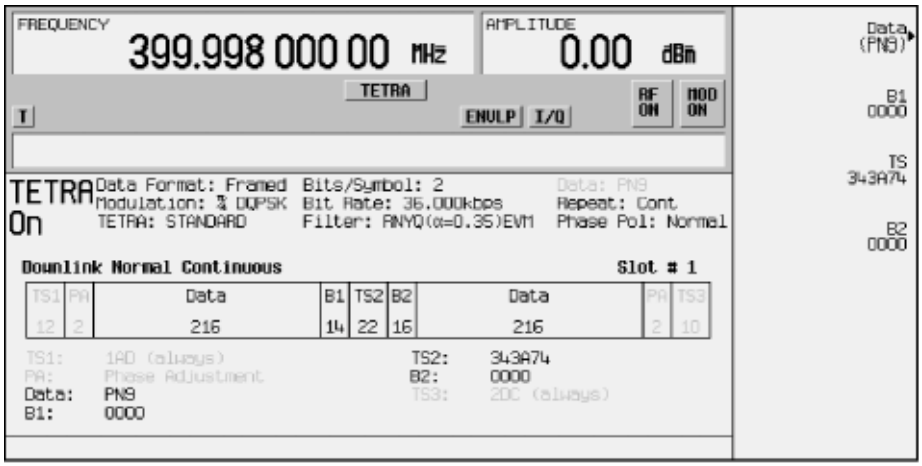
Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2)**, **Dn Custom Disc**, **Configure Dn Custom Disc**

SCPI Commands:

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDCustom?

Configure Dn Normal Cont

Pressing this softkey reveals a menu of softkeys for configuring a timeslot as a downlink continuous normal timeslot. The following figure shows an example of display graphics for a downlink continuous normal timeslot. The visual representation of the timeslot shows each field of the timeslot as it is defined by the TETRA standard.



pk7119a

In this example:

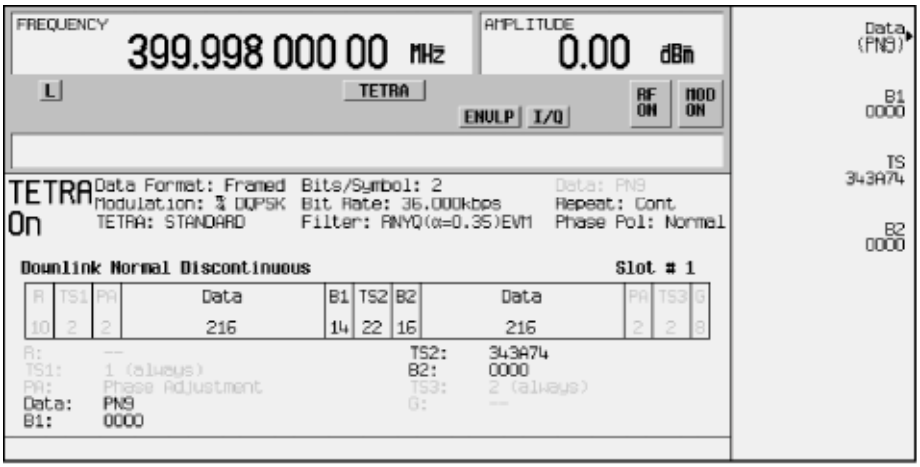
- **`TS1: 1AD (always)`** - Indicates that the 12-bit training sequence field always contains hexadecimal 1AD. The text in this field is grey, indicating that you cannot change the contents of this first training sequence field.
- **`PA: Phase Adjustment`** - There are two 2-bit phase adjustment fields. The text in this field is grey, indicating that you cannot change the contents of either phase adjustment field.
- **`Data: PN9`** - Indicates that the data selection for both 216-bit data fields is PN9. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.
- **`B1: 0000`** - Indicates that the 14-bit broadcast bits field contains hexadecimal 0000. Press the **B1** softkey in the Configure Dn Normal Cont menu to change the value of the broadcast bits field.
- **`TS2: 343A74`** - Indicates that this 22-bit training sequence field contains hexadecimal 343A74. Press the **TS** softkey in the Configure Dn Normal Cont menu to change the value of this second training sequence field.

- **B2: 0000** - Indicates that the 16-bit broadcast bits field contains hexadecimal 0000. Press the **B2** softkey in the Configure Dn Normal Cont menu to change the value of the broadcast bits field.
- **TS3: 2DC (always)** - Indicates that this 10-bit training sequence field always contains hexadecimal 2DC. The text in this field is grey, indicating that you cannot change the contents of this third training sequence field.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2)**, **Dn Normal Cont**, **Configure Dn Normal Cont**

Configure Dn Normal Disc

Pressing this softkey reveals a menu of softkeys for configuring a timeslot as a downlink discontinuous normal timeslot. The following figure shows an example of display graphics for a downlink discontinuous normal timeslot. The visual representation of the timeslot shows each field of the timeslot as it is defined by the TETRA standard.



pk7122a

In this example:

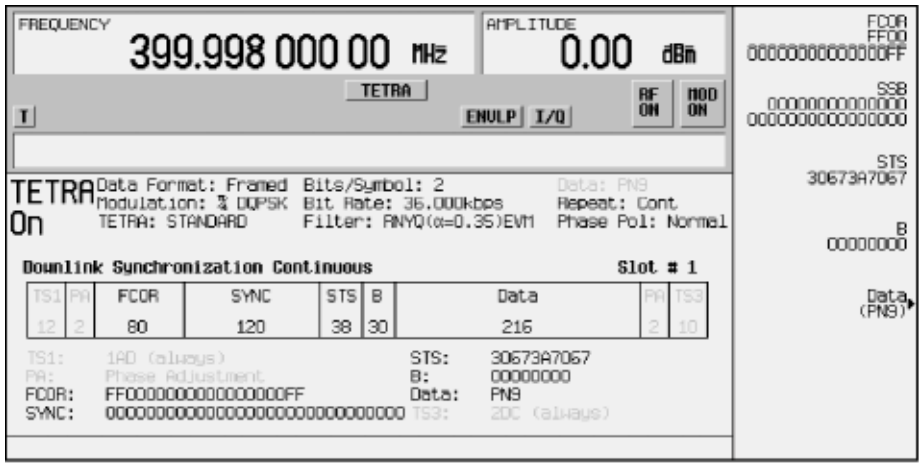
- **R: --** - Ramp time is a 10-bit field. The text in this field is grey, indicating that you cannot change the contents of the ramp time field.
- **TS1: 1 (always)** - Indicates that this 2-bit training sequence field always contains hexadecimal 1. The text in this field is grey, indicating that you cannot change the contents of this first training sequence field.

- **PA: Phase Adjustment** - There are two 2-bit phase adjustment bits fields. The text in this field is grey, indicating that you cannot change the contents of either phase adjustment field.
- **Data: PN9** - Indicates that the data selection for both 216-bit data fields is PN9. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.
- **B1: 0000** - Indicates that the 14-bit broadcast bits field contains hexadecimal 0000. Press the **B1** softkey in the Configure Dn Normal Disc menu to change the value of the broadcast bits field.
- **TS2: 343A74** - Indicates that this 22-bit training sequence field contains hexadecimal 343A74. Press the **TS** softkey in the Configure Dn Normal Disc menu to change the value of this second training sequence field.
- **B2: 0000** - Indicates that the 16-bit broadcast bits field contains hexadecimal 0000. Press the **B2** softkey in the Configure Dn Normal Disc menu to change the value of the broadcast bits field.
- **TS3: 2 (always)** - Indicates that the 2-bit training sequence field always contains hexadecimal 2. The text in this field is grey, indicating that you cannot change the contents of this third training sequence field.
- **G: --** - Guard time is an 8-bit field. The text in this field is grey, indicating that you cannot change the contents of the guard time field.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2)**, **Dn Normal Disc**, **Configure Dn Normal Disc**

Configure Dn Sync Cont

Pressing this softkey reveals a menu of softkeys for configuring a timeslot as a downlink continuous synchronization timeslot. The following figure shows an example of display graphics for a downlink continuous synchronization timeslot. The visual representation of the timeslot shows each field of the timeslot as it is defined by the TETRA standard.



pk7120a

In this example:

- **TS1: 1AD (always)** - Indicates that this 12-bit training sequence field always contains hexadecimal 1AD. The text in this field is grey, indicating that you cannot change the contents of this first training sequence field.
- **PA: Phase Adjustment** - There are two 2-bit phase adjustment fields. The text in this field is grey, indicating that you cannot change the contents of either phase adjustment field.
- **FCOR: FF0000000000000000FF** - Indicates that 80-bit frequency correction field contains hexadecimal FF0000000000000000FF. Press the **FCOR** softkey in the Configure Dn Sync Cont menu to change the value of the frequency correction bits field.
- **SYNC: 00000000000000000000000000000000** - Indicates that 120-bit synchronization block bits field contains hexadecimal 00000000000000000000000000000000. Press the **SSB** softkey in the Configure Dn Sync Cont menu to change the value of the synchronization block bits field.
- **STS: 30673A7067** - Indicates that 38-bit synchronization training sequence field contains hexadecimal 30673A7067. Press the **STS** softkey in the Configure Dn Sync

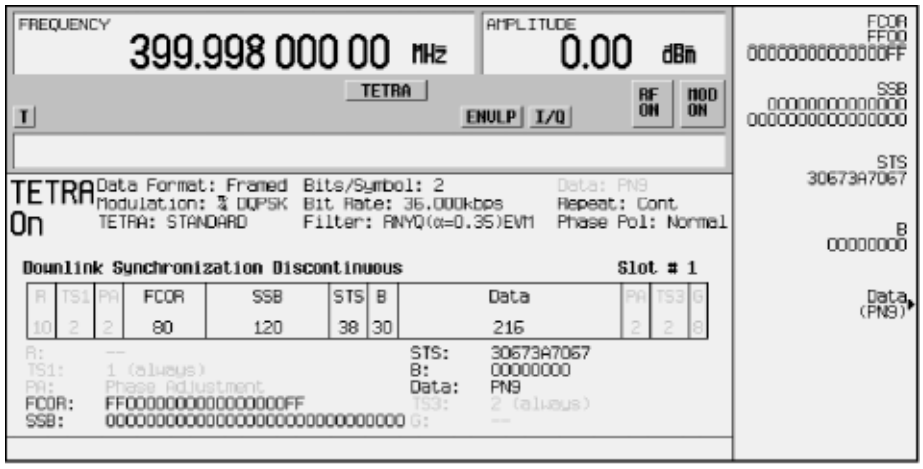
Cont menu to change the value of the synchronization training sequence field.

- **B: 00000000** - Indicates that the 30-bit broadcast bits field contains hexadecimal 00000000. Press the **B** softkey in the Configure Dn Sync Cont menu to change the value of the broadcast bits field.
- **Data: PN9** - Indicates that the data selection for the 216-bit data field is PN9. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.
- **TS3: 2DC (always)** - Indicates that this 10-bit training sequence field always contains hexadecimal 2DC. The text in this field is grey, indicating that you cannot change the contents of this third training sequence field.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2)**, **Dn Sync Cont**, **Configure Dn Sync Cont**

Configure Dn Sync Disc

Pressing this softkey reveals a menu of softkeys for configuring a timeslot as a downlink discontinuous synchronization timeslot. The following figure shows an example of display graphics for a downlink discontinuous synchronization timeslot. The visual representation of the timeslot shows each field of the timeslot as it is defined by the TETRA standard.



pk7123a

In this example:

- **R: --** - Ramp time is a 10-bit field. The text in this field is grey, indicating that you

cannot change the contents of the ramp time field.

- **TS1: 1 (always)** - Indicates that the 2-bit training sequence field always contains hexadecimal 1. The text in this field is grey, indicating that you cannot change the contents of this first training sequence field.
- **PA: Phase Adjustment** - There are two 2-bit phase adjustment fields. The text in this field is grey, indicating that you cannot change the contents of either phase adjustment field.
- **FCOR: FF00000000000000FF** - Indicates that the 80-bit frequency correction field contains hexadecimal FF00000000000000FF. Press the **FCOR** softkey in the Configure Dn Sync Disc menu to change the value of the frequency correction bits field.
- **SSB: 00000000000000000000000000000000** - Indicates that the 120-bit synchronization block bits field contains hexadecimal 000000000000000000000000000000. Press the **SSB** softkey in the Configure Dn Sync Disc menu to change the value of the synchronization block bits field.
- **STS: 30673A7067** - Indicates that the 38-bit synchronization training sequence field contains hexadecimal 30673A7067. Press the **STS** softkey in the Configure Dn Sync Disc menu to change the value of the synchronization training sequence field.
- **B: 00000000** - Indicates that the 30-bit broadcast bits field contains hexadecimal 00000000. Press the **B** softkey in the Configure Dn Sync Disc menu to change the value of the broadcast bits field.
- **Data: PN9** - Indicates that the data selection for the 216-bit data field is PN9. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.
- **TS3: 2 (always)** - Indicates that this 2-bit training sequence field always contains hexadecimal 2. The text in this field is grey, indicating that you cannot change the contents of this third training sequence field.
- **G: --** - Guard time is an 8-bit field. The text in this field is grey, indicating that you cannot change the contents of the guard time field.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2)**, **Dn Sync Disc**, **Configure Dn Sync Disc**

Configure Frame

Pressing this softkey reveals a menu for enabling scramble capability, setting the scramble seed value, and selecting the PN9 mode.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Frame**

Configure Hardware

Pressing this softkey reveals a menu that allows you to set or select a particular latch or hardware configuration to meet your specific needs.

Softkey Location: Press **Mode**, **TETRA**, **More (1 of 2)**, **Configure Hardware**

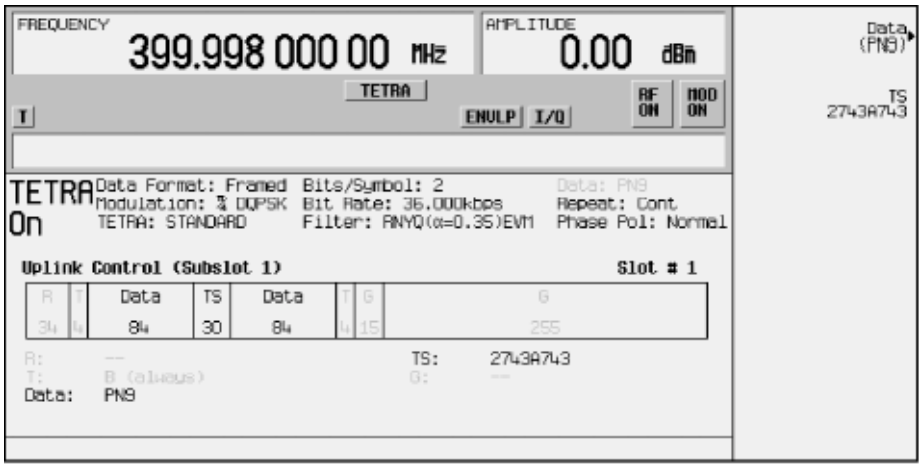
Configure Timeslot

Pressing this softkey reveals a menu of choices for configuring the timeslots. In this menu, select which timeslots to turn on and select the timeslot type. Choose from uplink normal, control, and custom channels, or downlink continuous or discontinuous normal, custom, or synchronization channels. Then use the subsequent menus to configure the timeslot fields. Scramble capability is also available in this menu and the PN9 data pattern can be set to normal or quick for downlink timeslots. This softkey is inactive until you set **Data Format Pattern Framed** to **Framed**.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**

Configure Up Control 1

Pressing this softkey reveals a menu of softkeys for configuring a timeslot as an uplink subslot 1 control timeslot. Up control 1 is half of a timeslot in length. Either subslot 1 or subslot 2 can be filled, but not both. The following figure shows an example of display graphics for an uplink subslot 1 control timeslot. The visual representation of the timeslot shows each field of the timeslot as it is defined by the TETRA standard.



pk7124a

In this example:

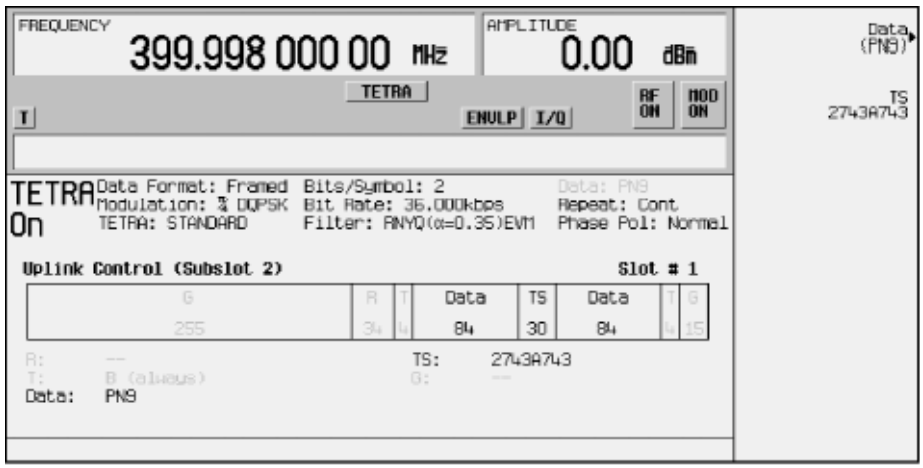
- **R: --** - Ramp time is a 34-bit field. The text in this field is grey, indicating that you cannot change the contents of the ramp time field.
- **T: B (always)** - Indicates that both of the 4-bit tail fields always contain hexadecimal B. The text in this field is grey, indicating that you cannot change the contents of the tail bits fields.
- **Data: PN9** - Indicates that the data selection for both 84-bit data fields is PN9. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.
- **TS: 2743A743** - Indicates that the 30-bit training sequence field contains hexadecimal 2743A743. Press the **TS** softkey in the Configure Up Control 1 menu to change the value of the training sequence field.
- **G: --** - There are two guard time fields. The first is a 15-bit field for subslot 1. The second is a 255-bit field that fills subslot 2. The text in this field is grey, indicating that you cannot change the contents of the guard time fields.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Up Control 1**, **Configure Up Control 1**

Configure Up Control 2

Pressing this softkey reveals a menu of softkeys for configuring a timeslot as an uplink subslot 2 control timeslot. Up control 2 is half of a timeslot in length. Either subslot 1 or subslot 2 can be filled, but not both.The following figure shows

an example of display graphics for an uplink subslot 2 control timeslot. The visual representation of the timeslot shows each field of the timeslot as it is defined by the TETRA standard.



pk7125a

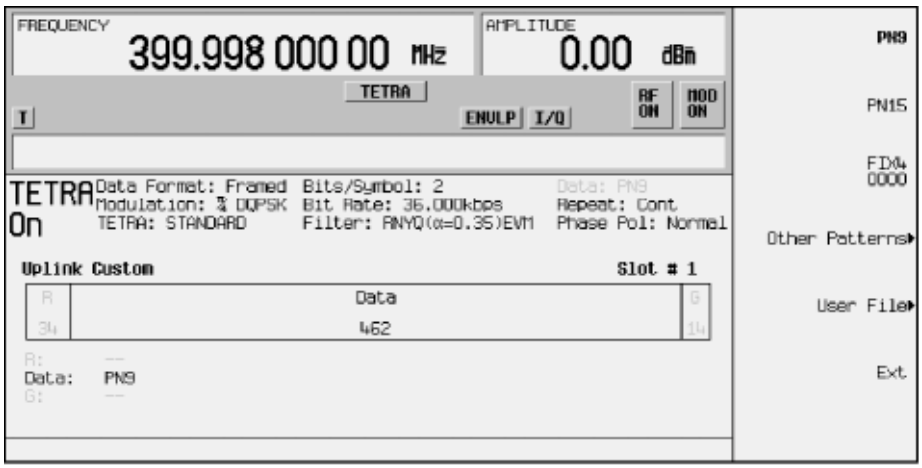
In this example:

- **R: --** - Ramp time is a 34-bit field. The text in this field is grey, indicating that you cannot change the contents of the ramp time field.
- **T: B (always)** - Indicates that both of the 4-bit tail fields always contain hexadecimal B. The text in this field is grey, indicating that you cannot change the contents of the tail bit fields.
- **Data: PN9** - Indicates that the data selection for both 84-bit data fields is PN9. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.
- **TS: 2743A743** - Indicates that the 30-bit training sequence field contains hexadecimal 2743A743. Press the **TS** softkey in the Configure Up Control 2 menu to change the value of the training sequence field.
- **G: --** - There are two guard time fields. The first is a 255-bit field that fills subslot 1. The second is a 15-bit field for subslot 2. The text in this field is grey, indicating that you cannot change the contents of either guard time field.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Up Control 2**, **Configure Up Control 2**

Configure Up Custom

Pressing this softkey reveals a menu of softkeys for selecting the data pattern for an uplink custom timeslot. The following figure shows an example of display graphics for an uplink custom timeslot. The visual representation of the timeslot shows each field of the timeslot.



pk7126a

In this example:

- **R: --** - Ramp time is a 34-bit field. The text in this field is grey, indicating that you cannot change the contents of the ramp time field.
- **Data: PN9** - Indicates that the data selection for this custom timeslot is PN9. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.
- **G: --** - Guard time is a 14-bit field. The text in this field is grey, indicating that you cannot change the contents of the guard time field.

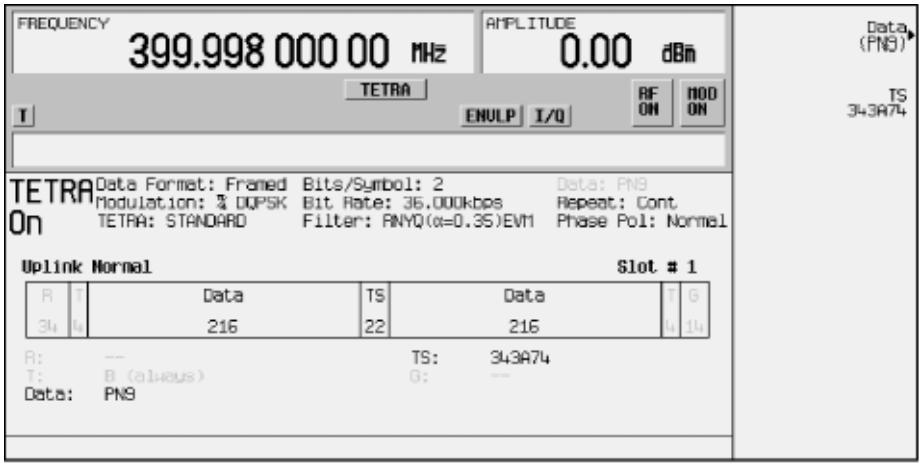
Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Up Custom**, **Configure Up Custom**

SCPI Commands:

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:CUSTom?

Configure Up Normal

Pressing this softkey reveals a menu of softkeys for configuring a timeslot as an uplink normal timeslot. The following figure shows an example of display graphics for an uplink normal timeslot. The visual representation of the timeslot shows each field of the timeslot as it is defined by the TETRA standard.



pk7127a

In this example:

- **R: --** - Ramp time is a 34-bit field. The text in this field is grey, indicating that you cannot change the contents of the ramp time field.
- **T: B (always)** - Indicates that both of the 4-bit tail fields always contain hexadecimal B. The text in this field is grey, indicating that you cannot change the contents of the tail bits fields.
- **Data: PN9** - Indicates that the data selection for both 216-bit data fields is PN9. Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.
- **TS: 343A74** - Indicates that the training sequence field contains hexadecimal 343A74. Press the **TS** softkey in the Configure Up Normal menu to change the value of the training sequence field.
- **G: --** - Guard time is a 14-bit field. The text in this field is grey, indicating that you cannot change the contents of the guard time field.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up Normal**

Data

Pressing this softkey reveals a menu of choices for internal data generation (PN9, PN15, fixed 4-bit repeating sequences, set patterns of ones and zeroes) or you can choose to supply your own data (download a binary file or input data using the DATA INPUT connector). This softkey is available in the TETRA menu to select a data pattern for modulated transmissions that are not framed. With **TETRA Off On** set to **On** and **Data Format Pattern Framed** set to **Pattern**, the signal generator then outputs either a single occurrence (**Pattern Repeat Single**) or a continuous stream (**Pattern Repeat Cont**) of your choice of data. This softkey is also available for timeslot configuration. Choose from the same menu of selections for configuring the timeslot data fields.

Softkey Location: Press **Mode**, **TETRA**, **Data**
or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up Normal**, **Data**

Data is also located in all of the other configure timeslot menus except the uplink and downlink configure custom menus.

Status after Normal Preset: PN9

SCPI Commands:

[:SOURce]:RADio:TETRa:DATA?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCNormal[:DATA]?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCSync[:DATA]?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDNormal[:DATA]?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDSync[:DATA]?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC1[:DATA]?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC2[:DATA]?

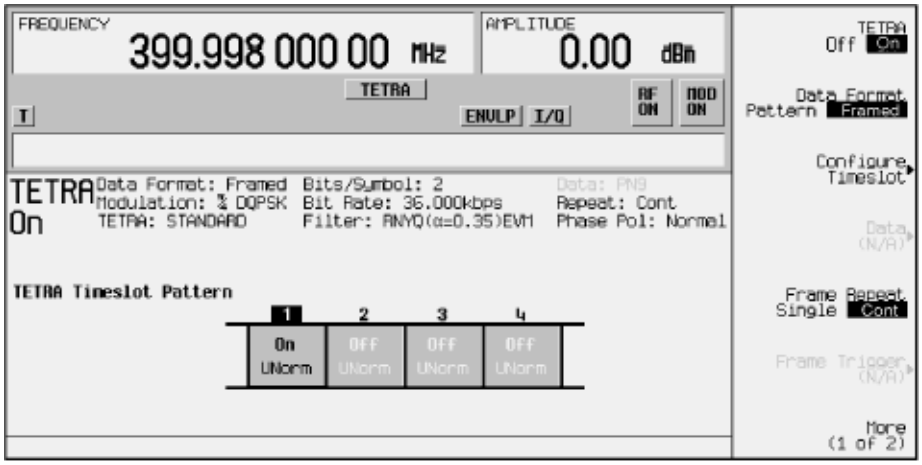
[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UNORmal[:DATA]?

Data Format Pattern Framed

Press this softkey to toggle between **Data Format Pattern** and **Data Format Framed** modes. When you select **Framed**, you will be transmitting your framed data pattern in a TETRA format.

When you select **Data Format Pattern**, you will be transmitting a continuous stream of your selected data pattern. Select the data pattern using the **Data** softkey. The **Data** softkey is activated when you select **Data Format Pattern** and inactivated when you select **Data Format Framed**.

The **Data Format Pattern Framed** softkey is coupled to the **Burst Envelope Off On** softkey in the I/Q menu. At any time that TETRA is enabled (**TETRA Off On** is set to **On**) and **Data Format Framed** is selected, the **ENVLP** annunciator is turned on in the display (indicating that **Burst Envelope On** is also selected). The following figure shows the display graphics that appear when the TETRA menu is accessed, **Data Format Pattern Framed** is set to **Framed**, and you are not configuring a timeslot:



pk7117a

In this example:

- **TETRA On** - Indicates that TETRA is enabled. This field changes to **TETRA Off** when **TETRA Off On** is set to **Off**.
- **Data Format: Framed** - Indicates that the data pattern is a framed transmission. This field changes to **Data Format: Pattern** when **Data Format Pattern Framed** is set to **Pattern** indicating that you are transmitting a continuous stream of your selected data pattern.

- **Modulation: π/4DQPSK** - Indicates that π/4DQPSK modulation is being internally generated.
- **TETRA: STANDARD** - Indicates that the structure of the TETRA transmission follows the standard as defined by the TETRA protocol. This field changes to **TETRA: MODIFIED** under the following circumstances:
  - filter is NYQ
  - filter alpha is changed
  - bit rate is changed
  - burst shape is changed
  - phase polarity is set to invert
- **Bit/Symbol: 2** - Indicates that 2 bits per symbol are required according to the TETRA standard.
- **Bit Rate: 36.000kbps** - The bit rate is set according to the TETRA standard. This can be changed in the Bit Rate menu. A * next to the value indicates that it differs from the standard.
- **Filter: RNYQ (α=0.35)EVM** - Indicates that root Nyquist filter (root raised cosine) is selected, with an alpha of 0.35, and the filter is set for optimizing error vector magnitude. A * next to the alpha value indicates that it differs from the standard. If you select optimization for adjacent channel power, **EVM** toggles to **ACP**. This field changes to **Filter: NYQ(α=0.35)** if you select the Nyquist filter (raised cosine).
- **Data: PN9** - Indicates that a PN9 sequence has been selected for transmitting without framing. In this example, the text in this field is grey, indicating an inactive function (framed mode is on). Other selections allowed include PN15, fixed 4-bit patterns, fixed patterns of ones and zeroes, user files, or external data.
- **Repeat: Cont** - Indicates that the data pattern repeat is set to continuous mode. If you select single mode, this field changes to **Repeat: Single**.
- **Phase Pol: Normal** - Indicates the direction of rotation of the phase modulation vector. If you select inverted mode, this field changes to **Phase Pol: Invert**.
- The visual representation of the TETRA timeslot pattern shows, in this case, that timeslot 1 is on and configured as an uplink normal timeslot. Timeslots 2, 3, and 4 are off and configured as uplink normal timeslots. The timeslot pattern is displayed only when **Data Format Pattern Framed** is set to **Framed**.

To configure the timeslots, press the **Configure Timeslot** softkey. The **Configure Timeslot** softkey is activated when you select **Data Format Framed** and is inactivated when you select **Data Format Pattern**.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**

Status after Normal Preset: Pattern

SCPI Commands:

[:SOURce]:RADio:TETRa:BURSt[:STATe] ON|OFF|1|0

[:SOURce]:RADio:TETRa:BURSt[:STATe]?

Dn Custom Cont

Press this softkey to select a downlink continuous custom timeslot type for the active timeslot. A downlink continuous custom timeslot is configured using an internally-generated data pattern, a downloaded sequence of bits stored in a user file, or by supplying external data. This custom timeslot is provided for users' flexibility but it is not a standard TETRA timeslot.

Downlink timeslots cannot be mixed with uplink timeslots.If you already have any timeslots designated as uplink, they will be changed to downlink when any other timeslot is designated as downlink. The following table shows the timeslot type interchanges that will occur if the frame was designated as uplink and then either continuous downlink or discontinuous downlink is selected.

From Uplink Timeslot	To Continuous Downlink Timeslot	To Discontinuous Downlink Timeslot
Up Custom	Dn Custom Cont	Dn Custom Disc
Up Control 1	Dn Custom Cont	Dn Custom Disc
Up Control 2	Dn Custom Cont	Dn Custom Disc
Up Normal	Dn Normal Cont	Dn Normal Disc

When you have selected **Dn Custom Cont** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your configuration.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2)**, **Dn Custom Cont**

SCPI Commands:

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4[:TYPE] DCCustom

Dn Custom Disc

Press this softkey to select a downlink discontinuous custom timeslot type for the active timeslot. A downlink discontinuous custom timeslot is configured using an internally-generated data pattern, a downloaded sequence of bits stored in a user file, or by supplying external data. This custom timeslot is provided for users' flexibility but it is not a standard TETRA timeslot.

Downlink timeslots cannot be mixed with uplink timeslots. If you already have any timeslots designated as uplink, they will be changed to downlink when any other timeslot is designated as downlink. The following table shows the timeslot type interchanges that will occur if the frame was designated as uplink and then either continuous downlink or discontinuous downlink is selected.

From Uplink Timeslot	To Continuous Downlink Timeslot	To Discontinuous Downlink Timeslot
Up Custom	Dn Custom Cont	Dn Custom Disc
Up Control 1	Dn Custom Cont	Dn Custom Disc
Up Control 2	Dn Custom Cont	Dn Custom Disc
Up Normal	Dn Normal Cont	Dn Normal Disc

When you have selected **Dn Custom Disc** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your configuration.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2)**, **Dn Custom Disc**

SCPI Commands:

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4[:TYPE] DDCustom

Dn Normal Cont

Press this softkey to select downlink continuous normal as the timeslot type for the active timeslot.

Downlink timeslots cannot be mixed with uplink timeslots. If you already have any timeslots designated as uplink, they will be changed to downlink when any other timeslot is designated as downlink. The following table shows the timeslot type interchanges that will occur if the frame was designated as uplink and then either continuous downlink or discontinuous downlink is selected.

From Uplink Timeslot	To Continuous Downlink Timeslot	To Discontinuous Downlink Timeslot
Up Custom	Dn Custom Cont	Dn Custom Disc
Up Control 1	Dn Custom Cont	Dn Custom Disc
Up Control 2	Dn Custom Cont	Dn Custom Disc
Up Normal	Dn Normal Cont	Dn Normal Disc

When you select **Dn Normal Cont** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2)**, **Dn Normal Cont**

SCPI Commands:

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4[:TYPE] DCNormal

Dn Normal Disc

Press this softkey to select downlink discontinuous normal as the timeslot type for the active timeslot.

Downlink timeslots cannot be mixed with uplink timeslots. If you already have any timeslots designated as uplink, they will be changed to downlink when any other timeslot is designated as downlink. The following table shows the timeslot type interchanges that will occur if the frame was designated as uplink and then either continuous downlink or discontinuous downlink is selected.

From Uplink Timeslot	To Continuous Downlink Timeslot	To Discontinuous Downlink Timeslot
Up Custom	Dn Custom Cont	Dn Custom Disc
Up Control 1	Dn Custom Cont	Dn Custom Disc
Up Control 2	Dn Custom Cont	Dn Custom Disc
Up Normal	Dn NormalCont	Dn Normal Disc

When you select **Dn Normal Disc** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2**, **Dn Normal Cont**

SCPI Commands:

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4[:TYPE] DDNormal

Dn Sync Cont

Press this softkey to select downlink continuous synchronization as the timeslot type for the active timeslot.

Downlink timeslots cannot be mixed with uplink timeslots. If you already have any timeslots designated as uplink, they will be changed to downlink when any other timeslot is designated as downlink. The following table shows the timeslot type interchanges that will occur if the frame was designated as uplink and then either continuous downlink or discontinuous downlink is selected.

From Uplink Timeslot	To Continuous Downlink Timeslot	To Discontinuous Downlink Timeslot
Up Custom	Dn Custom Cont	Dn Custom Disc
Up Control 1	Dn Custom Cont	Dn Custom Disc
Up Control 2	Dn Custom Cont	Dn Custom Disc
Up Normal	Dn Normal Cont	Dn Normal Disc

When you select **Dn Sync Cont** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2)**, **Dn Sync Cont**

SCPI Commands:

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4[:TYPE] DCSync

Dn Sync Disc

Press this softkey to select downlink discontinuous synchronization as the timeslot type for the active timeslot.

Downlink timeslots cannot be mixed with uplink timeslots. If you already have any timeslots designated as uplink, they will be changed to downlink when any other timeslot is designated as downlink. The following table shows the timeslot type interchanges that will occur if the frame was designated as uplink and then either continuous downlink or discontinuous downlink is selected.

From Uplink Timeslot	To Continuous Downlink Timeslot	To Discontinuous Downlink Timeslot
Up Custom	Dn Custom Cont	Dn Custom Disc
Up Control 1	Dn Custom Cont	Dn Custom Disc
Up Control 2	Dn Custom Cont	Dn Custom Disc
Up Normal	Dn Normal Cont	Dn Normal Disc

When you select **Dn Sync Disc** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2**, **Dn Sync Cont**

SCPI Commands:

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4[:TYPE] DDSync

Ext

Press this softkey in the data selection menus to select external data. With **Ext** selected, you should apply the data signal to the DATA INPUT connector. If you have selected **Ext** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **Ext** is displayed in the **Data** field in the top line of the text area of the display. If you have selected **Ext** for configuring the timeslot data fields, **EXT** is displayed in the **Data** field located near the bottom of the text area of the display. In framed mode, the external data is gated to the data regions of the timeslot.

Another **Ext** softkey is located in the Frame Trigger and Pattern Trigger menus. Press **Ext** in either of these two menus to select external triggering for your data pattern. Apply a TTL input to the rear panel PATTERN TRIG IN connector to trigger your frame or pattern data.

Softkey Location: Press **Mode**, **TETRA**, **Data**, **Ext**
or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up Normal**, **Data**, **Ext**
or press **Mode**, **TETRA**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Ext**
or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Ext**

Ext is also located in the uplink and downlink configure custom menu and in the Data menus found in every other TETRA configure timeslot type menu.

SCPI Commands:

[:SOURce]:RADio:TETRa:DATA EXTernal

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:CUSTom EXTernal

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCCustom EXTernal

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCNormal[:DATA] EXTernal

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCSync[:DATA] EXTernal

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDCustom[:DATA] EXTernal

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDNormal[:DATA] EXTernal

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDSync[:DATA] EXTernal

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC1[:DATA] EXTernal

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC2[:DATA] EXTernal

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UNORmal[:DATA] EXTernal

[:SOURce]:RADio:TETRa:TRIGger[:SOURce] EXTernal

Ext Data Clock Normal Symbol

Press this softkey to toggle the external data clock use between **Normal** and **Symbol**. When you select **Normal**, you must supply a signal (either a clock or a pulse) to the DATA CLOCK INPUT connector to clock the DATA and SYMBOL SYNC signals. (An unlock will occur if external data is selected and these signals are not supplied.) When you select **Symbol**, no signal is required at the DATA CLOCK INPUT connector. Instead, the data is clocked on both the rising and falling edges of the SYMBOL SYNC signal.

Softkey Location: Press **Mode**, **TETRA**, **More (1 of 2)**, **Configure Hardware**, **Ext Data Clock Normal Symbol**

Status after Normal preset: Normal

SCPI Commands:

[:SOURce]:RADio:TETRa:EDCLock SYMBol|NORMal

[:SOURce]:RADio:TETRa:EDCLock?

Ext Delay Bits

Press this softkey to specify the number of bits for the external trigger delay. When **Ext Delay Off On** is set to **On**, a value greater than 0 will delay the transmission of the triggered data after the external trigger event by the number of bits specified. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. The range of values allowed is 0 through 65,535 bits. This softkey is inactive until the trigger selection is set to **Ext**.

Softkey Location: Press **Mode**, **TETRA**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Ext**, **Ext Delay Bits**
or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Ext**, **Ext Delay Bits**

Status after Normal Preset: 0

SCPI Commands:

[:SOURce]:RADio:TETRa:TRIGger[:SOURce]:EXTernal:DELay <value>

[:SOURce]:RADio:TETRa:TRIGger[:SOURce]:EXTernal:DELay?

Ext Delay Off On

Press this softkey to toggle the external trigger delay on and off. When this function is turned on, the transmission of the triggered data will be delayed after the external trigger event by the number of bits specified by the **Ext Delay Bits** softkey. This function is only available when the trigger selection is set to **Ext**.

Softkey Location: Press **Mode**, **TETRA**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Ext**, **Ext Delay Off On**
or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Ext**, **Ext Delay Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:RADio:TETRa:TRIGger[:SOURce]:EXTernal:DELay:STATe ON|OFF|1|0

[:SOURce]:RADio:TETRa:TRIGger[:SOURce]:EXTernal:DELay:STATe?

Fall Delay

Press this softkey to change the shape of the bursted RF signal by entering a falling edge delay. To change the fall delay, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0 through 63.50 bits.

Softkey Location: Press **Mode**, **TETRA**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Fall Delay**

Status after Normal Preset: 9.50 bits

SCPI Commands:

[:SOURce]:RADio:TETRa:BURSt:SHAPe:FALL:DELay <value>

[:SOURce]:RADio:TETRa:BURSt:SHAPe:FALL:DELay?

[:SOURce]:RADio:TETRa:BURSt:SHAPe:FDELay <value>

[:SOURce]:RADio:TETRa:BURSt:SHAPe:FDELay?

Fall Time

Press this softkey to change the shape of the bursted RF signal by entering a falling edge time. To change the fall time, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0.024 through 30 bits.

Softkey Location: Press **Mode**, **TETRA**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Fall Time**

Status after Normal Preset: 7.814 bits

SCPI Commands:

[:SOURce]:RADio:TETRa:BURSt:SHAPe:FALL:TIME <value>

[:SOURce]:RADio:TETRa:BURSt:SHAPe:FALL:TIME?

[:SOURce]:RADio:TETRa:BURSt:SHAPe:FTIMe <value>

[:SOURce]:RADio:TETRa:BURSt:SHAPe:FTIMe?

FCOR

Press this softkey to change the 80-bit frequency correction bits (FCOR) value. The preset hexadecimal value (when normal preset is selected) for the frequency correction bits reflects the TETRA standard, however you can enter a new value by pressing this softkey. To enter a value (in hexadecimal), press **FCOR**. The frequency correction bits value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The current value for frequency correction bits is displayed in the **FC0R** field near the bottom of the text area of the display.

Status after Factory Preset: FF0000000000000000FF

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2)**, **Dn Sync Cont**, **Configure Dn Sync Cont**, **FCOR**
or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2)**, **Dn Sync Disc**, **Configure Dn Sync Disc**, **FCOR**

SCPI Commands:

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCSync:FCOR <80 bit value>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCSync:FCOR?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDSync:FCOR <80 bit value>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDSync:FCOR?

Filter

Pressing this softkey reveals a menu of choices for changing the filter selection between root Nyquist (root raised cosine) and Nyquist (raised cosine), for changing the default filter alpha, and for restoring the default filter alpha.

Softkey Location: Press **Mode**, **TETRA**, **(More 1 of 2)**, **Modify Standard**, **Filter**

Filter Alpha

Press this softkey to change the filter alpha parameter. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. The range of values allowed is 0.30 through 0.60.

Softkey Location: Press **Mode**, **TETRA**, **(More 1 of 2)**, **Modify Standard**, **Filter**, **Filter Alpha**

Status after Normal Preset: 0.35

SCPI Commands:

[:SOURce]:RADio:TETRa:ALPHa <value>

[:SOURce]:RADio:TETRa:ALPHa?

Filter RNYQ NYQ

Press this softkey to toggle the filter selection between Root Nyquist (root raised cosine) and Nyquist (raised cosine). Notice that your filter selection is shown on the display in the **Filter** field.

Softkey Location: **Mode**, **TETRA**, **More (1 of 2)**, **Modify Standard**, **Filter**, **Filter RNYQ NYQ**

Status after Normal Preset: RNYQ

SCPI Commands:

[:SOURce]:RADio:TETRa:FILTer RNYQuist|NYQuist

[:SOURce]:RADio:TETRa:FILTer?

FIX4

Press this softkey to select a 4-bit repeating sequence data pattern. Press **FIX4** and the 4-bit pattern becomes the active function. Enter your desired 4-bit pattern using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. If you have selected **FIX4** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **FIX4** is displayed in the **Data** field in the top line of the text area of the display. If you have selected **FIX4** for configuring the timeslot data fields, your 4-bit pattern is displayed in the **Data** field located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **TETRA**, **Data**, **FIX4**
or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up Normal**, **Data**, **FIX4**

FIX4 is also located in the uplink and downlink configure custom menu and in the Data menus found in every other TETRA configure timeslot type menu.

Status after Normal Preset: 0000

SCPI Commands:

[:SOURce]:RADio:TETRa:DATA FIX4

[:SOURce]:RADio:TETRa:DATA:FIX4 <0-15>

[:SOURce]:RADio:TETRa:DATA:FIX4?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:CUSTom FIX4

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:CUSTom:FIX4 <0-15>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:CUSTom:FIX4?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCCustom FIX4

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCCustom:FIX4 <0-15>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCCustom:FIX4?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCNormal[:DATA] FIX4

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCNormal[:DATA]:FIX4 <0-15>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCNormal[:DATA]:FIX4?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCSync[:DATA] FIX4

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCSync[:DATA]:FIX4 <0-15>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCSync[:DATA]:FIX4

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDCustom[:DATA] FIX4

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDCustom[:DATA]:FIX4 <0-15>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDCustom[:DATA]:FIX4?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDNormal[:DATA] FIX4

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDNormal[:DATA]:FIX4 <0-15>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDNormal[:DATA]:FIX4?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDSync[:DATA] FIX4

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDSync[:DATA]:FIX4 <0-15>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDSync[:DATA]:FIX4?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC1[:DATA] FIX4

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC1[:DATA]:FIX4 <0-15>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC1[:DATA]:FIX4?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC2[:DATA] FIX4

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC2[:DATA]:FIX4 <0-15>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC2[:DATA]:FIX4?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UNORmal[:DATA] FIX4

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UNORmal[:DATA]:FIX4 <0-15>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UNORmal[:DATA]:FIX4?

Frame Repeat Single Cont

Press this softkey to toggle between a single output of framed data and continuous transmission of frames. Selecting **Single** will output the following sequences:

- 4-Bit Patterns (FIX4) - A single frame is generated. The 4-bit pattern repeats until the data fields are completely filled. Each trigger transmits the same frame.
- Other Patterns (fixed patterns of equal quantities of ones and zeroes) - A single frame is generated. The selected pattern repeats until the data fields are completely filled. Each trigger transmits the same frame.
- PN9 - A single frame is generated. The data fields are filled with the leading bits of the PN9 sequence. A trigger causes the frame to be transmitted. The data fields of this frame are then filled sequentially with the next series of PN9 data bits. A trigger causes the frame to be transmitted. This process continues, transmitting the entire PN9 sequence frame by frame. The last bit of the PN9 sequence in a data field is immediately followed by the first bit of a second PN9 sequence.
- PN15 - A single frame is generated. The data fields are filled with the leading bits of the PN15 sequence. A trigger causes the frame to be transmitted. The data fields of this frame are then filled sequentially with the next series of PN15 data bits. A trigger causes the frame to be transmitted. This process continues, transmitting the entire PN15 sequence frame by frame. The last bit of the PN15 sequence in a data field is immediately followed by the first bit of a second PN15 sequence.
- User File - The user's file should have the appropriate data to fill an integer number of timeslots. If not, the remaining bits are truncated. Depending on the size of the file, more than one frame can possibly be generated.
- External Data - External data is clocked into the data fields of the timeslot. A single frame is generated.

Combinations of these data patterns may cause some patterns to be truncated. Refer to Chapter 7, "Operation" for the details of the data dependencies.

Selecting **Cont** with framed data causes the frames to be transmitted continuously.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**

Status after Normal Preset: Continuous

SCPI Commands:

[:SOURce]:RADio:TETRa:REPeat SINGle|CONTinuous

[:SOURce]:RADio:TETRa:REPeat?

Frame Trigger

Pressing this softkey reveals a menu of choices for triggering your framed pattern. You can choose to trigger using the front panel **Trigger** key, an external trigger supplied to the PATTERN TRIG IN connector, or by a *TRG command or GET (group execute trigger) signal sent over HP-IB. This softkey is inactive until **Data Format Pattern Framed** is set to **Framed** and **Frame Repeat Single Cont** is set to **Single**.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**

Status after Normal Preset: Trigger Key

SCPI Commands:

[:SOURce]:RADio:TETRa:TRIGger[:SOURce]?

Goto Bottom Row

Press this softkey to move the selection bar to the bottom row of file names in the Goto Row menu that is accessed from the User File menu.

Softkey Location: Press **Mode**, **TETRA**, **Data**, **User File**, **Goto Row**, **Goto Bottom Row** or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up Normal**, **Data**, **User File**, **Goto Row**, **Goto Bottom Row**

Goto Middle Row

Press this softkey to move the selection bar to the middle row of file names in the Goto Row menu that is accessed from the User File menu.

Softkey Location: Press **Mode**, **TETRA**, **Data**, **User File**, **Goto Row**, **Goto Middle Row** or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up Normal**, **Data**, **User File**, **Goto Row**, **Goto Middle Row**

Goto Row

Pressing this softkey reveals a menu of softkeys that help you move the selection bar through the rows of file names in the User File menu. You can also go to a specific row by rotating the front panel knob, using the up and down arrow keys, or entering the row number with the numeric keypad. Once the desired row number is displayed, press the **Enter** terminator softkey.

Softkey Location: Press **Mode**, **TETRA**, **Data**, **User File**, **Goto Row** or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up Normal**, **Data**, **User File**, **Goto Row**

Goto Top Row

Press this softkey to move the selection bar to the top row of file names in the Goto Row menu that is accessed from the User File menu.

Softkey Location: Press **Mode**, **TETRA**, **Data**, **User File**, **Goto Row**, **Goto Top Row** or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up Normal**, **Data**, **User File**, **Goto Row**, **Goto Top Row**

Modify Standard

Pressing this softkey reveals a menu of choices for modifying the standard transmission in the following ways:

- changing the filter from root Nyquist to Nyquist
- changing the filter alpha
- changing the transmission bit rate
- changing the burst rising edge time and delay
- changing the burst falling edge time and delay
- inverting the phase polarity

Softkey Location: Press **Mode**, **TETRA**, **(More 1 of 2)**, **Modify Standard**

Optimize RNYQ For EVM ACP

Press this softkey to optimize the root Nyquist filter for minimized error vector magnitude (select **EVM**) or for minimized adjacent channel power (select **ACP**). The EVM selection provides the most ideal passband. The ACP selection improves stopband rejection.

Softkey Location: Press **Mode**, **TETRA**, **(More 1 of 2)**, **Configure Hardware**, **Optimize RNYQ For EVM ACP**

Status after Normal Preset: EVM

SCPI Commands:

[:SOURce]:RADio:TETRa:CHANnel EVM|ACP

[:SOURce]:RADio:TETRa:CHANnel?

Other Patterns

Pressing this softkey reveals a menu of data pattern selections. Each of the selections in this menu is a pattern of equal quantities of ones and zeroes (such as four ones and four zeroes).

Softkey Location: Press **Mode**, **TETRA**, **Data**, **Other Patterns**
or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up Normal**, **Data**, **Other Patterns**

Other Patterns is also located in the uplink and downlink configure custom menu and in the Data menus found in every other TETRA configure timeslot type menu.

Page Down

Press this softkey to move down one page at a time in the displayed catalog of files.

Softkey Location: Press **Mode**, **TETRA**, **Data**, **User File**, **Page Down**
or press **Mode**, **TETRA**, **Data**, **User File**, **Goto Row**, **Page Down**
or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up Normal**, **Data**, **User File**, **Page Down**
or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up Normal**, **Data**, **User File**, **Goto Row**, **Page Down**

Page Down is also located in the User File menus found in every other TETRA configure timeslot type menu.

Page Up

Press this softkey to move up one page at a time in the displayed catalog of files.

Softkey Location: Press **Mode**, **TETRA**, **Data**, **User File**, **Page Up**
or press **Mode**, **TETRA**, **Data**, **User File**, **Goto Row**, **Page Up**
or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up Normal**, **Data**, **User File**, **Page Up**
or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up Normal**, **Data**, **User File**, **Goto Row**, **Page Up**

Page Up is also located in the User File menus found in every other TETRA configure timeslot type menu.

Pattern Repeat Single Cont

Set this softkey to **Single** to output one occurrence of a modulated data pattern that is not framed. Select the trigger event for the output using the **Pattern Trigger** softkey. Toggle to **Cont** to output a continuous stream of your data pattern.

Softkey Location: Press **Mode**, **TETRA**, **Pattern Repeat Single Cont**

Status after Normal Preset: Continuous

SCPI Commands:

[:SOURce]:RADio:TETRa:REPeat SINGle|CONTinuous

[:SOURce]:RADio:TETRa:REPeat?

Pattern Trigger

Pressing this softkey reveals a menu of choices for triggering a modulated data pattern that is not framed. You can choose to trigger using the front panel **Trigger** key, an external trigger supplied to the PATTERN TRIG IN connector, or by a *TRG command or GET (group execute trigger) signal sent over HP-IB. This softkey is inactive until **Pattern Repeat Single Cont** is set to **Single**.

Softkey Location: Press **Mode**, **TETRA**, **Pattern Repeat Single Cont**, **Pattern Trigger**

Status after Normal Preset: Trigger Key

SCPI Commands:

[:SOURce]:RADio:TETRa:TRIGger[:SOURce]?

Phase Polarity Normal Invert

Press this softkey to reverse the direction of rotation of the phase modulation vector. Choose **Invert** and the in-phase component will lag the quadrature-phase component by 90° in the resulting modulation. The inverted selection also applies to the I OUT and Q OUT signals.

Softkey Location: Press **Mode**, **TETRA**, **More (1 of 2)**, **Modify Standard**, **Phase Polarity Normal Invert**

Status after Normal Preset: Normal

SCPI Commands:

[:SOURce]:RADio:TETRa:POLarity[:ALL] NORMal|INVerted

[:SOURce]:RADio:TETRa:POLarity[:ALL]?

PN9

Press this softkey to select the PN9 pseudorandom bit pattern. If you have selected **PN9** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **PN9** is displayed in the **Data** field in the top line of the text area of the display. If you have selected **PN9** for configuring the framed timeslot data fields, **PN9** is displayed in the **Data** field located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **TETRA**, **Data**, **PN9**
or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up Normal**, **Data**, **PN9**

PN9 is also located in the uplink and downlink configure custom menu and in the Data menus found in every other TETRA configure timeslot type menu.

SCPI Commands:

[:SOURce]:RADio:TETRa:DATA PN9

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:CUSTom PN9

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCCustom PN9

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCNormal[:DATA] PN9

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCSync[:DATA] PN9

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDCustom[:DATA] PN9

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDNormal[:DATA] PN9

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDSync[:DATA] PN9

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC1[:DATA] PN9

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC2[:DATA] PN9

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UNORmal[:DATA] PN9

PN9 Mode Normal Quick

Press this softkey to toggle between normal and quick PN9 modes. A single output of a framed normal PN9 data pattern consists of enough frames so that the end of the PN9 sequence corresponds with the end of a frame. A single output of a framed quick PN9 data pattern consists of one entire PN9 sequence plus enough of a second PN9 sequence to fill the remaining data fields in the current frame. The second PN9 sequence is, therefore, truncated. Quick PN9 mode is only available for downlink timeslots.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Frame**, **PN9 Mode Normal Quick**

Status after Normal Preset: Normal

SCPI Commands:

[:SOURce]:RADio:TETRa:BURSt:PN9 NORMal|QUICk

[:SOURce]:RADio:TETRa:BURSt:PN9?

PN15

Press this softkey to select the PN15 pseudorandom bit pattern. If you have selected **PN15** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **PN15** is displayed in the **Data** field in the top line of the text area of the display. If you have selected **PN15** for configuring the framed timeslot data fields, **PN15** is displayed in the **Data** field located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **TETRA**, **Data**, **PN15**
or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up Normal**, **Data**, **PN15**

PN15 is also located in the uplink and downlink configure custom menu and in the Data menus found in every other TETRA configure timeslot type menu.

SCPI Commands:

[:SOURce]:RADio:TETRa:DATA PN15

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:CUSTom PN15

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCCustom PN15

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCNormal[:DATA] PN15

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCSync[:DATA] PN15

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDCustom[:DATA] PN15

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDNormal[:DATA] PN15

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDSync[:DATA] PN15

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC1[:DATA] PN15

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC2[:DATA] PN15

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UNORmal[:DATA] PN15

Restore Default Bit Rate

Press this softkey to reset the transmission bit rate to the default value (36.000 kbps). This softkey is a convenience feature for quickly resetting the bit rate. You can also change the bit rate by pressing the **Bit Rate** softkey.

Softkey Location: Press **Mode**, **TETRA**, **(More 1 of 2)**, **Modify Standard**, **Bit Rate**, **Restore Default Bit Rate**

Restore Default Burst Shape

Press this softkey to reset the burst shape characteristics to their default values (rise time = 9.376 bits, rise delay = 9.50 bits, fall time = 7.814 bits, fall delay = 9.50 bits). This softkey is a convenience feature for quickly resetting the burst shape. You can also change each of the burst characteristics individually by using the **Rise Time**, **Rise Delay**, **Fall Time**, and **Fall Delay** softkeys in this menu.

Softkey Location: Press **Mode**, **TETRA**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Restore Default Burst Shape**

Restore Default Filter Alpha

Press this softkey to reset the filter alpha parameter to its default value (0.350). This softkey is a convenience feature for quickly resetting the filter alpha. You can also change the bit rate by pressing the **Filter Alpha** softkey.

Softkey Location: Press **Mode**, **TETRA**, **(More 1 of 2)**, **Modify Standard**, **Filter**, **Restore Default Filter Alpha**

Rise Delay

Press this softkey to change the shape of the bursted RF signal by entering a rising edge delay. To change the rise delay, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0 through 63.50 bits.

Softkey Location: Press **Mode**, **TETRA**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Rise Delay**

Status after Normal Preset: 9.50 bits

SCPI Commands:

[:SOURce]:RADio:TETRa:BURSt:SHAPe:RISE:DELay <value>

[:SOURce]:RADio:TETRa:BURSt:SHAPe:RISE:DELay?

[:SOURce]:RADio:TETRa:BURSt:SHAPe:RDELay <value>

[:SOURce]:RADio:TETRa:BURSt:SHAPe:RDELay?

Rise Time

Press this softkey to change the shape of the bursted RF signal by entering a rising edge time. To change the rise time, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **bits** terminator softkey. The range of values allowed is 0.024 through 30 bits.

Softkey Location: Press **Mode**, **TETRA**, **(More 1 of 2)**, **Modify Standard**, **Burst Shape**, **Rise Time**

Status after Normal Preset: 9.376 bits

SCPI Commands:

[:SOURce]:RADio:TETRa:BURSt:SHAPe:RISE:TIME <value>

[:SOURce]:RADio:TETRa:BURSt:SHAPe:RISE:TIME?

[:SOURce]:RADio:TETRa:BURSt:SHAPe:RTIMe <value>

[:SOURce]:RADio:TETRa:BURSt:SHAPe:RTIMe?

Scramble Off On

Press this softkey to enable the scramble capability. When **Scramble Off On** is set to **On**, the data in the related fields will be scrambled using the seed value set with the **Scramble Seed** softkey.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Frame**, **Scramble Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:RADio:TETRa:BURSt:SCRamble[:STATe] ON|OFF|1|0

[:SOURce]:RADio:TETRa:BURSt:SCRamble[:STATe]?

Scramble Seed

Press this softkey to set the scramble seed value. The scramble seed specifies the starting point in the PRBS generator for the scramble. To enter a value (in hexadecimal), press **Scramble Seed**. The scramble seed value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The range of values allowed is hexadecimal 00000000 through FFFFFFFF.

The 32-bit scramble seed consists of four fields. The two least significant bits are defined by the TETRA standard to always be 1. (They must be specified anyway.) The remaining 30 bits are the extended color code, which is divided into three fields: mobile country code, mobile network code, and color code. The two least significant bits are appended to the color code so if, for example, you set a color code of 1, a scramble seed of 7 is required.

MSB LSB

10 Bits Mobile Country Code	14 Bits Mobile Network Code	6 Bits Color Code	2 Bits Always 11

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Frame**, **Scramble Seed**

Status after Normal Preset: FFFFFFF

SCPI Commands:

[:SOURce]:RADio:TETRa:BURSt:SCRamble:SEED <32-bit val>

[:SOURce]:RADio:TETRa:BURSt:SCRamble:SEED?

Select File

Press this softkey to select a file in the displayed catalog of binary files. To make your selection, first scroll through the list, using the front panel knob or up and down arrow keys, until the desired file is highlighted. Press **Select File** and the highlighted file is specified as your data selection. If you have selected a custom file as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **`UserFile`** is displayed in the **`Data`** field in the top line of the text area of the display. If you have selected a custom file for configuring timeslot data fields, the file name you selected is displayed in the **`Data`** field located near the bottom of the text area of the display.

Softkey Location: Press **Mode**, **TETRA**, **Data**, **User File**, **Select File**
or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up Normal**, **Data**, **User File**, **Select File**

Select File is also located in the User File menus found in every other TETRA configure timeslot type menu.

SCPI Commands:

[:SOURce]:RADio:TETRa:DATA “file name”

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:CUSTom “file name”

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCCustom “file name”

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCNormal[:DATA] “file name”

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCSync[:DATA] “file name”

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDCustom[:DATA] “file name”

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDNormal[:DATA] “file name”

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDSync[:DATA] “file name”

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC1[:DATA] “file name”

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC2[:DATA] “file name”

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UNORmal[:DATA] “file name”

SSB

Press this softkey to change the 120-bit synchronization block bits (SSB) value. To enter a value (in hexadecimal), press **STS**. The synchronization block bits value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The current value for synchronization block bits is displayed in the **SSB** field near the bottom of the text area of the display.

Status after Factory Preset: 000000000000000000000000000000

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2)**, **Dn Sync Cont**, **Configure Dn Sync Cont**, **SSB**
or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2)**, **Dn Sync Disc**, **Configure Dn Sync Disc**, **SSB**

SCPI Commands:

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCSync:SSB <120 bit value>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCSync:SSB?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDSync:SSB <120 bit value>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDSync:SSB?

STS

Press this softkey to change the 38-bit synchronization training sequence bits (STS) value. The preset hexadecimal value (when normal preset is selected) for the synchronization training sequence bits reflects the TETRA standard, however you can enter a new value by pressing this softkey. To enter a value (in hexadecimal), press **STS**. The synchronization training sequence value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The current value for synchronization training sequence is displayed in the **STS** field near the bottom of the text area of the display.

Status after Factory Preset: 30673A7067

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2)**, **Dn Sync Cont**, **Configure Dn Sync Cont**, **STS**
or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **More (2 of 2)**, **Dn Sync Disc**, **Configure Dn Sync Disc**, **STS**

SCPI Commands:

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCSync:STS <38 bit value>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCSync:STS?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDSync:STS <38 bit value>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDSync:STS?

Sync Out

Press this softkey to reveal a menu of choices for outputting a 1-bit synchronization signal to the EVENT 1 rear panel connector. In this menu you can choose to set the synchronization signal to occur at the beginning of a data pattern, at the beginning of a frame, at the beginning of a selected timeslot, or at the beginning of each timeslot in a frame.

Softkey Location: Press **Mode**, **TETRA**, **More (1 of 2)**, **Sync Out**

Status after Normal Preset: Begin Pattern

SCPI Commands:

[:SOURce]:RADio:TETRa:SOUT?

Sync Out Offset

Press this softkey to move the synchronization signal forward or back from the beginning of the data pattern, frame, or timeslot. To set the number of bits of offset, press **Sync Out Offset** and synchronization offset becomes the active function. Enter the desired value using the front panel knob, up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. The range of values allowed is –509 through +509 bits.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **More (1 of 2)**, **Sync Out**, **Sync Out Offset**

Status after Normal Preset: 0 bits

SCPI Commands:

[:SOURce]:RADio:TETRa:SOUT:OFFSet <value>

[:SOURce]:RADio:TETRa:SOUT:OFFSet?

TETRA Off On

Press this softkey to enable the TETRA communications standard. Setting **TETRA Off On** to **On** sets up the internal hardware to generate the structure that follows the TETRA standard. The internal I/Q modulator generates π/4DQPSK digital modulation and the **TETRA** and **I/Q** annunciators are turned on in the display. Although the digital modulation is enabled with this softkey, the RF carrier is modulated by the enabled modulation only when you have also set **Mod On/Off** to **On**.

Setting **TETRA Off On** to **On** presets the following softkeys in the I/Q menu: **I/Q Off On** is set to **On** and **I/Q Source** is set to **Int I/Q**. You can override these selections in the I/Q menu.

Softkey Location: Press **Mode**, **TETRA**, **TETRA Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:RADio:TETRa[:STATe] ON|OFF|1|0

[:SOURce]:RADio:TETRa[:STATe]?

Timeslot

Press this softkey to select a timeslot to be configured. Choose any of the four timeslots. Enter the timeslot number using the front panel knob, the up and down arrow keys, or enter the number using the numeric keypad and press the **Enter** terminator softkey.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot #**

Timeslot Off On

Press this softkey to toggle the active timeslot on and off. For example, to turn on timeslot 2, select the timeslot by pressing the **Timeslot #** softkey in this same menu. Enter the number 2 to make timeslot 2 active. Then turn this timeslot on by toggling **Timeslot Off On** to **On**. Notice that the visual representation of the timeslot pattern now shows timeslot 2 turned on.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Off On**

Status after Normal Preset: On (timeslot 1), Off (timeslots 2 - 4)

SCPI Commands:

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:STATe ON|OFF|1|0

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:STATe?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:STATe ON|OFF|1|0

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:STATe?

Timeslot Type

Pressing this softkey reveals a menu of choices for setting the timeslot type for the active timeslot. You can choose to set any timeslot to be an uplink normal, control 1, control 2, or custom timeslot. You can also select from downlink continuous or discontinuous normal, custom, or synchronization timeslots. When you have selected the type for the timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**

Status after Normal Preset: Uplink Normal (for all timeslots)

SCPI Commands:

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4[:TYPE]?

Trigger Key

Press this softkey to select the front panel **Trigger** key as the pattern trigger for a single output of a modulated data transmission that is not framed (**Data Format Pattern Framed** is set to **Pattern**) or select the **Trigger** key as the frame trigger for a single output of your framed data. Once selected, you can trigger a single event at any time by pressing the **Trigger** key.

Softkey Location: Press **Mode**, **TETRA**, **Pattern Repeat Single Cont**, **Pattern Trigger**, **Trigger Key**
or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Frame Repeat Single Cont**, **Frame Trigger**, **Trigger Key**

SCPI Commands:

[:SOURce]:RADio:TETRa:TRIGger[:SOURce] KEY

TS

Press this softkey to change the training sequence (TS). The preset hexadecimal value (when normal preset is selected) for TS reflects the TETRA standard, however you can enter a new value by pressing this softkey. To enter a value (in hexadecimal), press **TS**. The training sequence value becomes the active function. Enter a new value using the front panel knob, up and down arrow keys, or use the numeric keypad and the **A**, **B**, **C**, **D**, **E**, and **F** softkeys and press the **Enter** terminator softkey. The current value for training sequence is displayed in the **TS** field near the bottom of the text area of the display.

Status after Factory Preset: 343A74 (uplink normal, downlink normal continuous and discontinuous), 2743A743 (uplink control 1 and 2)

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up Normal**, **TS**

TS is also located in the uplink configure control 1 and control 2 menus and in the downlink configure normal continuous and discontinuous menus.

SCPI Commands:

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCNormal:TSEQuence <30 bit value>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DCNormal:TSEQuence?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDNormal:TSEQuence <30 bit value>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:DDNormal:TSEQuence?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC1:TSEQuence <30 bit value>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC1:TSEQuence?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC2:TSEQuence <30 bit value>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UC2:TSEQuence?

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UNORmal:TSEQuence <22 bit value>

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4:UNORmal:TSEQuence?

Up Control 1

Press this softkey to select uplink control subslot 1 as the timeslot type for the active timeslot.

Uplink timeslots cannot be mixed with downlink timeslots. If you already have any timeslots designated as downlink, they will be changed to uplink when any other timeslot is designated as uplink. The following table shows the timeslot type interchanges that will occur if the frame was designated as downlink and then uplink is selected.

From Continuous Downlink Timeslot	From Discontinuous Downlink Timeslot	To Uplink Timeslot
Dn Custom Cont	Dn Custom Disc	Up Custom
Dn Normal Cont	Dn Normal Disc	Up Normal
Dn Sync Cont	Dn Sync Disc	Up Custom

When you select **Up Control 1** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Up Control 1**

SCPI Commands:

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4[:TYPE] UC1

Up Control 2

Press this softkey to select uplink control subslot 2 as the timeslot type for the active timeslot.

Uplink timeslots cannot be mixed with downlink timeslots. If you already have any timeslots designated as downlink, they will be changed to uplink when any other timeslot is designated as uplink. The following table shows the timeslot type interchanges that will occur if the frame was designated as downlink and then uplink is selected.

From Continuous Downlink Timeslot	From Discontinuous Downlink Timeslot	To Uplink Timeslot
Dn Custom Cont	Dn Custom Disc	Up Custom
Dn Normal Cont	Dn Normal Disc	Up Normal
Dn Sync Cont	Dn Sync Disc	Up Custom

When you select **Up Control 1** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Up Control 2**

SCPI Commands:

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4[:TYPE] UC2

Up Custom

Press this softkey to select an uplink custom timeslot type for the active timeslot. An uplink custom timeslot is configured using an internally-generated data pattern, a downloaded sequence of bits stored in a user file, or by supplying external data. The uplink custom timeslot is provided for users' flexibility but it is not a standard TETRA timeslot.

Uplink timeslots cannot be mixed with downlink timeslots. If you already have any timeslots designated as downlink, they will be changed to uplink when any other timeslot is designated as uplink. The following table shows the timeslot type interchanges that will occur if the frame was designated as downlink and then uplink is selected.

From Continuous Downlink Timeslot	From Discontinuous Downlink Timeslot	To Uplink Timeslot
Dn Custom Cont	Dn Custom Disc	Up Custom
Dn Normal Cont	Dn Normal Disc	Up Normal
Dn Sync Cont	Dn Sync Disc	Up Custom

When you have selected **Up Custom** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your configuration.

Softkey Location: Press **Mode**, **TETRAC**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Up Custom**

SCPI Commands:

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4[:TYPE] CUSTom

Up Normal

Press this softkey to select uplink normal as the timeslot type for the active timeslot.

Uplink timeslots cannot be mixed with downlink timeslots. If you already have any timeslots designated as downlink, they will be changed to uplink when any other timeslot is designated as uplink. The following table shows the timeslot type interchanges that will occur if the frame was designated as downlink and then uplink is selected.

From Continuous Downlink Timeslot	From Discontinuous Downlink Timeslot	To Uplink Timeslot
Dn Custom Cont	Dn Custom Disc	Up Custom
Dn Normal Cont	Dn Normal Disc	Up Normal
Dn Sync Cont	Dn Sync Disc	Up Custom

When you select **Up Normal** for a timeslot, the visual representation of the timeslot pattern on the display is immediately updated to show your selection.

Softkey Location: Press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Timeslot Type**, **Up Normal**

SCPI Commands:

[:SOURce]:RADio:TETRa:SLOT[1]|2|3|4[:TYPE] UNORmal

User File

Press this softkey to display the catalog of binary files stored in the signal generator's memory. You can select a custom file from this catalog for your data pattern. Scroll through the listed files and when your selection is highlighted, press the **Select File** softkey. If you have selected **User File** as a data pattern for modulated transmissions that are not framed (**Data Format Pattern Framed** is set to **Pattern**), **`UserFile`** is displayed in the **`Data`** field in the top line of the text area of the display. If you have selected **User File** for configuring timeslot data fields, the file name you selected is displayed in the **`Data`** field located near the bottom of the text area of the display.

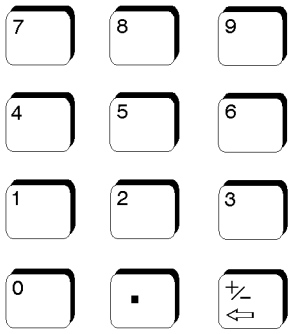
User's files should exactly fill the data fields in a framed transmission. (Create the files to fill an integer number of frames.) If the end of the user's file does not coincide with the end of a frame, data will be truncated in one of the following ways:

- Enough frames will be generated to transmit as much of the data pattern as will fit into complete frames. The remaining bits of the data pattern (which are too few to completely fill a frame) are truncated.
- If two files of unequal sizes are selected for the same framed transmission, enough frames will be generated to transmit as much of the data pattern of the largest file as will fit into complete frames. The remaining bits of the data pattern are truncated. The smaller file will be repeated as many times as necessary to completely fill these frames. Data will be truncated for the smaller file to coincide with the end of the last frame.
- If a user's file and a PN9 or PN15 file are selected for the same framed transmission and the user's file is shorter than the PN9/15, enough frames will be generated to transmit the PN9/15. The end of the PN9/15 data will coincide with the end of the last frame. The smaller user's file will be repeated as many times as necessary to completely fill these frames. Data will be truncated for the smaller file to coincide with the end of the last frame.
- If a user's file and a PN9 file are selected for the same framed transmission and the user's file is longer than the PN9, enough frames will be generated to transmit as much of the data pattern as will fit into complete frames. The remaining bits of the data pattern (which are too few to completely fill a frame) are truncated. The PN9 data will be repeated as many times as necessary to completely fill these frames.

Softkey Location: Press **Mode**, **TETRA**, **Data**, **User File**
or press **Mode**, **TETRA**, **Data Format Pattern Framed**, **Configure Timeslot**, **Configure Up Normal**, **Data**, **User File**

User File is also located in the uplink and downlink configure custom menu and in the Data menus found in every other TETRA configure timeslot type menu.

Numeric Keypad



The numeric keypad consists of the digit keys (0 through 9), a decimal point key, and a backspace key, [+/-←] The backspace key has dual functions for both backspacing and for changing the sign of a value to positive or negative. Use these keys at any time when the active function requires a value input. The backspace key function changes with the situation.

If you are modifying a previously entered value:

- If the value is negative, pressing the backspace key deletes the entire value and leaves the negative sign. Subsequent key presses change the sign between positive and negative states.
- If the value is positive, pressing the backspace key deletes the entire value and also changes the sign to a negative state. Subsequent key presses change the sign between positive and negative states.

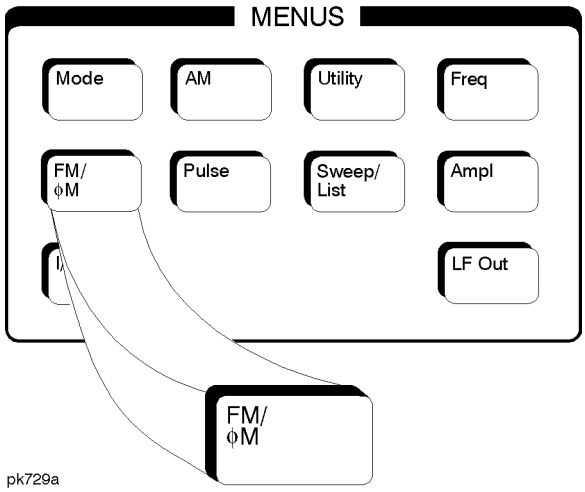
If you are entering a new value:

- If the cursor is to the right of the digits, pressing the backspace key deletes the digit immediately to the left. When no digits remain, subsequent key presses change the sign between positive and negative states.
- If the cursor is on a digit, pressing the backspace key deletes the digit immediately to the left. When a single digit remains, pressing the backspace key changes the negative sign (if present) to positive and then subsequent key presses have no effect.

These keys have autorepeat capability (except for the decimal point key). Hold a key down and its function is continuously executed until you release it.

Phase Modulation

Pressing the front panel phase modulation key (**ΦM**) reveals a menu of softkeys. These softkeys are described in this section in alphabetical order.



ΦM Dev

Use this softkey to set the phase modulation deviation for the **ΦM Path 1** and **ΦM Path 2** configurations. To change the value of the ΦM deviation, press the softkey once. The current value for ΦM deviation is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **pi rad**, **rad**, or **deg** terminator softkey. The range of values allowed depends on the carrier frequency and the rate selected. Refer to Table 5-1.

Table 5-1. Maximum Deviation Values for Phase Modulation

Mode	Maximum Deviation	Maximum Rates (3 dB BW)	
		ΦM Path 1	ΦM Path 2
Normal	N[1] x 90 radians	100 kHz	100 kHz
High Bandwidth	N x 2π radians	1.5 MHz (typical)	1 MHz (typical)
	N x π/2 radians	6 MHz (typical)	1 MHz (typical)

1. For the value of N, refer to Table 5-2.

Table 5-2. Carrier Frequency Bands versus Value of N

Carrier Frequency	N
250 kHz to ≤ 249.999 MHz	1
> 249.999 MHz to ≤500 MHz	0.5
> 500 MHz to ≤1 GHz	1
> 1 GHz to ≤2 GHz	2
> 2 GHz to 4 GHz	4

For example, if you set up **ΦM Path 1** for normal phase modulation with a carrier frequency of 400 MHz, and a rate of 100 kHz, the maximum peak deviation that you can set is 0.5 (value of N) times 90 radians resulting in a maximum peak deviation of 45 radians.

Notice that the new value of ΦM deviation applies only to whichever ΦM path configuration you have currently selected. Also, **ΦM Path 2** is limited to a maximum rate of 1 MHz. Also, whenever **ΦM Path 1** is used with **ΦM Path 2**, the deviation for **ΦM Path 1** must be greater than or equal to the deviation for **ΦM Path 2**.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **ΦM Path 1 2**

Status after Normal Preset: 0 radians

SCPI Commands:

[:SOURce]:PM[1]|2[:DEViation] <val><unit>

[:SOURce]:PM[1]|2[:DEViation]?

ΦM Dev Couple Off On

This softkey toggles the ΦM deviation coupling on and off. Turning on ΦM deviation coupling links the ΦM deviation values of **ΦM Path 1** and **ΦM Path 2**. When the values are coupled, any change you make to one ΦM deviation value is applied to both ΦM deviation values.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **ΦM Dev Couple Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:PM[1]|2:[DEViation]:TRACk ON|OFF|1|0

[:SOURce]:PM[1]|2:[DEViation]:TRACk?

ΦM Dual-Sine Ampl Ratio

Press this softkey to set the ratio of the deviation of ΦM tone 2 to the deviation of ΦM tone 1 as a percent. The range of values allowed is 0 to 100%. The minimum increment allowed is 0.1%. The sum of the two ΦM deviations results in the total ΦM deviation (set by the **ΦM Dev** softkey in the initial ΦM Menu).

For example, if the total ΦM deviation is 300 radians and you set **ΦM Dual-Sine Ampl Ratio** to 50%, then the deviation of ΦM tone 1 will be 200 radians and the deviation of ΦM tone 2 will be 100 radians (50% of 200 radians) so that the deviation of the two tones adds up to 300 radians (200 radians plus 100 radians).

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **ΦM Waveform**, **Dual-Sine**, **ΦM Dual-Sine Ampl Ratio**

Status after Normal Preset: 100.0%

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:FREQuency:ALTernate:AMPLitude:PERCent <val><unit>

[:SOURce]:PM[1]|2:INTernal[1]:FREQuency:ALTernate:AMPLitude:PERCent?

ΦM Off On

This softkey toggles the phase modulation on or off for whichever ΦM configuration (**ΦM Path 1** or **ΦM Path 2**) you have selected. Notice, however that although you can turn on phase modulation with this softkey, the RF carrier is modulated by the enabled modulation only when you have also set **Mod On/Off** to **On**. Whenever phase modulation is enabled, the **ΦM** annunciator is turned on in the display.

There are two paths for ΦM modulation which can be simultaneously enabled as long as they use different sources (Int, Ext1, or Ext2). **ΦM Path 2** is limited to a maximum rate of 1 MHz. **ΦM Path 2** must be set to a deviation less than or equal to **ΦM Path 1**. The modulation signals from both paths are summed internally for composite modulation.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **ΦM Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:PM[1]|2:STATe ON|OFF|1|0

[:SOURce]:PM[1]|2:STATe?

ΦM Path 1 2

Use **ΦM Path 1** and **ΦM Path 2** to define two unique phase modulation configurations. For example, select **ΦM Path 1** (**ΦM Path 1** is the default after a normal preset. If **ΦM Path 1** is not highlighted, press the softkey once and the selection will toggle from **ΦM Path 2** to **ΦM Path 1**.) Configure the modulation characteristics (such as deviation, source, rate, and waveform) using the remaining softkeys in the ΦM menu. Then enable ΦM by setting **ΦM Off On** to **On**.

To configure a second phase modulation configuration, toggle to **ΦM Path 2**. Define the modulation characteristics for this second configuration and enable ΦM by setting **ΦM Off On** to **On**.

The RF carrier is available at the RF OUTPUT connector when you set **RF On/Off** to **On**. Set **Mod On/Off** to **On** to modulate the RF carrier with the modulations that you have enabled.

ΦM Path 1 and **ΦM Path 2** are summed internally for composite modulation. Either path can be switched to any one of the modulation sources: Int, Ext1, or Ext2. All modulation types can be simultaneously enabled, except FM with ΦM, AM with external burst source, and wideband AM with I/Q. AM, FM, and ΦM can sum simultaneous inputs from any two sources (Int, Ext1, and Ext2). Any given source (Int, Ext1, or Ext2) can only be routed to one activated modulation type.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **ΦM Path 1 2**

Status after Normal Preset: ΦM Path 1

ΦM Rate

Use this softkey to change the internal modulation frequency for the **ΦM Path 1** and **ΦM Path 2** configurations. To change the value, press the softkey once. The current value for ΦM rate is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Hz** or **kHz** terminator softkey. The range of values allowed is 0.1 Hz to 10 kHz. (0.1 Hz to 50 kHz is the range allowed if sinewave is selected as the internal waveform.) The minimum increment allowed is 0.1 Hz. Notice that the new value of ΦM rate applies only to whichever ΦM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **ΦM Rate**

Status after Normal Preset: 400 Hz

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:FREQuency <val><unit>

[:SOURce]:PM[1]|2:INTernal[1]:FREQuency?

ΦM Source

Pressing this softkey reveals a menu of choices for phase modulation sources. You can choose internally-generated phase modulation or select an externally-applied signal from either the EXT 1 INPUT or EXT 2 INPUT connectors. The internal modulation is always AC-coupled. For the externally-applied signals, you can choose between AC- and DC-coupled modulation. A 1.0 Vpk input is required for calibrated ΦM deviation settings. The **EXT 1 LO/HI** and **EXT 2 LO/HI** display annunciators will turn on if the peak input voltage differs from 1.0 Vpk by more than 3%. (The LO/HI annunciators only function for AC-coupled external inputs.)

The internal and external 1 and 2 sources have multiple uses. You can use them for amplitude, frequency, and phase modulation. For burst modulation, you can only use the external 1 source and you must use the external 2 source for pulse modulation. However, any given source can only be routed to one enabled modulation at a time. If, for example, you were using the external 1 source in a frequency modulation configuration for **FM Path 1**, and then you configured **AM Path 2** to also use the external 1 source, the signal generator would turn off **FM Path 1** and assign the external 1 source to your **AM Path 2** configuration. Notice that for these purposes the external 1 AC-coupled source is the same as the external 1 DC-coupled source and the external 2 AC-coupled source is the same as the external 2 DC-coupled source.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **ΦM Source**

SCPI Commands:

[:SOURce]:PM[1]|2:SOURce?

ΦM Start Rate

Use this softkey to change the starting internal modulation frequency for swept-sine phase modulation. To change the value, press the softkey once. The current value for the ΦM start rate is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Hz** or **kHz** terminator softkey. The range of values allowed is 0.1 Hz to 50 kHz. The minimum increment allowed is 0.1 Hz.

This softkey is coupled to the **ΦM Rate** softkey in the initial ΦM Menu and the **ΦM Tone 1 Rate** softkey in the ΦM Dual-Sine Menu. Any value set for **ΦM Start Rate** is reflected in the **ΦM Rate** and **ΦM Tone 1 Rate** softkeys. Conversely, if you change the value for either the **ΦM Rate** softkey or the **ΦM Tone 1 Rate** softkey, the value for **ΦM Start Rate** is changed to match.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **ΦM Waveform**, **Swept-Sine**, **ΦM Start Rate**

Status after Normal Preset: 400.0 Hz

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:FREQuency <val><unit>

[:SOURce]:PM[1]|2:INTernal[1]:FREQuency?

ΦM Stop Rate

Use this softkey to change the ending internal modulation frequency for swept-sine phase modulation. To change the value, press the softkey once. The current value for the ΦM stop rate is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Hz** or **kHz** terminator softkey. The range of values allowed is 0.1 Hz to 50 kHz. The minimum increment allowed is 0.1 Hz.

This softkey is coupled to the **ΦM Tone 2 Rate** softkey in the ΦM Dual-Sine Menu. Any value set for **ΦM Stop Rate** is reflected in the **ΦM Tone 2 Rate** softkey. Conversely, if you change the value for the **ΦM Tone 2 Rate** softkey, the value for **ΦM Stop Rate** is changed to match.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **ΦM Waveform**, **Swept-Sine**, **ΦM Stop Rate**

Status after Normal Preset: 400.0 Hz

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:FREQuency:ALTernate <val><unit>

[:SOURce]:PM[1]|2:INTernal[1]:FREQuency:ALTernate?

ΦM Sweep Time

Press this softkey to set the sweep time for swept-sine phase modulation. The signal generator will vary the ΦM rate from the specified start rate to the stop rate in the time set with this softkey. Enter the desired sweep time using the up and down arrow keys, the front panel knob, or enter a value using the numeric keypad and press the **sec** or **msec** terminator softkey. The range of values allowed is 1 ms through 65.535 s. The minimum increment allowed is 1 ms.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **ΦM Waveform**, **Swept-Sine**, **ΦM Sweep Time**

Status after Normal Preset: 100.0 msec

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:SWEep:TIME <val><unit>

[:SOURce]:PM[1]|2:INTernal[1]:SWEep:TIME?

ΦM Sweep Trigger

Pressing this softkey reveals a menu of choices for triggering swept-sine phase modulation. You can choose triggering that occurs immediately, triggering that is supplied by the HP-IB, triggering on either the positive or negative edge of a signal supplied to the TRIGGER IN connector, or triggering by the front panel **Trigger** key.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **ΦM Waveform**, **Swept-Sine**, **ΦM Sweep Trigger**

Status after Normal Preset: Immediate

SCPI Commands:

:TRIGger[:SEQuence]:SOURce?

ΦM Tone 1 Rate

Press this softkey to set the internal modulation frequency for the ΦM tone 1. Enter the desired rate using the up and down arrow keys, the front panel knob, or enter a value using the numeric keypad and press the **kHz** or **Hz** terminator softkey. The range of values allowed is 0.1 Hz through 50 kHz. The minimum increment allowed is 0.1 Hz.

This softkey is coupled to the **ΦM Rate** softkey in the initial ΦM Menu and the **ΦM Start Rate** softkey in the ΦM Swept-Sine Menu. Any value set for **ΦM Tone 1 Rate** is reflected in the **ΦM Rate** and **ΦM Start Rate** softkeys. Conversely, if you change the value for either the **ΦM Rate** softkey or the **ΦM Start Rate** softkey, the value for **ΦM Tone 1 Rate** is changed to match.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **ΦM Waveform**, **Dual-Sine**, **ΦM Tone 1 Rate**

Status after Normal Preset: 400.0 Hz

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:FREQuency <val><unit>

[:SOURce]:PM[1]|2:INTernal[1]:FREQuency?

ΦM Tone 2 Rate

Press this softkey to set the internal modulation frequency for the ΦM tone 2. Enter the desired rate using the up and down arrow keys, the front panel knob, or enter a value using the numeric keypad and press the **kHz** or **Hz** terminator softkey. The range of values allowed is 0.1 Hz through 50 kHz. The minimum increment allowed is 0.1 Hz.

This softkey is coupled to the **ΦM Stop Rate** softkey in the ΦM Swept-Sine Menu. Any value set for **ΦM Tone 2 Rate** is reflected in the **ΦM Stop Rate** softkey. Conversely, if you change the value for the **ΦM Stop Rate** softkey, the value for **ΦM Tone 2 Rate** is changed to match.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **ΦM Waveform**, **Dual-Sine**, **ΦM Tone 2 Rate**

Status after Normal Preset: 400.0 Hz

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:FREQuency:ALTernate <val><unit>

[:SOURce]:PM[1]|2:INTernal[1]:FREQuency:ALTernate?

ΦM Waveform

Pressing this softkey reveals a menu of ΦM waveform choices for your **ΦM Path 1** and **ΦM Path 2** configurations. Select from sine, triangle, square, ramp, noise, dual-sine, and swept-sine waveforms. Notice that your waveform selection applies only to which ever ΦM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **ΦM Waveform**

Status after Normal Preset: Sine

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Bus

This softkey is one of the choices in the ΦM Sweep Trigger menu. With **Bus** selected, you use the HP-IB to trigger single sweeps of swept-sine phase modulation.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **ΦM Waveform**, **Swept-Sine**, **ΦM Sweep Trigger**, **Bus**

Status after Normal Preset: ΦM sweep trigger is set to Immediate

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:SWEep:TRIGger BUS

[:SOURce]:PM[1]|2:INTernal[1]:SWEep:TRIGger?

DCFM/DCΦM Cal

Pressing this softkey initiates a DCΦM calibration. This calibration eliminates the offset in DC phase modulation so that the carrier phase remains the same with no modulation applied. External, DC-coupled ΦM must be active when this command is executed.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **DCFM/DCΦM Cal**

SCPI Commands:

:CALibration:DCFM

Dual-Sine

Pressing this softkey reveals a menu of choices for setting the dual-sine phase modulation parameters. In this menu you can set the ΦM rates for two separate tones. In addition you can set a ratio of the tone 2 ΦM deviation to the tone 1 ΦM deviation.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **ΦM Waveform**, **Dual-Sine**

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe DUALsine

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Ext

This softkey is one of the choices in the ΦM Sweep Trigger menu. Choosing **Ext** allows you to trigger swept-sine phase modulation using a signal applied to the TRIGGER IN rear panel connector. Set the polarity of the trigger signal using the **Trigger In Polarity Neg Pos** softkey.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **ΦM Waveform**, **Swept-Sine**, **ΦM Sweep Trigger**, **Ext**

Status after Normal Preset: ΦM sweep trigger is set to Immediate

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:SWEep:TRIGger EXTernal

[:SOURce]:PM[1]|2:INTernal[1]:SWEep:TRIGger?

Ext 1 AC-Coupled

This softkey lets you input an external, AC-coupled, phase modulation signal to the EXT 1 INPUT connector. The modulation signal is tested for voltage and a display annunciator will report a high or low condition if the voltage is > ±3% of 1 Vpk.

The external 1 input has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 1 input in an amplitude modulation configuration for **AM Path 1**, and then you configured **ΦM Path 2** to also use the external 1 input, the signal generator would turn off **AM Path 1** and assign the external 1 input to your **ΦM Path 2** configuration. For the purposes of this discussion, the external 1 AC-coupled input is the same as the external 1 DC-coupled source.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **ΦM Source**, **Ext 1 AC-Coupled**

SCPI Commands:

[:SOURce]:PM[1]|2:SOURce EXTernal1

[:SOURce]:PM[1]|2:EXTernal[1]:COUPling AC

[:SOURce]:PM[1]|2:EXTernal[1]:COUPling?

Ext 1 DC-Coupled

This softkey lets you input an external, DC-coupled, phase modulation signal to the EXT 1 INPUT connector.

The external 1 input has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 1 input in an amplitude modulation configuration for **AM Path 1**, and then you configured **ΦM Path 2** to also use the external 1 input, the signal generator would turn off **AM Path 1** and assign the external 1 input to your **ΦM Path 2** configuration. For the purposes of this discussion, the external 1 AC-coupled input is the same as the external 1 DC-coupled source.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **ΦM Source**, **Ext 1 DC-Coupled**

SCPI Commands:

[:SOURce]:PM[1]|2:SOURce EXTernal1

[:SOURce]:PM[1]|2:EXTernal[1]:COUPling DC

[:SOURce]:PM[1]|2:EXTernal[1]:COUPling?

Ext 2 AC-Coupled

This softkey lets you input an external, AC-coupled, phase modulation signal to the EXT 2 INPUT connector. The modulation signal is tested for voltage and a display annunciator will report a high or low condition if the voltage is > ±3% of 1 Vpk.

The external 2 input has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 2 input in an amplitude modulation configuration for **AM Path 1**, and then you configured **ΦM Path 2** to also use the external 2 input, the signal generator would turn off **AM Path 1** and assign the external 2 input to your **ΦM Path 2** configuration. For the purposes of this discussion, the external 2 AC-coupled input is the same as the external 2 DC-coupled source.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **ΦM Source**, **Ext 2 AC-Coupled**

SCPI Commands:

[:SOURce]:PM[1]|2:SOURce EXTernal2

[:SOURce]:PM[1]|2:EXTernal2:COUPling AC

[:SOURce]:PM[1]|2:EXTernal2:COUPling?

Ext 2 DC-Coupled

This softkey lets you input an external, DC-coupled, phase modulation signal to the EXT 2 INPUT connector.

The external 2 input has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 2 input in an amplitude modulation configuration for **AM Path 1**, and then you configured **ΦM Path 2** to also use the external 2 input, the signal generator would turn off **AM Path 1** and assign the external 2 input to your **ΦM Path 2** configuration. For the purposes of this discussion, the external 2 AC-coupled input is the same as the external 2 DC-coupled source.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **ΦM Source**, **Ext 2 DC-Coupled**

SCPI Commands:

[:SOURce]:PM[1]|2:SOURce EXTernal2

[:SOURce]:PM[1]|2:EXTernal2:COUPling DC

[:SOURce]:PM[1]|2:EXTernal2:COUPling?

FM/ΦM Normal High BW

This softkey toggles between the menus for FM, normal ΦM, and wideband ΦM. Normal ΦM lets you set the phase deviation as high as N x 90 radians with a 3 dB bandwidth of 100 kHz. Wideband ΦM provides increased bandwidth while restricting the maximum deviation to deviation settings up to π/2 radians (90°). The modulation bandwidth is typically 6 MHz. For deviation settings between π/2 and 2π radians (360°), the modulation bandwidth is typically 1.5 MHz. (These increased bandwidths are only available using **ΦM Path 1**. **ΦM Path 2** is limited to 1 MHz.)

Softkey Location: Press **FM/ΦM** hardkey, press **FM/ΦM** softkey once for normal bandwidth or twice for high bandwidth

Status after Normal Preset: FM

SCPI Commands:

[:SOURce]:PM[1]|2:BANDwidth|BWIDth NORMalHIGH

[:SOURce]:PM[1]|2:BANDwidth|BWIDth?

Immediate

This softkey is one of the choices in the ΦM Sweep Trigger menu. Choosing **Immediate** immediately triggers swept-sine phase modulation in a continuous mode. To stop the sweep, choose a different trigger such as **Ext**, or set the waveform to something other than **Swept-Sine**.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **ΦM Waveform**, **Swept-Sine**, **ΦM Sweep Trigger**, **Immediate**

Status after Normal Preset: ΦM sweep trigger is set to Immediate

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:SWEep:TRIGger IMMediate

[:SOURce]:PM[1]|2:INTernal[1]:SWEep:TRIGger?

Internal

This softkey lets you internally generate an AC-coupled, phase modulation signal.

The internal source has multiple uses but can be used for only one modulation at a time. If, for example, you were using the internal source in an amplitude modulation configuration for **AM Path 1**, and then you configured **ΦM Path 2** to also use the internal source, the signal generator would turn off **AM Path 1** and assign the internal source to your **ΦM Path 2** configuration.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **ΦM Source**, **Internal**

Status after Normal Preset: Internal

SCPI Commands:

[:SOURce]:PM[1]|2:SOURce INT[1]

[:SOURce]:PM[1]|2:SOURce?

Noise

This softkey lets you specify noise as the phase modulation waveform for the **ΦM Path 1** and **ΦM Path 2** configurations. Notice that the selected waveform applies only to whichever ΦM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **ΦM Waveform**, **Noise**

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe NOISe

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Ramp

This softkey lets you specify ramp as the phase modulation waveform for the **ΦM Path 1** and **ΦM Path 2** configurations. Notice that the selected waveform applies only to whichever ΦM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **ΦM Waveform**, **Ramp**

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe RAMP

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Sine

This softkey lets you specify sine as the phase modulation waveform for the **ΦM Path 1** and **ΦM Path 2** configurations. Notice that the selected waveform applies only to whichever ΦM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **ΦM Waveform**, **Sine**

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe SINe

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Square

This softkey lets you to specify square as the phase modulation waveform for the **ΦM Path 1** and **ΦM Path 2** configurations. Notice that the selected waveform applies only to whichever ΦM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **ΦM Waveform**, **Square**

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe SQUare

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Swept-Sine

Pressing this softkey reveals a menu of choices for setting the swept-sine phase modulation parameters. In this menu you can set the start and stop ΦM rate and the sweep time. You can set the signal generator to a single, externally-triggered sweep on either a negative or positive TTL level or you can choose continuous sweep, triggered immediately. In this menu you can also select either a positive or negative polarity for the TRIGGER OUT signal.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **ΦM Waveform**, **Swept-Sine**

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe SWEPtsine

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Triangle

This softkey lets you to specify triangle as the frequency modulation waveform for the **ΦM Path 1** and **ΦM Path 2** configurations. Notice that the selected waveform applies only to whichever ΦM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **ΦM Waveform**, **Triangle**

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe TRIangle

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Trigger In Polarity Neg Pos

Press this softkey to toggle between a negative TTL level trigger (0 V) and a positive TTL level trigger (+5 V) for externally triggering swept-sine phase modulation.

This softkey is coupled to the **Trigger In Polarity Neg Pos** softkey for swept-sine AM, FM, and LF Out, and to the **Ext Neg** and **Ext Pos** sweep trigger selections in the Sweep/List Menu. If you set the **Trigger In Polarity Neg Pos** softkey in the ΦM Swept-Sine Menu to **Neg**, the **Trigger In Polarity Neg Pos** softkey is also set to **Neg** for swept-sine AM, FM, and LF Out. And, in addition, if the step or list sweep trigger is set to **Ext Pos**, the trigger selection will automatically be changed to **Ext Neg**. The same softkeys will toggle to **Pos** or to **Ext Pos** if you select **Pos** in the Swept-Sine ΦM Menu.

Conversely, if the **Trigger In Slope Neg Pos** softkey is toggled in the swept-sine AM, FM, or LF Out menus, it will cause the swept-sine ΦM softkey to toggle also. This is also true for the **Ext Neg** and **Ext Pos** step or list sweep trigger selections.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **ΦM Waveform**, **Swept-Sine**, **Trigger In Polarity Neg Pos**

Status after Normal Preset: Pos

SCPI Commands:

:TRIGger[:SEQuence]:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:SLOPe?

Trigger Key

This softkey is one of the choices in the ΦM Sweep Trigger menu. With **Trigger Key** selected, when you press the **Trigger** front panel key you immediately trigger a single sweep of swept-sine phase modulation.

The **Trigger** key has autorepeat capability. Hold it down and you will repeatedly trigger sweeps until you release the key.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **ΦM Waveform**, **Swept-Sine**, **ΦM Sweep Trigger**, **Trigger Key**

Status after Normal Preset: ΦM sweep trigger is set to Immediate

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:SWEep:TRIGger KEY

[:SOURce]:PM[1]|2:INTernal[1]:SWEep:TRIGger?

Trigger Out Polarity Neg Pos

This softkey toggles the polarity of the TTL signal that is output at the rear panel TRIGGER OUT connector. When **Trigger Out Polarity Neg Pos** is set to **Pos**, the output signal is asserted high (+5 V) at the start of the swept-sine phase modulation sweep and low (0 V) when the sweep is concluded. Setting **Trigger Out Polarity Neg Pos** to **Neg** reverses the polarity, where a high is 0 V and a low is +5 V.

This softkey is coupled to the **Trigger Out Polarity Neg Pos** softkey in the swept-sine AM, FM, and LF Out menus and the sweep/list menu. When the polarity is toggled for this softkey in any one of these menus, it affects all locations of the softkey.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to **ΦM**, press **More (1 of 2)**, **ΦM Waveform**, **Swept-Sine**, **Trigger Out Polarity Neg Pos**

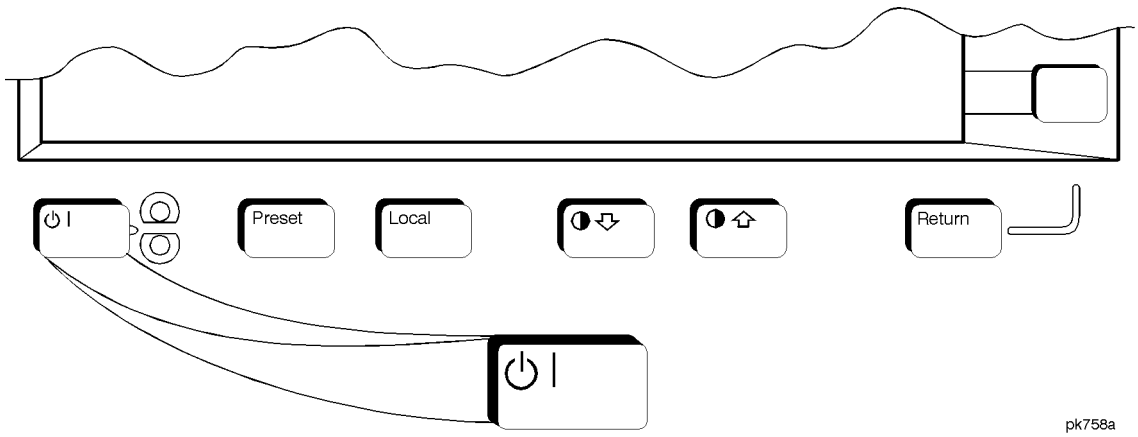
Status after Normal Preset: Pos

SCPI Commands:

:TRIGger:OUTPut:POLarity POSitive|NEGative

:TRIGger:OUTPut:POLarity?

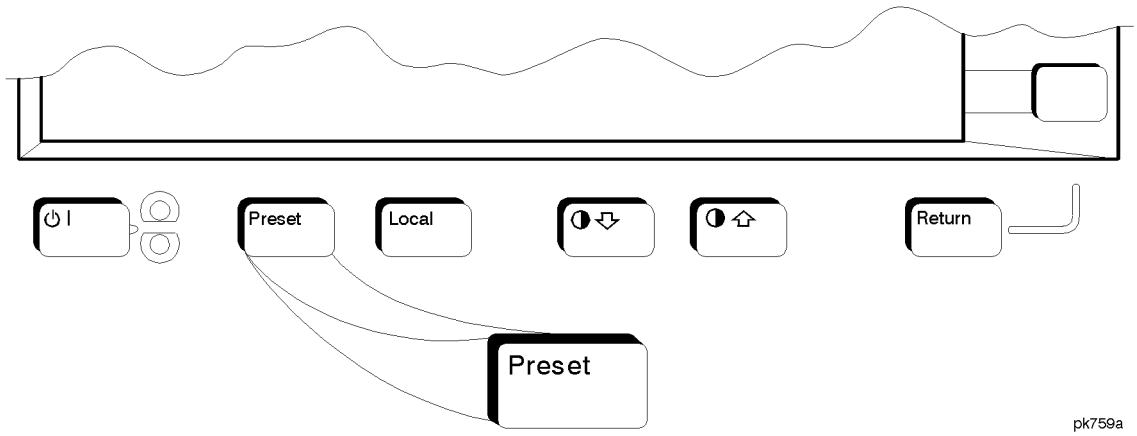
Power Switch



Pressing this front panel key toggles power to the signal generator either on (green LED on) or to standby (yellow LED on). In standby mode, the power switch is off but the instrument is still connected to the mains circuit by way of the power cord. The detachable power cord is the instrument disconnecting device. The front panel power switch, therefore, is not, and should not be used as, a line switch.

CAUTION: Avoid turning off power to the signal generator unless it is quiescent (not currently changing state as a result of front panel operation or remote control).

Preset



This key sets the signal generator to a known state (either the factory-defined state or a user-defined state). The factory-defined preset conditions are shown in the following table. To set your signal generator to default to these conditions, set the **Preset Normal User** softkey to **Normal**. Or you can define your own preset conditions and set your signal generator to preset to that unique state. Refer to the **Preset Normal User** softkey description which is part of the **Utility** key section.

SCPI Commands:

:SYSTem:PRESet

Table 5-3. Factory-Defined Preset Conditions

Amplitude			
Parameter	**Condition**	**Parameter**	**Condition**
Amplitude	-135 dBm	Amplitude Increment	Persistent State
Amplitude Offset	0.00 dB	Amplitude Offset Increment	Persistent State
Amplitude Reference State	Off	Amplitude Reference	0.00 dBm
Attenuator Hold	Off	ALC	On
Power Search	Manual	ALC BW	Normal
Amplitude Modulation			
Parameter	**Condition**	**Parameter**	**Condition**
AM Path	1	AM	Off
AM Depth	0.1%	AM Depth Increment	Persistent State
AM Rate	400 Hz	AM Rate Increment	Persistent State
AM Source	Internal	AM Waveform	Sine
AM Depth Coupling	Off		
DECT (Option UN3 and UN4)			
Parameter	**Condition**	**Parameter**	**Condition**
DECT	Off	Data Format	Pattern
Data	PN9	Pattern Repeat	Continuous
Sync Out	Begin Pattern	Sync Out Offset	0 Bits
Filter BbT	0.50	Phase Polarity	Normal
BBG Data Clock	Internal	Bit Rate	1.152000 Mbps
Burst Rise Time	13.75 bits	Burst Rise Delay	2.50 bits
Burst Fall Time	11.55 bits	Burst Fall Delay	0.00 bits
Transmit Link	RFP	FIX4 Pattern	0000
Framed Data	PN9	Timeslots Turned On	0 (RFP), 0 (PP)
Timeslots 0 Type	RFP Traffic Bearer, PP Traffic Bearer	Timeslot 1 - 11 Type	RFP Custom PP Custom

Table 5-3. Factory-Defined Preset Conditions

DECT Continued			
Parameter	**Condition**	**Parameter**	**Condition**
S (RFP Traffic Bearer, RFP Low Capacity, RFP Dummy Bearer 1, PP Dummy Bearer 2)	E98A	S (PP Traffic Bearer, PP Low Capacity)	1675
A Field (RFP Traffic Bearer, PP Traffic Bearer, RFP Low Capacity, PP Low Capacity, RFP Dummy Bearer 1, PP Dummy Bearer 2)	0000FFFF0000 FFFF		
Display			
Parameter	**Condition**	**Parameter**	**Condition**
Brightness	Persistent State	Inverse Video	Persistent State
Screen Saver (Off/On)	Persistent State	Screen Saver Mode	Persistent State
Screen Saver Delay	Persistent State	Contrast	Persistent State
Frequency			
Parameter	**Condition**	**Parameter**	**Condition**
Frequency	Max. Specified	Frequency Increment	Persistent State
Frequency Offset	0.00 Hz	Frequency Offset Increment	Persistent State
Frequency Reference State	Off	Frequency Reference	0 Hz
Frequency Multiplier	1	Phase Adjustment	0.000 Radians
Phase Adjustment Increment	Persistent State	Phase Noise Optimization	Mode 2
Frequency Modulation			
Parameter	**Condition**	**Parameter**	**Condition**
FM Path	1	FM	Off
FM Deviation	1.0 kHz	FM Deviation Increment	Persistent State
FM Rate	400 Hz	FM Rate Increment	Persistent State
FM Source	Internal	FM Waveform	Sine
FM Deviation Coupling	Off		

Table 5-3. Factory-Defined Preset Conditions

GSM (Options UN3 and UN4)			
Parameter	**Condition**	**Parameter**	**Condition**
GSM	Off	Data Format	Pattern
Pattern Data	PN9	Pattern Repeat	Continuous
Sync Out	Begin Pattern	Sync Out Offset	0 Bits
Phase Polarity	Normal	Differential Encoding	On
External 13 MHz Reference	Off	BBG Data clock	Internal
Timeslots Turned On	0	Timeslot 0 Type	Normal
Timeslots 1, 2, 3, 4, 5, 6, and 7 Type	Custom	Framed Data	PN9
Stealing Flag	0	Training Sequence Bits	0970897
Filter BbT	0.30	Bit Rate	270.833 kbps
Burst Rise Time	4.22 bits	Burst Rise Delay	0.00 bits
Burst Fall Time	3.44 bits	Burst Fall Delay	4.38 bits
HP-IB/RS-232			
Parameter	**Condition**	**Parameter**	**Condition**
HP-IB Address	Persistent State	Remote Language	SCPI
RS-232 Baud Rate	Persistent State	RS-232 Echo	Persistent State
Transmit Pace	Persistent State	Receive Pace	Persistent State
HP-IB/RS-232			
Parameter	**Condition**	**Parameter**	**Condition**
RTS	Persistent State		
I/Q Modulation			
Parameter	**Condition**	**Parameter**	**Condition**
I/Q	Off	I/Q Source	Ext I/Q
Burst Envelope	Off	Burst Source	Ext1 DC
I/Q Calibration Start Frequency	Persistent State	I/Q Calibration Stop Frequency	Persistent State
High Crest Mode	Off	Phase Polarity	Normal

Table 5-3. Factory-Defined Preset Conditions

I/Q Modulation Continued			
Parameter	**Condition**	**Parameter**	**Condition**
I/Q Calibration Type	Persistent State	I/Q Adjustments	Off
I/Q Gain	0.00 dB	I Offset	0.0%
Q Offset	0.0%		
Instrument Adjustments			
Parameter	**Condition**	**Parameter**	**Condition**
Step/Knob Ratio	Persistent State	Ref Osc Fine	Persistent State
Ref Osc Coarse	Persistent State		
Instrument Info/Help Mode			
Parameter	**Condition**	**Parameter**	**Condition**
Help Mode (Single/Continuous)	Persistent State	Modulation Status Information	On
LF Output			
Parameter	**Condition**	**Parameter**	**Condition**
LF Out	Off	LF Out Source	IntMod
LF Out Amplitude	0.000 V	LF Out Amplitude Increment	Persistent State
LF Out Modulation Frequency	400 Hz	LF Out Modulation Freq. Incr.	Persistent State
LF Out Period	80 µs	LF Out Period Increment	Persistent State
LF Out Width	40 µs	LF Out Width Increment	Persistent State
LF Out Waveform	Sine		
Memory Catalog			
Parameter	**Condition**	**Parameter**	**Condition**
Catalog Type	Persistent State		
NADC (Options UN3 and UN4)			
Parameter	**Condition**	**Parameter**	**Condition**
NADC	Off	Data Format	Pattern
Data	PN9	Pattern Repeat	Continuous
NADC Continued			

Table 5-3. Factory-Defined Preset Conditions

Parameter	Condition	Parameter	Condition
Sync Out	Begin Pattern	Sync Out Offset	0 Bits
Filter	Root Nyquist	Filter Alpha	0.35
Optimize RNYQ	For EVM	External Data Clock	Normal
BBG Data Clock	Internal	Bit Rate	48.600 kbps
Burst Rise Time	5.86 bits	Burst Rise Delay	9.00 bits
Burst Fall Time	5.47 bits	Burst Fall Delay	9.00 bits
Phase Polarity	Normal	Rate	Full
FIX4 Pattern	0000	Framed Data	PN9
Timeslots Turned On	1 and 4	Timeslot 1 and 4 Type	Uplink Traffic Channel
Timeslot 2, 3, 5, and 6 Type	Uplink Custom	SYNC (Up TCH, Down TCH)	A91DE4A
SACCH (Up TCH, Down TCH)	000	CDVCC (Up TCH, Down TCH)	000
PDC (Options UN3 and UN4)			
Parameter	**Condition**	**Parameter**	**Condition**
PDC	Off	Data Format	Pattern
Data	PN9	Pattern Repeat	Continuous
Sync Out	Begin Pattern	Sync Out Offset	0 Bits
Filter	Root Nyquist	Filter Alpha	0.50
Optimize RNYQ	For EVM	External Data Clock	Normal
BBG Data Clock	Internal	Bit Rate	42.000 kbps
Burst Rise Time	5.47 bits	Burst Rise Delay	8.00 bits
Burst Fall Time	3.83 bits	Burst Fall Delay	9.50 bits
Phase Polarity	Normal	Rate	Full
FIX4 Pattern	0000	Framed Data	PN9
Timeslots Turned On	0 and 3	Timeslot 0 and 3 Type	Uplink Traffic Channel
Timeslot 1, 2, 4, and 5 Type	Uplink Custom	SW (Up TCH, Up VOX)	785B4
PDC Continued			
Parameter	**Condition**	**Parameter**	**Condition**

Table 5-3. Factory-Defined Preset Conditions

SW (Down TCH)	87A4B	CC (Up TCH, Down TCH, Up VOX)	00
SACCH (Up TCH, Up VOX)	0000	SACCH (Down TCH	000000
Phase Modulation			
Parameter	**Condition**	**Parameter**	**Condition**
ΦM Path	1	ΦM	Off
ΦM Deviation	0.000 Radians	ΦM Deviation Increment	Persistent State
ΦM Bandwidth	Normal	ΦM Source	Internal
ΦM Rate	400 Hz	ΦM Rate Increment	Persistent State
ΦM Waveform	Sine	ΦM Deviation Coupling	Off
PHS (Option UN3 and UN4)			
Parameter	**Condition**	**Parameter**	**Condition**
PHS	Off	Data Format	Pattern
Data	PN9	Pattern Repeat	Continuous
Sync Out	Begin Pattern	Sync Out Offset	0 Bits
Filter	Root Nyquist	Filter Alpha	0.50
Optimize RNYQ	For EVM	External Data Clock	Normal
BBG Data Clock	Internal	Bit Rate	384.000 kbps
Burst Rise Time	4.98 bits	Burst Rise Delay	6.50 bits
Burst Fall Time	4.54 bits	Burst Fall Delay	8.50 bits
Phase Polarity	Normal	Control Channel	Uplink
Scramble	Off	Scramble Seed	3FF
FIX4 Pattern	0000	Framed Data	PN9
Timeslots Turned On	1 Downlink, 1 Uplink	Timeslot 1 Type	TCH
Timeslot 2, 3, and 4 Type (Uplink and Downlink)	Custom	UW (Downlink TCH)	3D4C
UW (Uplink TCH)	E149	UW (Downlink SYNC)	050EF2993

Table 5-3. Factory-Defined Preset Conditions

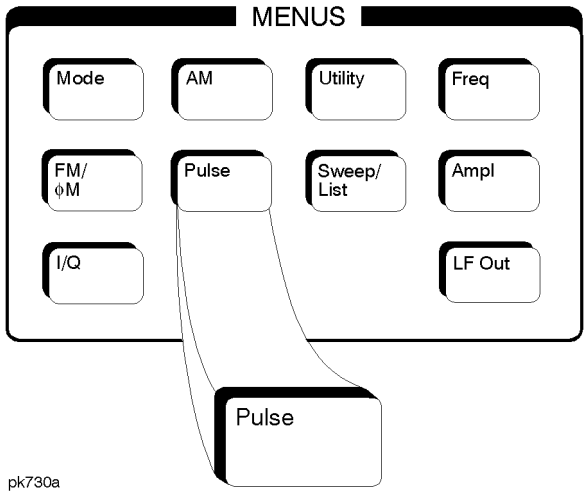
PHS Continued			
Parameter	**Condition**	**Parameter**	**Condition**
UW (Uplink SYNC)	6B899AF0	SA (Downlink TCH, Uplink TCH)	8000
CSID (Downlink SYNC, Uplink SYNC)	20200020001	PSID (Downlink SYNC, Uplink SYNC)	0000001
IDLE (Downlink SYNC, Uplink SYNC)	000000000		
Power On/Preset			
Parameter	**Condition**	**Parameter**	**Condition**
Power On (Last/Preset)	Persistent State	Preset Language	Persistent State
Preset (Normal/User)	Persistent State	Reverse Power Protection (Normal/HP8648)	Persistent State
PN9 Mode Preset	Persistent State		
Pulse Modulation			
Parameter	**Condition**	**Parameter**	**Condition**
Pulse Modulation	Off	Pulse Source	Internal Pulse
Pulse Period	80 µs	Pulse Period Increment	Persistent State
Pulse Width	40 µs	Pulse Width Increment	Persistent State
Pulse Rate	400.0 Hz	Pulse Rate Increment	Persistent State
Sweep List			
Parameter	**Condition**	**Parameter**	**Condition**
Sweep	Off	Sweep Type	List
Step Sweep Start Frequency	Maximum Specified	Step Sweep Stop Frequency	Maximum Specified
Step Sweep Frequency Increment	Persistent State	Sweep Repeat	Single
Step Sweep Start Amplitude	–135 dBm	Step Sweep Stop Amplitude	–135 dBm
Step Sweep Amplitude Increment	Persistent State	Step Sweep Number of Points	2
Step Sweep Dwell Time	2.0 ms	Step Sweep Dwell Time Incr.	Persistent State
Sweep Trigger	Immediate	Point Trigger	Immediate

Table 5-3. Factory-Defined Preset Conditions

Sweep List Continued			
Parameter	**Condition**	**Parameter**	**Condition**
List Sweep Dwell Type	List	Manual Mode	Off
Sweep Direction	Up	Trigger Out Polarity	Pos
TETRA (Option UN3 and UN4)			
Parameter	**Condition**	**Parameter**	**Condition**
TETRA	Off	Data Format	Pattern
Data	PN9	Pattern Repeat	Continuous
Sync Out	Begin Pattern	Sync Out Offset	0 Bits
Filter	Root Nyquist	Filter Alpha	0.35
Optimize RNYQ	For EVM	External Data Clock	Normal
BBG Data Clock	Internal	Bit Rate	36.000 kbps
Burst Rise Time	9.376 bits	Burst Rise Delay	9.50 bits
Burst Fall Time	7.814 bits	Burst Fall Delay	9.50 bits
Phase Polarity	Normal	PN9 Mode	Normal
Scramble	Off	Scramble Seed	FFFFFFFF
FIX4 Pattern	0000	Framed Data	PN9
Timeslots Turned On	1	Timeslot 1 Type	Uplink Normal
Timeslot 2, 3, and 4 Type	Uplink Normal	TS (Uplink Normal, Downlink Normal Cont, Downlink Normal Disc)	343A74
TS (Uplink Control 1, Uplink control 2)	2743A743	B1 (Downlink Normal Cont, Downlink Normal Disc)	0000
B2 (Downlink Normal Cont, Downlink Normal Disc)	0000	FCOR (Downlink Sync Cont, Downlink Sync Disc)	FF0000000000000000FF
SSB (Downlink Sync Cont, Downlink Sync Disc)	0000000000000000000000000000	STS (Downlink Sync Cont, Downlink Sync Disc)	30673A7067
B (Downlink Sync Cont, Downlink Sync Disc)	00000000		

Pulse

Pressing the front panel **Pulse** key reveals a menu of softkeys. These softkeys are described in this section in alphabetical order.



Ext2 DC-Coupled

This softkey lets you input an external, DC-coupled, pulse modulation signal to the EXT 2 INPUT connector.

The external 2 input has multiple uses but can be used for only one modulation at a time. If, for example you were using the external 2 input in a frequency modulation configuration for **FM Path 1**, and then you configured the pulse modulation source to also use the external 2 input, the signal generator would turn off **FM Path 1** and assign the external 2 input to your pulse configuration.

Softkey Location: Press **Pulse**, **Pulse Source**, **Ext2 DC-Coupled**

Status after Normal Preset: Pulse Source is set to Internal Square

SCPI Commands:

[:SOURce]:PULM:SOURce EXTernal2

[:SOURce]:PULM:SOURce?

Internal Pulse

This softkey lets you internally generate rectangular pulse modulation. Configure the pulse modulation using the **Pulse Period** and **Pulse Width** softkeys. For additional specifications, refer to Chapter 9, “Specifications.”

The internal source has multiple uses but can be used for only one modulation at a time. If, for example you were using the internal source in a frequency modulation configuration for **FM Path 1**, and then you configured the pulse modulation source to also use the internal source, the signal generator would turn off **FM Path 1** and assign the internal source to your pulse configuration.

Softkey Location: Press **Pulse**, **Pulse Source**, **Internal Pulse**

Status after Normal Preset: Pulse Source is set to Internal Square

SCPI Commands:

[:SOURce]:PULM:SOURce INT

[:SOURce]:PULM:SOURce?

[:SOURce]:PULM:INTernal[1]:FUNCtion:SHAPe <PULSe>

[:SOURce]:PULM:INTernal[1]:FUNCtion:SHAPe?

Internal Square

This softkey lets you internally generate squarewave pulse modulation. The duty cycle is set at 50% and you can set the pulse rate from 0.1 Hz to 50 kHz. For additional specifications, refer to Chapter 9, “Specifications.”

The internal source has multiple uses but can be used for only one modulation at a time. If, for example you were using the internal source in a frequency modulation configuration for **FM Path 1**, and then you configured the pulse modulation source to also use the internal source, the signal generator would turn off **FM Path 1** and assign the internal source to your pulse configuration.

Softkey Location: Press **Pulse**, **Pulse Source**, **Internal Square**

Status after Normal Preset: Pulse Source is set to Internal Square

SCPI Commands:

[:SOURce]:PULM:SOURce INT

[:SOURce]:PULM:SOURce?

[:SOURce]:PULM:INTernal[1]:FUNCtion:SHAPe <SQUare>

[:SOURce]:PULM:INTernal[1]:FUNCtion:SHAPe?

Pulse Off On

This softkey enables the pulse modulation for whichever pulse source you have selected. Notice, however, that although you can enable the pulse modulation state with this softkey, the RF carrier is modulated by the enabled modulation only when you have also set **Mod On/Off** to **On**. Whenever pulse modulation is enabled, the **PULSE** annunciator is turned on in the display.

Softkey Location: Press **Pulse**, **Pulse Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:PULM:STATe ON|OFF|1|0

[:SOURce]:PULM:STATe?

Pulse Period

Use this softkey to change the pulse period for internal pulse modulation. To change the period, press the softkey once. The current value for pulse period is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **msec** or **µsec** terminator softkey. The range of values allowed is 16 µs to 30 s. If the value for pulse period is less than the value for pulse width, pulse width is changed to the same value as pulse period. Notice that pulse period applies only to internal pulse modulation; when external pulse modulation or internal square pulse modulation is selected, this softkey is disabled.

Softkey Location: Press **Pulse**, **Pulse Period**

Status after Normal Preset: 80 µs

SCPI Commands:

[:SOURce]:PULM:INTernal[1]:PERiod <val><unit>

[:SOURce]:PULM:INTernal[1]:PERiod?

Pulse Rate

Use this softkey to change the pulse rate for internal square pulse modulation. To change the rate, press the softkey once. The current value for pulse rate is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Hz** or **kHz** terminator softkey. The range of values allowed is 0.1 Hz to 50 kHz. Notice that the new value of pulse rate applies only to internal square pulse modulation; when external pulse modulation or internal pulse modulation is selected, this softkey is disabled.

Softkey Location: Press **Pulse**, **Pulse Rate**

Status after Normal Preset: 400 Hz

SCPI Commands:

[:SOURce]:PULM:INTernal[1]:FREQuency <val><unit>

[:SOURce]:PULM:INTernal[1]:FREQuency?

Pulse Width

Use this softkey to change the pulse width for internal pulse modulation. To change the pulse width, press the softkey once. The current value for pulse width is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the µ**sec** or **msec** terminator softkey. The range of values allowed is 8 µs to 30 s. Notice that the new value of pulse width applies only to internal pulse modulation; when external pulse modulation or internal square pulse modulation is selected, this softkey is disabled.

Softkey Location: Press **Pulse**, **Pulse Width**

Status after Normal Preset: 40 µs

SCPI Commands:

[:SOURce]:PULM:INTernal[1]:PWIDth <val><unit>

[:SOURce]:PULM:INTernal[1]:PWIDth?

Pulse Source

Pressing this softkey reveals a menu of choices for pulse modulation sources. You can choose internally-generated pulse modulation, internally-generated square pulse modulation, or select an externally-applied, DC-coupled signal from the EXT 2 INPUT connector.

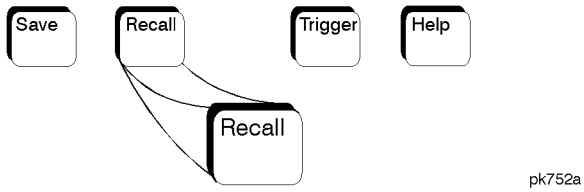
The internal and external 2 sources have multiple uses. However, you can use each source for only one modulation type at a time. If, for example, you were using the external 2 source in a frequency modulation configuration for **FM Path 1**, and then you configured the pulse modulation source to also use the external 2 source, the signal generator would turn off **FM Path 1** and assign the external 2 source to your pulse configuration.

Softkey Location: Press **Pulse**, **Pulse Source**

Status after Normal Preset: Internal Pulse

Recall

Pressing the front panel **Recall** key reveals a menu of softkeys. These softkeys are described in this section in alphabetical order.



Delete All Regs in Seq [n]

Press this softkey to delete the data saved in all of the registers of the selected sequence. Do not press this softkey until you have selected the correct sequence using the **Select Seq** softkey. For example, if you want to delete the data in all of the registers that are saved in sequence 4, press **Select Seq**. The currently selected sequence is displayed in the active entry area. Change the number to 4 using the up and down arrow keys, the front panel knob, or enter a 4 using the numeric keypad and press the **Enter** terminator softkey. Sequence 4 is now displayed in all softkeys which specify a sequence in this menu. Now press **Delete All Regs in Seq [4]** and the data in all of the registers stored in sequence 4 will be deleted. Be certain that you want to delete this data; you cannot recover it once deleted.

NOTE: This softkey has exactly the same function as the softkey with the identical name in the front panel **Save** key menu.

Softkey Location: Press **Recall**, **Delete All Regs in Seq [n]**

Delete All Sequences

Press this softkey to delete all of the data in all saved registers of all sequences. Be certain that you want to delete the data; you cannot recover it once deleted.

NOTE: This softkey has exactly the same function as the softkey with the identical name in the front panel **Save** key menu.

Softkey Location: Press **Recall**, **Delete All Sequences**

Delete Seq[n] Reg[nn]

Press this softkey to delete the contents of a specified register in a specified sequence. Do not press this softkey until you have selected the correct sequence and register using the **Select Seq** and **Recall Reg** softkeys. For example, if you want to delete the contents of register 5 in sequence 4, press **Select Seq**. The currently selected sequence is displayed in the active entry area. Change the number to 4 using the up and down arrow keys, the front panel knob, or enter a 4 using the numeric keypad and press the **Enter** terminator softkey. Sequence 4 is now displayed in all softkeys which specify a sequence in this menu. Now select register 5. (Remember, you must first have saved an instrument state to this register in sequence 4.) Press **Recall Reg**. The recall register number becomes the active function. Enter the number 5 using the numeric keypad and press the **Enter** terminator softkey. The instrument state is restored from this register and register 5 is now displayed in all softkeys which specify a register number in this menu. Now press **Delete Seq [4] Reg[05]** and register 5, stored in sequence 4, will be deleted. The instrument state that you had recalled from this register remains, however, until you change it. If you deleted this register in error, you can immediately resave it using the **Save Seq[n] Reg[n]** softkey in the **Save** menu.

NOTE: This softkey has exactly the same function as the softkey with the identical name in the front panel **Save** key menu.

Softkey Location: Press **Recall**, **Delete Seq[n] Reg[nn]**

Recall Reg

Press this softkey to recall an instrument state from a saved register. Recalling a register also selects that register number for all softkeys which specify a register number in this menu. For example, if you want to select register 5, press **Recall Reg**. (Remember, you must first have saved an instrument state to this register in the current sequence identified by the **Select Seq** softkey. If there is nothing saved, you cannot recall it.) The recall register number becomes the active function. Enter the number 5 using the numeric keypad and press the **Enter** terminator softkey. The instrument state is restored from this register and register 5 is now displayed in all softkeys which specify a register in this menu. You can also use the front panel knob and the up and down arrow keys to scroll through all saved registers for the selected sequence, recalling each instrument state.

Softkey Location: Press **Recall**, **Recall Reg**

IEEE 488.2 Common Commands:

*RCL <reg>[, <seq>]

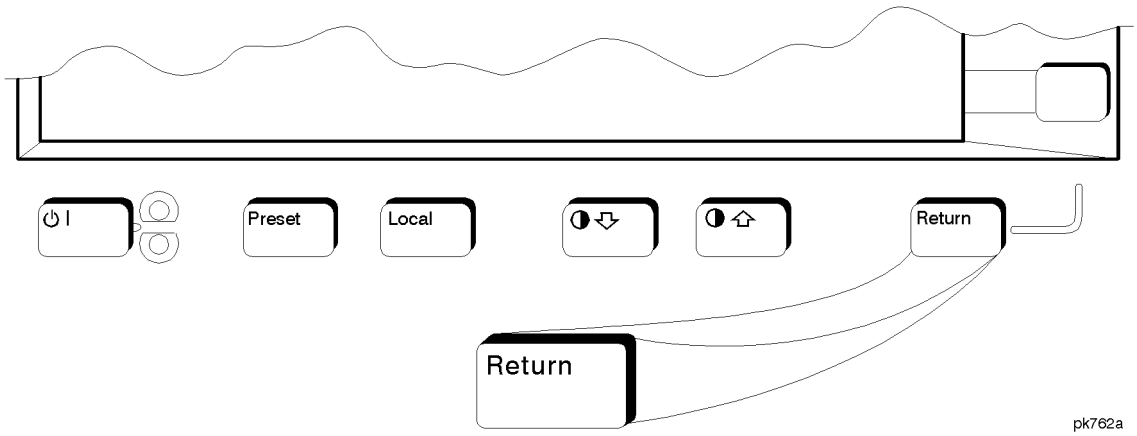
Select Seq

Press this softkey to choose a sequence for all softkeys which specify a sequence in this menu. For example, if you want to select sequence 4, press **Select Seq**. The currently selected sequence is displayed in the active entry area. Change the number to 4 using the up and down arrow keys, the front panel knob, or enter a 4 using the numeric keypad and press the **Enter** terminator softkey. Sequence 4 is now displayed in all softkeys which specify a sequence in this menu. There are 100 registers available (0 through 99) in each of 10 (0 through 9) sequences. You can use these registers in any combination so long as the total number of registers used does not exceed 50.

NOTE: The actual number of states that can be saved may be less if the user file system has non-instrument state files stored such as sweep/list sequences or binary files.

Softkey Location: Press **Recall**, **Select Seq**

Return



This front panel hardkey moves you from your current softkey menu to the softkey menu that precedes it. For example, press the **LF Out** front panel hardkey. The LF Out menu is displayed. Now press the **LF Out Source** softkey. (The arrow indicates that pressing this softkey will display another menu.) You should now see the LF Out Source menu. Press **Return**, and you are moved back to the LF Out menu.

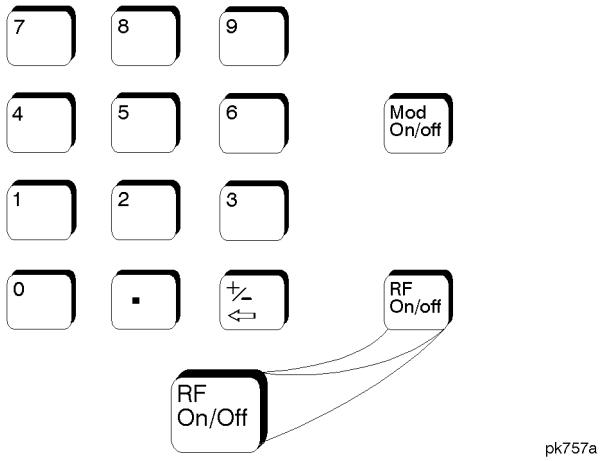
When you are at the top level of the menus the **Return** key has no function.

The **Return** key has autorepeat capability. Hold it down and you are moved repeatedly back through the menus until you either release the key or you reach the top level of the menus.

While you are entering data with the numeric keypad, pressing the **Return** key cancels the data input and leaves the original value unchanged.

Return

RF On/Off



This front panel hardkey toggles the RF signal on and off at the RF OUTPUT connector. Although you can configure and engage various modulations, no signal is available at the RF OUTPUT connector until **RF On/Off** is set to **On**. An annunciator is always turned on in the display to indicate whether RF is turned on or off.

Status after Normal Preset: RF Off

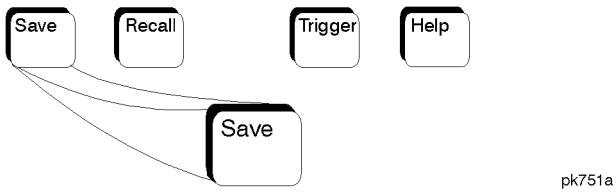
SCPI Commands:

:OUTPut[:STATe] ON|OFF|1|0

:OUTPut[:STATe]?

Save

Pressing the front panel **Save** key reveals a menu of softkeys. These softkeys are described in this section in alphabetical order.



When you press the **Save** key, the text area of the display shows the registers in use and any comments associated with the registers for the last sequence accessed. The display is updated whenever you make any changes to the registers or to the comments.

Add Comment To Seq[n] Reg[nn]

Press this softkey to add a comment that is associated with a register in use. The register number is listed in the text area of the display and the comment is shown immediately following the register. You can use the comment line, for example, to identify the instrument state saved in a register.

The comment line can consist of up to 55 alpha-numeric characters and special characters. To add or change a comment, the following editing capabilities are provided:

- The **Editing Mode Insert Replace** softkey in the Editing Keys menu toggles the editing mode from inserting text to replacing text. Insertion mode causes text to be entered in the position directly to the right of the cursor. Replacement mode causes the text to be entered in the position held by the cursor (replacing any existing text in that position).
- The **Clear Text** softkey in the Editing Keys menu deletes all of the existing text in the active entry area.
- Use the left and right arrow keys to position the cursor. Use the front panel knob, up and down arrow keys, or the direct editing softkeys, to enter an alphabetic character, numeral, or special character.

When you have entered the comment text, press the **Enter** terminator softkey. If you have changed your mind, press the **Return** hardkey. Once you press **Enter**, the new comment is saved to your selected register and displayed immediately.

Softkey Location: Press **Save**, **Add Comment To Seq[n] Reg[nn]**

SCPI Commands:

:MEMory:STATe:COMMent <reg_num>,<seq_num>,<comment>

:MEMory:STATe:COMMent? <reg_num>,<seq_num>

Clear Text

Press this softkey to delete the comment text in the active entry area. If you want to change the comment text saved with a register, use this softkey to quickly delete the existing text, then use the remaining editing features to enter a new comment.

Softkey Location: Press **Save**, **Add Comment To Seq[n] Reg[nn]**, **Editing Keys**, **Clear Text**

Delete All Regs in Seq [n]

Press this softkey to delete the data saved in all of the registers of the selected sequence. Do not press this softkey until you have selected the correct sequence using the **Select Seq** softkey. For example, if you want to delete all of the registers that are saved in sequence 4, press **Select Seq**. The currently selected sequence is displayed in the active entry area. Change the number to 4 using the up and down arrow keys, the front panel knob, or enter a 4 using the numeric keypad and press the **Enter** terminator softkey. Sequence 4 is now displayed in all softkeys which specify a sequence in this menu. Now press **Delete All Regs in Seq [4]** and the data in all of the registers stored in sequence 4 will be deleted. Be certain that you want to delete the data; you cannot recover it once deleted.

NOTE: This softkey has exactly the same function as the softkey with the identical name in the front panel **Recall** key menu.

Softkey Location: Press **Save**, **Delete All Regs in Seq [n]**

Delete All Sequences

Press this softkey to delete all of the data in all saved registers of all sequences. Be certain that you want to delete the data; you cannot recover it once deleted.

NOTE: This softkey has exactly the same function as the softkey with the identical name in the front panel **Recall** key menu.

Softkey Location: Press **Save**, **Delete All Sequences**

Delete Seq[n] Reg[nn]

Press this softkey to delete the contents of a specified register in a specified sequence. Do not press this softkey until you have selected the correct sequence and register using the **Select Seq** and **Select Reg** softkeys. For example, if you want to delete register 5 in sequence 4, press **Select Seq**. The currently selected sequence is displayed in the active entry area. Change the number to 4 using the up and down arrow keys, the front panel knob, or enter a 4 using the numeric keypad and press the **Enter** terminator softkey. Sequence 4 is now displayed in all softkeys which specify a sequence number in this menu. Now select register 5, press **Select Reg**. The currently selected register is displayed in the active entry area. Change the number to 5 in the same way that you changed the sequence number. Register 5 is now displayed in all softkeys which specify a register number in this menu. Now press **Delete Seq [4] Reg[05]** and register 5, stored in sequence 4, will be deleted. Be certain that you want to delete the data; you cannot recover the data once deleted.

NOTE: This softkey has exactly the same function as the softkey with the identical name in the front panel **Recall** key menu.

Softkey Location: Press **Save**, **Delete Seq[n] Reg[nn]**

Editing Keys

Pressing this softkey reveals a menu of choices for creating and editing the comment text for the selected register. In this menu you can delete the existing text in the active entry area (either the existing comment, or comment text that you have subsequently entered), and you can toggle the editing mode from inserting text to replacing text.

Softkey Location: Press **Save**, **Add Comment To Seq[n] Reg[nn]**, **Editing Keys**

Editing Mode Insert Replace

Press this softkey to toggle the editing mode from inserting text to replacing text. Insertion mode causes text to be entered in the position directly to the right of the cursor. Replacement mode causes the text to be entered in the position held by the cursor (replacing any existing text in that position).

Softkey Location: Press **Save**, **Add Comment To Seq[n] Reg[nn]**, **Editing Keys**, **Editing Mode Insert Replace**

Save Seq[n] Reg[nn]

Press this softkey to save the current instrument state in the specified register and sequence. The instrument state includes all of your setup selections except list and step sweep data and functions which are identified in this manual as persistent states.

Do not press this softkey until you have specified the correct sequence and register using the **Select Seq** and **Select Reg** softkeys. For example, if you want to save to register 5 in sequence 4, press **Select Seq**. The currently selected sequence is displayed in the active entry area. Change the number to 4 using the up and down arrow keys, the front panel knob, or enter a 4 using the numeric keypad and press the **Enter** terminator softkey. Sequence 4 is now displayed in all softkeys which specify a sequence in this menu. Now select register 5, press **Select Reg**. The currently selected register is displayed in the active entry area. Change the number to 5 in the same way that you changed the sequence number. Register 5 is now displayed in all softkeys which specify a register in this menu. Now press **Save Seq [4] Reg[05]** and the current instrument state will be stored in register 5 of sequence 4.

There are 100 registers available (0 through 99) in each of 10 (0 through 9) sequences. You can use these registers in any combination so long as the total number of registers used does not exceed 100.

Softkey Location: Press **Save**, **Save Seq[n] Reg[nn]**

IEEE 488.2 Common Commands:

*SAV <reg>[, <seq>]

Select Reg

Press this softkey to choose a register for all softkeys which specify a register in this menu. For example, if you want to select register 5, press **Select Reg**. The currently selected register is displayed in the active entry area. Change the number to 5 using the up and down arrow keys, the front panel knob, or enter a 5 using the numeric keypad and press the **Select Reg** terminator softkey. Register 5 is now displayed in all softkeys which specify a register in this menu.

You can also use this softkey to select a register and save the current instrument state to that register. For example, if you want to select and save to register 6, press **Select Reg**. The currently selected register is displayed in the active entry area. Change the number to 6 using the numeric keypad and press the **Save Reg** terminator softkey. Register 6 is now displayed in all softkeys which specify a register in this menu and the current instrument state has been saved to register 6.

There are 100 registers available (0 through 99) in each of 10 (0 through 9) sequences. You can use these registers in any combination so long as the total number of registers used does not exceed 100.

Softkey Location: Press **Save**, **Select Reg**

Select Seq

Press this softkey to choose a sequence for all softkeys which specify a sequence in this menu. For example, if you want to select sequence 4, press **Select Seq**. The currently selected sequence is displayed in the active entry area. Change the number to 4 using the up and down arrow keys, the front panel knob, or enter a 4 using the numeric keypad and press the **Enter** terminator softkey. Sequence 4 is now displayed in all softkeys which specify a sequence in this menu.

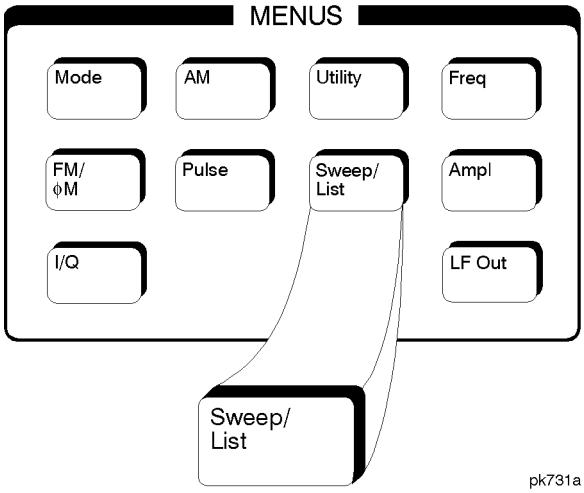
There are 100 registers available (0 through 99) in each of 10 (0 through 9) sequences. You can use these registers in any combination so long as the total number of registers used does not exceed 100.

NOTE: The actual number of states that can be saved may be less if the user file system has non-instrument state files stored such as sweep/list sequences or binary files.

Softkey Location: Press **Save**, **Select Seq**

Sweep/List

Pressing the front panel **Sweep/List** key reveals a menu of softkeys. Using these softkeys you can define a series of points containing frequency, amplitude and dwell time information for the signal generator to sweep. The softkeys are described in this section in alphabetical order.



Points

Press this softkey to define the number of points in a step sweep. To enter the number of points in the sweep, press **# Points**. The number of step sweep points becomes the active function and the current value is shown in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. A step sweep must always have a minimum of 2 points and can be configured to have as many as 401 points.

Softkey Location: Press **Sweep/List**, **Configure Step Sweep**, **# Points**

Status after Normal Preset: 2

SCPI Commands:

[:SOURce]:SWEep:POINts <val>

[:SOURce]:SWEep:POINts?

Ampl

Press this softkey to set the signal generator to sweep amplitude data only. The frequency is set at a constant value determined by the **Frequency** front panel key. You can define a sweep containing both amplitude and frequency information and still choose to sweep amplitude only.

Softkey Location: Press **Sweep/List**, **Sweep**, **Ampl**

Status after Normal Preset: Sweep is set to Off

SCPI Commands:

[:SOURce]:POWer:MODE LIST

[:SOURce]:POWer:MODE?

Ampl Start

Press this softkey to set the amplitude of the first point in the sweep. You can set the value anywhere in the range of the signal generator's specified output power. Press **Ampl Start** and amplitude becomes the active function for the first point in the sweep. To enter the value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **dBm**, **dBuV**, **dBuVemf**, **mV**, **uV**, **mVemf**, or **uVemf** terminator softkey.

Softkey Location: Press **Sweep/List**, **Configure Step Sweep**, **Ampl Start**

Status after Normal Preset: –135 dBm

SCPI Commands:

[:SOURce]:POWer:STARt <val><unit>

[:SOURce]:POWer:STARt?

Ampl Stop

Press this softkey to set the amplitude of the last point in the sweep. You can set the value anywhere in the range of the signal generator's specified output power. Press **Ampl Stop** and amplitude becomes the active function for the last point in the sweep. To enter the value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **dBm**, **dBuV**, **dBuVemf**, **mV**, **uV**, **mVemf**, or **uVemf** terminator softkey.

Softkey Location: Press **Sweep/List**, **Configure Step Sweep**, **Ampl Stop**

Status after Normal Preset: –135 dBm

SCPI Commands:

[:SOURce]:POWer:STOP <val><unit>

[:SOURce]:POWer:STOP?

Bus

This softkey is one of the choices in both the Sweep Trigger menu and the Point Trigger menu. Press either the **Sweep Trigger** softkey or the **Point Trigger** softkey to view these menus. Choosing **Bus** in the Sweep Trigger menu allows you to trigger a list or step sweep using the HP-IB. Choosing **Bus** in the Point Trigger menu allows you to trigger a sweep point-by-point using the HP-IB via *TRG or the GET line (Group Execute Trigger).

Softkey Location: Press **Sweep/List**, **More (1 of 2)**, **Sweep Trigger**, **Bus**
or press **Sweep/List**, **More (1 of 2)**, **Point Trigger**, **Bus**

Status after Normal Preset: Sweep and point trigger are set to Immediate

SCPI Commands:

[:SOURce]:LIST:TRIGger:SOURce BUS

[:SOURce]:LIST:TRIGger:SOURce?

Configure List Sweep

Pressing this softkey reveals a menu of softkeys for defining a list sweep. In this menu you can insert and delete points in a sweep. Each point can contain frequency, amplitude, and dwell time information. The list point information is stored in three binary files: FREQ_FILE, POW_FILE, and DWEL_FILE. These files will survive a preset but not a power cycle. If they are deleted, the signal generator will recreate these files as needed. In this menu you can also edit existing points in the sweep.

Softkey Location: Press **Sweep/List**, **Configure List Sweep**

SCPI Commands:

[:SOURce]:LIST:DWELl <val>{, <val>}

[:SOURce]:LIST:DWELl?

[:SOURce]:LIST:DWELl:POINts?

[:SOURce]:LIST:FREQuency <val>{, <val>}

[:SOURce]:LIST:FREQuency?

[:SOURce]:LIST:FREQuency:POINts?

[:SOURce]:LIST:POWer <val>{, <val>}

[:SOURce]:LIST:POWer?

[:SOURce]:LIST:POWer:POINts?

Configure Step Sweep

Pressing this softkey reveals a menu of softkeys for defining a step sweep. In this menu you can set the start and stop frequencies for a sweep, set the start and stop power levels, and you can set the number of points in the sweep with the dwell time at each point.

Softkey Location: Press **Sweep/List**, **Configure Step Sweep**

Delete File

Press this softkey to delete a file in the catalog listing. Use the up and down arrow keys until the file you wish to delete is highlighted. Press **Delete File** and then press the **Confirm Delete** softkey. Be certain that you want to delete the file; you cannot recover this sweep data once you press **Confirm Delete**. If you do not want to delete the file, press **Return** instead of **Confirm Delete**.

Softkey Location: Press **Sweep/List**, **Configure List Sweep**, **More (1 of 2)**, **Load/Store**, **Delete File**

Delete Item

Press this softkey to delete an item in the displayed list of sweep points. Use the arrow keys until the desired item is highlighted. Then press **Delete Item** to eliminate this item from the sweep list. Be certain that you want to delete this item; you cannot recover it once you have deleted it. If the last item in a list is deleted, it is replaced by the default value.

Softkey Location: Press **Sweep/List**, **Configure List Sweep**, **Delete Item**

Delete Row

Press this softkey to delete a selected row in the sweep list. Use the up and down arrow keys until any item is selected in the row you wish to delete. Press **Delete Row** and the entire row is deleted. Be certain that you want to delete the row; you cannot recover this sweep data once you press **Delete Row**. If the last row in a list is deleted, it is replaced by the default value.

Softkey Location: Press **Sweep/List**, **Configure List Sweep**, **Delete Row**

Dwell Type List Step

Press this softkey to toggle the dwell time for the list sweep points between the values defined in the list sweep and the value set for step sweep. Choose **List** to sweep with dwell times that you have defined in the list sweep. Choose **Step** and you will sweep each point in the list with a dwell time set by the **Step Dwell** softkey in the Configure Step Sweep menu. When you are sweeping using the step sweep dwell time, the list sweep dwell time values are grayed out to indicate that they are not being used.

Status after Normal Preset: List

Softkey Location: Press **Sweep/List**, **Configure List Sweep**, **More (1 of 2)**, **Dwell Type List Step**

SCPI Commands:

[:SOURce]:LIST:DWELl:TYPE <val>{, <val>}

[:SOURce]:LIST:DWELl:TYPE LIST|STEP

[:SOURce]:LIST:DWELl:TYPE?

Edit Item

Press this softkey to change an item in the displayed list of sweep points. Use the arrow keys or the front panel knob until the correct item is highlighted. Press **Edit Item** and the item is displayed in the active entry area. Change the value using the up and down arrow keys, or the front panel knob and press the **Enter** terminator softkey. Or enter a new value using the numeric keypad and then press a units terminator softkey.

A short cut for editing, Auto Edit, is also available. Highlight the item you want to edit. Enter a new value *using the numeric keys*; editing immediately starts for the highlighted item. Press the **Enter** terminator softkey. The new value is stored and the next item is highlighted.

Softkey Location: Press **Sweep/List**, **Configure List Sweep**, **Edit Item**

Ext

This softkey is one of the choices in both the Sweep Trigger menu and the Point Trigger menu. Press either the **Sweep Trigger** softkey or the **Point Trigger** softkey to view this key. Choosing **Ext** allows you to trigger a sweep point-by-point on either the negative or positive edge of a signal applied to the TRIGGER IN rear panel connector. Set the polarity of the trigger signal using the **Trigger In Polarity Neg Pos** softkey.

Softkey Location: Press **Sweep/List**, **More (1 of 2)**, **Sweep Trigger**, **Ext**
or press **Sweep/List**, **More (1 of 2)**, **Point Trigger**, **Ext**

Status after Normal Preset: Immediate

SCPI Commands:

[:SOURce]:LIST:TRIGger:SOURce EXTernal

[:SOURce]:LIST:TRIGger:SOURce?

:TRIGger[:SEQuence]:SOURce EXTernal

:TRIGger[:SEQuence]:SOURce?

:TRIGger[:SEQuence]:SLOPe?

Freq

Press this softkey to set the signal generator to sweep frequency data only. The amplitude is set at a constant level determined by the **Amplitude** front panel key. You can define a sweep containing both amplitude and frequency information and still choose to sweep frequency only.

Softkey Location: Press **Sweep/List**, **Sweep**, **Freq**

Status after Normal Preset: Sweep is set to Off

SCPI Commands:

[:SOURce]:FREQuency:MODE LIST

[:SOURce]:FREQuency:MODE?

Freq&Ampl

Press this softkey to set the signal generator to sweep both frequency and amplitude data. Both the frequency and the amplitude lists must have the same number of points or they must have only one point. If a list has only one point, then that point is used for each of the other list's points.

Softkey Location: Press **Sweep/List**, **Sweep**, **Freq&Ampl**

Status after Normal Preset: Sweep is set to Off

SCPI Commands:

[:SOURce]:POWer:MODE LIST

[:SOURce]:POWer:MODE?

[:SOURce]:FREQuency:MODE LIST

[:SOURce]:FREQuency:MODE?

Freq Start

Press this softkey to set the frequency of the first point in the sweep. You can set the value anywhere in the range of the signal generator's specified output frequency. Press **Freq Start** and frequency becomes the active function for the first point in the sweep. To enter the value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **GHz**, **MHz**, **kHz**, or **Hz** terminator softkey.

Softkey Location: Press **Sweep/List**, **Configure Step Sweep**, **Freq Start**

Status after Normal Preset: Maximum specified frequency

SCPI Commands:

[:SOURce]:FREQuency:STARt <val><unit>

[:SOURce]:FREQuency:STARt?

Freq Stop

Press this softkey to set the frequency of the last point in the sweep. You can set the value anywhere in the range of the signal generator's specified output frequency. Press **Freq Stop** and frequency becomes the active function for the last point in the sweep. To enter the value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **GHz**, **MHz**, **kHz**, or **Hz** terminator softkey.

Softkey Location: Press **Sweep/List**, **Configure Step Sweep**, **Freq Stop**

Status after Normal Preset: Maximum specified frequency

SCPI Commands:

[:SOURce]:FREQuency:STOP <val><unit>

[:SOURce]:FREQuency:STOP?

Goto Bottom Row

Press this softkey to move the selection bar to the bottom row of list sweep points in the Goto Row menu that is accessed from the Configure List Sweep menu. If you are in the Goto Row menu that is accessed from the Load/Store menu, the selection bar moves to the bottom row of the catalog of list files.

Softkey Location: Press **Sweep/List**, **Configure List Sweep**, **Goto Row**, **Goto Bottom Row** or press **Sweep/List**, **Configure List Sweep**, **More (1 of 2)**, **Load/Store**, **Goto Row**, **Goto Bottom Row**

Goto Middle Row

Press this softkey to move the selection bar to the middle row of list sweep points in the Goto Row menu that is accessed from the Configure List Sweep menu. If you are in the Goto Row menu that is accessed from the Load/Store menu, the selection bar moves to the middle row of the catalog of list files.

Softkey Location: Press **Sweep/List**, **Configure List Sweep**, **Goto Row**, **Goto Middle Row** or press **Sweep/List**, **Configure List Sweep**, **More (1 of 2)**, **Load/Store**, **Goto Row**, **Goto Middle Row**

Goto Row

Pressing this softkey reveals a menu of softkeys that help you move the selection bar through the rows of list sweep points when you are in the Configure List Sweep menu. If you are in the Load/Store menu, the softkey helps you move the selection bar through the catalog of list files. You can also go to a specific row by rotating the front panel knob, using the up and down arrow keys, or entering the row number with the numeric keypad. Once the desired row number is displayed, press the **Enter** terminator softkey.

Softkey Location: Press **Sweep/List**, **Configure List Sweep**, **Goto Row** or press **Sweep/List**, **Configure List Sweep**, **More (1 of 2)**, **Load/Store**, **Goto Row**

Goto Top Row

Press this softkey to move the selection bar to the top row of list sweep points in the Goto Row menu that is accessed from the Configure List Sweep menu. If you are in the Goto Row menu that is accessed from the Load/Store menu, the selection bar moves to the top row of the catalog of list files.

Softkey Location: Press **Sweep/List**, **Configure List Sweep**, **Goto Row**, **Goto Top Row** or press **Sweep/List**, **Configure List Sweep**, **More (1 of 2)**, **Load/Store**, **Goto Row**, **Goto Top Row**

Immediate

This softkey is one of the choices in both the Sweep Trigger menu and the Point Trigger menu. Press either the **Sweep Trigger** softkey or the **Point Trigger** softkey to view these menus. Choosing **Immediate** in the Sweep Trigger menu immediately triggers the current sweep when you press the **Single Sweep** softkey. When sweep repeat is continuous and **Immediate** is chosen for the sweep trigger, then sweeps are triggered consecutively (a new sweep is triggered as soon as the current sweep ends). Choosing **Immediate** in the Point Trigger menu causes the sweep to pause for the dwell time at each point after the hardware has been set up for that point's frequency and amplitude.

Softkey Location: Press **Sweep/List**, **More (1 of 2)**, **Sweep Trigger**, **Immediate**
or press **Sweep/List**, **More (1 of 2)**, **Point Trigger**, **Immediate**

Status after Normal Preset: Sweep and point trigger are set to Immediate

SCPI Commands:

[:SOURce]:LIST:TRIGger:SOURce IMMediate

[:SOURce]:LIST:TRIGger:SOURce?

Insert Item

Press this softkey to place a copy of the selected item directly below that item in the sweep list. First use the up and down arrow keys until the item you wish to copy is selected. Press **Insert Item** and an identical copy of the selected item is placed below it.

Softkey Location: Press **Sweep/List**, **Configure List Sweep**, **Insert Item**

Insert Row

Press this softkey to place a copy of the selected row directly below that row in the sweep list. First use the up and down arrow keys until any item is selected in the row you wish to copy. Press **Insert Row** and an identical copy of the selected row is placed below it.

Softkey Location: Press **Sweep/List**, **Configure List Sweep**, **Insert Row**

Load From Selected File

Press this softkey to load the list sweep data from a file into the current sweep list. Use the arrow keys to highlight the desired sweep list file. Press **Load List From Selected File** and the list sweep data from the selected file is loaded into the current list sweep. You can only have one list sweep at a time so the existing list sweep data will be lost unless it is first stored to a file. This softkey is inactive unless at least one list sweep data file has been stored to memory.

Softkey Location: Press **Sweep/List**, **Configure List Sweep**, **More (1 of 2)**, **Load/Store**, **Load From Selected File**

SCPI Commands:

:MEMory:LOAD:LIST <filename>

:MMEMory:LOAD:LIST <filename>

Load List From Step Sweep

Press this softkey to eliminate the existing sweep list data and replace it with the step sweep data points. You can only have one sweep list at a time so be certain that you wish to delete the existing list. You cannot recover the sweep list data once you press **Load List From Step Sweep**.

Softkey Location: Press **Sweep/List**, **Configure List Sweep**, **More (1 of 2)**, **Load List From Step Sweep**

Load/Store

Pressing this softkey reveals a menu of choices for storing list sweep data to a file or loading list sweep data from a file into the current sweep list. In this menu you can also delete existing list sweep files.

Softkey Location: Press **Sweep/List**, **Configure List Sweep**, **More (1 of 2)**, **Load/Store**

Manual Mode Off On

This softkey toggles manual selection of the current sweep point on and off. When **Manual Mode** is **On**, the selected sweep/list point controls the frequency and amplitude according to the sweep type. The current point in the sweep is displayed in the active entry area and also below the **Manual Point** softkey. This softkey is disabled when **Sweep** is set to **Off**.

Softkey Location: Press **Sweep/List**, **More (1 of 2)**, **Manual Mode Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:LIST:MODE AUTO|MANual

[:SOURce]:LIST:MODE?

Manual Point

Press this softkey to choose a point in the sweep list. When **Manual Mode** is **On**, the selected sweep/list point controls the frequency and amplitude according to the sweep type. The current point number is shown in the active entry area when you press **Manual Point**. The frequency of the point is shown in the frequency area of the display. The amplitude of the point is shown in the amplitude area of the display. You can choose which point to sweep using the up and down arrow keys, the front panel knob, or by entering the point number desired using the numeric keypad and pressing the **Enter** terminator softkey. This softkey is disabled when **Manual Mode Off On** is set to **Off**.

Softkey Location: Press **Sweep/List**, **More (1 of 2)**, **Manual Point**

Status after Normal Preset: 1

SCPI Commands:

[:SOURce]:LIST:MANual <val>

[:SOURce]:LIST:MANual?

Off

This softkey turns off all sweep functions. The output signal is then set according to the current frequency and amplitude settings defined by the front panel **Frequency** and **Amplitude** keys.

Softkey Location: Press **Sweep/List**, **Sweep**, **Off**

SCPI Commands:

[:SOURce]:FREQuency:MODE CW|FIXED

[:SOURce]:FREQuency:MODE?

[:SOURce]:POWer:MODE FIXED

[:SOURce]:POWer:MODE?

Page Down

Press this softkey to view the next page of list sweep points when you are in the Configure List Sweep menu or to view the next page of the catalog listing when you are in the Load/Store List menu.

Softkey Location: Press **Sweep/List**, **Configure List Sweep**, **Goto Row**, **Page Down** or press **Sweep/List**, **Configure List Sweep**, **More (1 of 2)**, **Load/Store**, **Page Down** or press **Sweep/List**, **Configure List Sweep**, **More (1 of 2)**, **Load/Store**, **Goto Row**, **Page Down**

Page Up

Press this softkey to view the previous page of list sweep points when you are in the Configure List Sweep menu or to view the previous page of the catalog listing when you are in the Load/Store List menu.

Softkey Location: Press **Sweep/List**, **Configure List Sweep**, **Goto Row**, **Page Up** or press **Sweep/List**, **Configure List Sweep**, **More (1 of 2)**, **Load/Store**, **Page Up** or press **Sweep/List**, **Configure List Sweep**, **More (1 of 2)**, **Load/Store**, **Goto Row**, **Page Up**

Point Trigger

Pressing this softkey reveals a menu of choices for triggering a sweep point-by-point. You can choose triggering that occurs after the dwell time for the previous point has passed, triggering that is supplied by the HP-IB, triggering on either the positive or negative edge of a signal supplied to the TRIGGER IN connector, or triggering by the front panel **Trigger** key.

Softkey Location: Press **Sweep/List**, **More (1 of 2)**, **Point Trigger**

Status after Normal Preset: Immediate

SCPI Commands:

[:SOURce]:LIST:TRIGger:SOURce BUS|IMMediate|EXTernal|KEY

[:SOURce]:LIST:TRIGger:SOURce?

Preset List

Press this softkey to eliminate the current sweep list and replace it with a new list consisting of the following: one point at the maximum specified frequency, with an amplitude of –135 dBm, and a dwell time of 2 ms. Be certain that you want to delete the current sweep list; you cannot recover the information once you press **Preset List**.

Softkey Location: Press **Sweep/List**, **Configure List Sweep**, **More (1 of 2)**, **Preset List**

Single Sweep

Press this softkey to arm the sweep. The **ARMED** annunciator will turn on in the display. The signal generator will begin the sweep as soon as the sweep trigger is received. If you have set the sweep trigger to **Immediate**, a sweep is initiated as soon as you arm the sweep. The sweep sets the power and the frequency to the first point of the sweep while it is not initiated or is waiting for the sweep trigger. This softkey is disabled when **Sweep** is set to **Off**.

Softkey Location: Press **Sweep/List**, **Single Sweep**

SCPI Commands:

:INITiate:CONTinuous[:ALL] ON|OFF|1|0

:INITiate[:IMMediate][:ALL]

:INITiate[:IMMediate][:ALL]?

Step Dwell

Press this softkey to set the dwell time for each point of a step sweep. To set the dwell time, press **Step Dwell**. The current dwell time is displayed in the active entry area. Enter the desired dwell time using the up and down arrow keys, the front panel knob, or enter a value using the numeric keypad and press the **sec** or **msec** terminator softkey. The range of values allowed is 1 ms through 60 s in 1 ms increments. Dwell time is used when the point trigger is **Immediate**. The dwell time is the amount of time the sweep is guaranteed to pause after setting the frequency and power for the current sweep/list point.

Softkey Location: Press **Sweep/List**, **Configure Step Sweep**, **Step Dwell**

SCPI Commands:

[:SOURce]:SWEep:DWELl <val>

[:SOURce]:SWEep:DWELl?

Store to File

Press this softkey to store the current list sweep data to a file in internal non-volatile memory. Press **Store To File** and you will automatically enter the editing mode to create a file name.

The file name can consist of up to 23 alpha-numeric and special characters. The following steps show you how to create the following example file name, **`FREQ 1453 TO 1465 MHZ`**:

NOTE: The following example uses softkeys to enter the file name. You can also use a combination of the front panel knob and the arrow keys to accomplish the same function.

1. Press the softkey labeled **ABCDEFG**. A menu is revealed containing a softkey for each alphabetic character from A through G.
2. Press the softkey labeled **F**. An F is entered as the first character in your file name. Notice that the active entry area now shows **`Store to: F`**.
3. Enter an R in the file name by pressing the **OPQRSTU** softkey and then pressing the **R** softkey. Enter an E and a Q.
4. Next enter a space by pressing the **& # + –** softkey and then pressing .
5. Enter the value 1453 using the numeric keypad.
6. Enter another space and the letters TO.
7. Enter another space and the value 1465.
8. Enter another space and the letters MHZ.

9. Now press the **Enter** terminator softkey and the list sweep data is saved with the file name, **FREQ 1453 to 1465 MHZ**. The characters **@LIST** are automatically appended to the file name as file type identification.

Softkey Location: Press **Sweep/List**, **Configure List Sweep**, **More (1 of 2)**, **Load/Store**, **Store To File**

SCPI Commands:

:MEMory:STORe:LIST <filename>

:MMEMory:STORe:LIST <filename>

Sweep

Pressing this softkey reveals a menu of choices for determining the sweep parameters. In this menu you can choose to sweep frequency only, amplitude only, or both frequency and amplitude. You can also choose to turn off all sweep functions.

Softkey Location: Press **Sweep/List**, **Sweep**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:FREQuency:MODE CW|FIXed|LIST

[:SOURce]:FREQuency:MODE?

[:SOURce]:POWer:MODE FIXed|LIST

[:SOURce]:POWer:MODE?

Sweep Direction Down Up

This softkey changes the direction of the sweep. Choose **Up** to sweep from the first point in the list to the last point, or from the step sweep start frequency and amplitude to the stop frequency and amplitude. Choose **Down** to reverse the direction of the sweep.

Softkey Location: Press **Sweep/List**, **More (1 of 2)**, **Sweep Direction Down Up**

Status after Normal Preset: Up

SCPI Commands:

[:SOURce]:LIST:DIRection UP|DOWN

[:SOURce]:LIST:DIRection?

Sweep Repeat Single Cont

This softkey toggles the sweep repetition between single sweep or continuous sweep types. The sweep and point triggers will then trigger the sweep.

Softkey Location: Press **Sweep/List**, **Sweep Repeat Single Cont**

Status after Normal Preset: Single

SCPI Commands:

:INITiate:CONTinuous[:ALL] ON|OFF|1|0

:INITiate:CONTinuous[:ALL]?

Sweep Trigger

Pressing this softkey reveals a menu of choices for triggering a full sweep. You can choose triggering that occurs immediately once a sweep is armed, triggering that is supplied by the HP-IB, triggering on either the positive or negative edge of a signal supplied to the TRIGGER IN connector, or triggering by the front panel **Trigger** key.

Softkey Location: Press **Sweep/List**, **More (1 of 2)**, **Sweep Trigger**

Status after Normal Preset: Immediate

SCPI Commands:

:TRIGger[:SEQuence]:SOURce |BUS|IMMediate|EXTernal|KEY

:TRIGger[:SEQuence]:SOURce?

Sweep Type List Step

This softkey toggles the sweep type from list sweep to step sweep. You create a list sweep by supplying the frequency, amplitude, and dwell time for each point in the sweep. You create a step sweep by supplying the start and stop frequency and amplitude, the number of points, and a dwell time. The signal generator then calculates the points between the first and last point in a linear manner.

Softkey Location: Press **Sweep/List**, **Sweep Type List Step**

Status after Normal Preset: List

SCPI Commands:

[:SOURce]:LIST:TYPE LIST|STEP

[:SOURce]:LIST:TYPE?

Trigger In Polarity Neg Pos

Press this softkey to toggle between a negative TTL level trigger (0 V) and a positive TTL level trigger (+5 V) for externally triggering step or list sweeps.

The **Pos** (and **Neg**) selections for the Trigger In Polarity softkey in the Sweep Trigger and Point Trigger menus are coupled; you cannot choose **Neg** for one and **Pos** for the other. The first selection will follow the second. For example, if you choose **Neg** for the sweep trigger and then choose **Pos** for the point trigger, the sweep trigger selection will automatically change to **Pos**.

If either the sweep trigger or the point trigger is external, the polarity is coupled to the **Trigger In Polarity Neg Pos** softkey for swept-sine AM, FM, ΦM, and LF Out. For example, if you set the sweep trigger to **Pos**, the **Trigger In Polarity Neg Pos** softkey will toggle to **Pos** for swept-sine AM, FM, ΦM, and LF Out. Conversely, if the **Trigger In Slope Neg Pos** softkey is toggled in the swept-sine AM, FM, ΦM, or LF Out menus, it will cause the sweep or point trigger softkeys to toggle also.

Softkey Location: Press **Sweep/List**, **More (1 of 2)**, **Sweep Trigger**, **Ext**, **Trigger In Polarity Neg Pos** or press **Sweep/List**, **More (1 of 2)**, **Point Trigger**, **Ext**, **Trigger In Polarity Neg Pos**

Status after Normal Preset: Pos

SCPI Commands:

:TRIGger[:SEQuence]:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:SLOPe?

Trigger Key

This softkey is one of the choices in both the Sweep Trigger menu and the Point Trigger menu. Press either the **Sweep Trigger** softkey or the **Point Trigger** softkey to view these menus. Choosing **Trigger Key** in the Sweep Trigger menu immediately triggers an armed sweep when you press the **Trigger** front panel key. Choosing **Trigger Key** in the Point Trigger menu immediately triggers the next point in a running sweep.

Softkey Location: Press **Sweep/List**, **More (1 of 2)**, **Sweep Trigger**, **Trigger Key** or press **Sweep/List**, **More (1 of 2)**, **Point Trigger**, **Trigger Key**

Status after Normal Preset: Sweep and point trigger are set to Immediate

SCPI Commands:

[:SOURce]:LIST:TRIGger:SOURce KEY

[:SOURce]:LIST:TRIGger:SOURce?

Trigger Out Polarity Neg Pos

This softkey toggles the polarity of the TTL signal that is output at the rear panel TRIGGER OUT connector. When **Trigger Out Polarity Neg Pos** is set to **Pos** the output signal is asserted high (+5 V) at the start of a dwell sequence, or at the start of waiting for the point trigger, and low (0 V) when the dwell is over, or when the point trigger is received. Setting **Trigger Out Polarity Neg Pos** to **Neg** reverses the polarity where a high is 0 V and a low is +5 V.

This softkey is coupled to the **Trigger Out Polarity Neg Pos** softkey in the swept-sine AM, FM, ΦM, and LF Out menus. When the polarity is toggled for this softkey in any one of these menus, it affects all locations of the softkey.

Softkey Location: Press **Sweep/List**, **More (1 of 2)**, **Trigger Out Polarity Neg Pos**

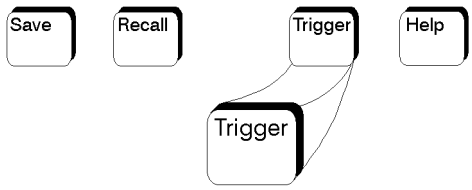
Status after Normal Preset: Pos

SCPI Commands:

:TRIGger:OUTPut:POLarity POSitive|NEGative

:TRIGger:OUTPut:POLarity?

Trigger



Press this front panel hardkey to trigger a specified event or series of events.

- The **Trigger** key can start a step or list sweep under the following conditions:
  - Sweep mode is configured and turned on
  - In single sweep mode, the sweep is armed
  - The **Sweep Trigger** softkey, in the Sweep/List menu, is set to **Trigger Key**
- The **Trigger** key can cause the sweep to step point by point in a step or list sweep under the following conditions:
  - Sweep mode is configured and turned on
  - In single sweep mode, the sweep is armed
  - The **Point Trigger** softkey, in the Sweep/List menu, is set to **Trigger Key**
  - The sweep must be triggered if **Sweep Trigger** is not set to **Immediate**

  Also, under these conditions the **Trigger** key has autorepeat capability. Hold it down and it will repeatedly trigger the consecutive points in the sweep.
- The **Trigger** key can start a single sweep of swept-sine amplitude, frequency, or phase modulation under the following conditions:
  - **Trigger Key** is selected in the AM, FM, or ΦM Sweep Trigger menu
  - Swept-sine AM, FM, or ΦM is enabled

  Also, under these conditions the **Trigger** key has autorepeat capability. Hold it down and it will repeatedly trigger the sweep. This has the effect of stopping the current sweep, before it finishes, when the key repeat is detected.
- The **Trigger Key** can start an LF swept-sine output under the following conditions:
  - **Function Generator** is selected as the **LF Out Source**.
  - The **LF Out Sweep Trigger** is set to **Trigger Key**.
  - Swept-sine LF out is selected.

Also, under these conditions the **Trigger** key has autorepeat capability. Hold it down and it will repeatedly trigger the sweep. This has the effect of stopping the current sweep, before it finishes, when the key repeat is detected.

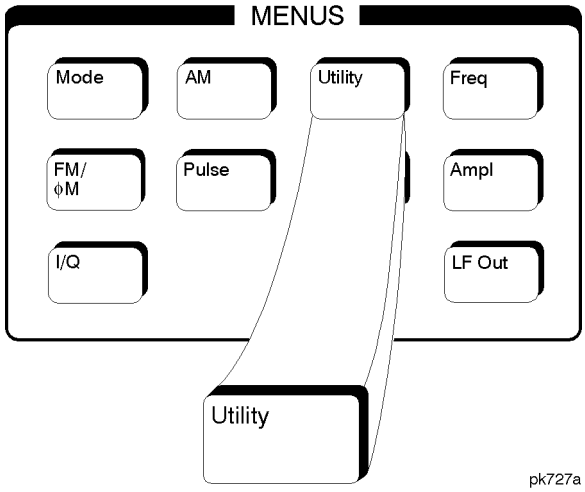
- With any of the digital modulation formats configured and turned on, the **Trigger** key can initiate a burst to output a frame or a data sequence under the following conditions:
  - The digital modulation format is configured and turned on
  - The **Pattern Trigger**, or **Frame Trigger**, softkey, in the digital modulation menu, is set to **Trigger Key**

SCPI Commands:

:TRIGger[:SEQuence][:IMMediate]

Utility

Pressing the front panel **Utility** key reveals a menu of softkeys. These softkeys are described in this section in alphabetical order.



All

This softkey lets you specify that all types of files (including instrument state files, binary user data, and the current sweep list) are to be listed on the display when **Memory Catalog** is selected.

Catalog type is a persistent state; it is not changed by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **Memory Catalog**, **Catalog Type**, **All**

SCPI Commands:

:MEMory:CATalog[:ALL]?

Binary

This softkey lets you specify that only binary files are to be listed on the display when **Memory Catalog** is selected.

Catalog type is a persistent state; it is not changed by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **Memory Catalog**, **Catalog Type**, **Binary**

SCPI Commands:

:MEMory:CATalog:BINary?

Black Pixels Screen Test

This softkey is provided for factory use in testing the display. Pressing this softkey sets all the pixels on the display to black. Pressing the **Local** front panel key returns the display to normal signal generator operation.

Softkey Location: Press **Utility**, **Display**, **Black Pixels Screen Test**

Brightness

Use this softkey to adjust the display brightness (intensity). The display is set to maximum brightness at the factory. To change the brightness, press **Utility**, **Display**, **Brightness.** The current value shown in the active entry area is a relative value for brightness. Increasing the number increases the brightness; decreasing the number decreases the brightness. You can adjust the brightness value to any number from 1 through 50. (To adjust the brightness via remote operation, set the value from 0.0 to 1.0.) Use the front panel knob, the up and down arrow keys, or enter a value using the numeric keypad and press the **Enter** terminator softkey.

Brightness is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **Display**, **Brightness**

SCPI Commands:

:DISPlay:BRIGhtness <value>

:DISPlay:BRIGhtness?

Calibrate Options 1EH,UN3,UN4,HO3

Press this softkey to initiate a baseband generator calibration if you have either Option 1EH, UN3, UN4, or HO3. To confirm that you want to start the calibration, press the **Start Calibration and Store Results** softkey. The calibration takes several minutes. During the calibration, a message is displayed indicating the calibration is in progress and showing the percent complete. When the calibration is finished, the Utility menu is returned.

Perform this calibration if you have just installed a baseband generator in your signal generator. This calibration is not intended for repeated execution. Any further calibrations that may be required should be performed through the I/Q Calibration menu located in the **I/Q** key menus.

Softkey Location: Press **Utility**, **Instrument Adjustments**, **Install/Remove Options**, **Calibrate Options 1EH,UN3,UN4,HO3**

Catalog Type

Pressing this softkey reveals a menu of choices for displaying files. You can choose to display all files (including instrument state files, binary user data, and the current sweep list), binary files only, list files only, or instrument state files only. When you have made your selection, the display is updated and your choice displayed below the **Catalog Type** softkey.

Catalog type is a persistent state; it is not changed by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **Memory Catalog**, **Catalog Type**

Clear Error Queue(s)

Press this softkey to delete any messages that are stored in the error message queues. (There are separate error queues for front panel operation and for SCPI. Pressing this softkey clears both.) You cannot recover from this action; once the messages are deleted, they are permanently gone. When the error message queue is empty, the **ERR** annunciator is turned off.

Softkey Location: Press **Utility**, **Error Info**, **Clear Error Queue(s)**

IEEE 488.2 Common Commands:

*CLS

Clear Text

Press this softkey to delete the existing file name in the active entry area. When you copy from one file to another, the same file name is given to the new file unless you change it. Press **Clear Text** to delete the existing file name and then enter in a new file name using the editing keys provided.

Softkey Location: Press **Utility**, **Memory Catalog**, **Copy File**, **Editing Keys**, **Clear Text**

Copy File

Press this softkey to copy and rename a file in the displayed catalog of files. To copy a file, first select the file from the displayed list by scrolling through the list using the front panel knob or the up and down arrow keys. When the desired file is highlighted, press **Copy File**. The message **`Copy to: <filename>`** is displayed in the active entry area where <filename> is the name of the currently selected file. Your copied file will have the same name as the original file so you must rename it. To rename the copied file, the following editing capabilities are provided:

- The **Editing Mode Insert Replace** softkey in the Editing Keys menu toggles the editing mode from inserting text to replacing text. Insertion mode causes text to be entered in the position directly to the right of the cursor. Replacement mode causes the text to be entered in the position held by the cursor (replacing any existing text in that position).
- The **Clear Text** softkey in the Editing Keys menu deletes all of the existing text in the active entry area.
- Use the left and right arrow keys to position the cursor. Use the front panel knob, or the direct editing softkeys, to enter an alphabetic character, numeral, or special character.

When you have entered the new file name, press the **Enter** terminator softkey. If you have changed your mind, press the **Return** hardkey. Once you press **Enter**, the new file is stored and displayed immediately in the catalog list.

Softkey Location: Press **Utility**, **Memory Catalog**, **Copy File**

Delete All Binary Files

Press this softkey to delete all of the binary files in the displayed catalog of files. You will then confirm that you want to delete all of the binary files in memory. Press the **Confirm Delete Of Binary Files** terminator softkey and all of the files are deleted. You cannot recover the files after this step. If you have changed your mind and do not wish to delete the files, press the **Return** front panel hardkey instead.

Softkey Location: Press **Utility**, **Memory Catalog**, **Catalog Type**, **Binary**, **More (1 of 2)**, **Delete All Binary Files**

SCPI Commands:

:MEMory:DELete:BINary

Delete All Files

Press this softkey to delete all of the files in the displayed catalog of files. You will then confirm that you want to delete all of the files (binary, instrument state, and list files) in memory. Press the **Confirm Delete Of All Files** terminator softkey and all of the files are deleted. You cannot recover the files after this step. If you have changed your mind and do not wish to delete the files, press the **Return** front panel hardkey instead. This softkey does not affect the persistent state or calibration information. If power on mode is set to last, a new last state file will be created when the instrument idles.

Softkey Location: Press **Utility**, **Memory Catalog**, **Catalog Type**, **All**, **More (1 of 2)**, **Delete All Files**

SCPI Commands:

:MEMory:DELete:ALL

Delete All List Files

Press this softkey to delete all of the list files in the displayed catalog of files. You will then confirm that you want to delete all of the list files in memory. Press the **Confirm Delete Of List Files** terminator softkey and all of the list files are deleted. You cannot recover the files after this step. If you have changed your mind and do not wish to delete the file, press the **Return** front panel hardkey instead.

Softkey Location: Press **Utility**, **Memory Catalog**, **Catalog Type**, **List**, **More (1 of 2)**, **Delete All List Files**

SCPI Commands:

:MEMory:DELete:LIST

Delete All State Files

Press this softkey to delete all of the instrument state files in the displayed catalog of files. You will then confirm that you want to delete all of the instrument state files in memory. Press the **Confirm Delete Of State Files** terminator softkey and all of the files are deleted. You cannot recover the files after this step. If you have changed your mind and do not wish to delete the files, press the **Return** front panel hardkey instead.

Softkey Location: Press **Utility**, **Memory Catalog**, **Catalog Type**, **State**, **More (1 of 2)**, **Delete All State Files**

SCPI Commands:

:MEMory:DELete:STATe

Delete File

Press this softkey to delete a file in the displayed catalog of files. To delete a file, first select the file from the displayed list by scrolling through the list using the front panel knob or up and down arrow keys. When the desired file is highlighted, press **Delete File**. Then press the **Confirm Delete** terminator softkey and the file is deleted. You cannot recover the file after this step. If you have changed your mind and do not wish to delete the file, press the **Return** front panel hardkey instead.

Softkey Location: Press **Utility**, **Memory Catalog**, **Delete File**

SCPI Commands:

:MEMory:DELete[:NAME] <filename>

Diagnostic Info

Press this softkey for a display of diagnostic information about the signal generator. This information included in the display is:

- Instrument model
- Instrument options
- Instrument serial number
- Current firmware revision
- Current firmware date
- Number of hours the signal generator has been powered on
- Number of hours the display has been lit
- Number of power cycles
- Number of attenuator cycles
- Number of reverse power protection trips

Softkey Location: Press **Utility**, **Instrument Info/Help Mode**, **Diagnostic Info**

Display

Pressing this softkey reveals a menu of choices for adjusting and testing the display. In this menu you are able to set up the screen saver, change the display brightness, and perform black and white pixel screen tests.

Softkey Location: Press **Utility**, **Display**

Editing Keys

Pressing this softkey reveals a menu of choices for editing the name of a file you have just copied. When you copy a file, its name is copied also. As you cannot have two identical file names, use this menu to edit the file name of the copied file. In this menu you can delete the existing text in the active entry area (either the copied file name, or a file name that you have subsequently entered), and you can toggle the editing mode from inserting text to replacing text.

Softkey Location: Press **Utility**, **Memory Catalog**, **Copy File**, **Editing Keys**

Editing Mode Insert Replace

Press this softkey to toggle the editing mode from inserting text to replacing text. Insertion mode causes text to be entered in the position directly to the right of the cursor. Replacement mode causes the text to be entered in the position held by the cursor (replacing any existing text in that position).

Softkey Location: Press **Utility**, **Memory Catalog**, **Copy File**, **Editing Keys**, **Editing Mode Insert Replace**

Error Info

Pressing this softkey reveals a menu of choices for viewing error messages. In this menu you can view any of the error messages in the queue, and you can clear all of the error messages in the queue.

Softkey Location: Press **Utility**, **Error Info**

Help Mode Single Cont

This softkey toggles the help mode between single and continuous. In single mode, when you press the **Help** key, help text is provided for the next front panel hardkey or softkey that you press. Your next key press returns you to normal operation. In continuous mode, when you press the **Help** key, help text is provided for the next front panel hardkey or softkey that you press and that key's function is also executed. You will stay in this help mode until you press the **Help** key again.

Help mode is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **Instrument Info/Help Mode**, **Help Mode Single Cont**

SCPI Commands:

:SYSTem:HELP:MODE SINGle|CONTinuous

:SYSTem:HELP:MODE?

HP8648A/B/C/D

This softkey is one of the choices in both the Preset Language menu and the Remote Language menu. The **HP8648A/B/C/D** softkey is a language choice for the signal generator that is compatible with the remote language commands used by the HP 8648A/B/C/D. Choosing **HP8648A/B/C/D** in the Preset Language menu

allows you to select this remote language as the default after a normal preset. Choosing **HP8648A/B/C/D** in the Remote Language menu allows you to immediately change the signal generator to use this remote language.

Softkey Location: Press **Utility**, **Power On/Preset**, **Preset Language**, **HP8648A/B/C/D** or press **Utility**, **HP-IB/RS-232**, **Remote Language**, **HP8648A/B/C/D**

SCPI Commands:

:SYSTem:LANGuage “HP8648”

:SYSTem:LANGuage?

:SYSTem:PRESet:LANGuage “HP8648”

:SYSTem:PRESet:LANGuage?

HP8656B,8657A/B

This softkey is one of the choices in both the Preset Language menu and the Remote Language menu. The **HP8656B,8657A/B** softkey is a language choice for the signal generator that is compatible with the remote language commands used by the HP 8656B and the HP 8657A/B. Refer to the programming guide for specifics on which commands are implemented. Choosing **HP8656B,8657A/B** in the Preset Language menu allows you to select this remote language as the default after a normal preset. Choosing **HP8656B,8657A/B** in the Remote Language menu allows you to immediately change the signal generator to use this remote language.

Softkey Location: Press **Utility**, **Power On/Preset**, **Preset Language**, **HP8656B,8657A/B**
or press **Utility**, **HP-IB/RS-232**, **Remote Language**, **HP8656B,8657A/B**

SCPI Commands:

:SYSTem:LANGuage “COMP”

:SYSTem:LANGuage?

:SYSTem:PRESet:LANGuage “COMP”

:SYSTem:PRESet:LANGuage?

HP8657D NADC

This softkey is one of the choices in both the Preset Language menu and the Remote Language menu. The **HP8657D NADC** softkey is a language choice for the signal generator that is compatible with the remote language commands used by the HP 8657D with NADC digital modulation capabilities. Refer to the programming guide for specifics on which commands are implemented. Choosing **HP8656D NADC** in the Preset Language menu allows you to select this remote language as the default after a normal preset. Choosing **HP8656D NADC** in the Remote Language menu allows you to immediately change the signal generator to use this remote language.

Softkey Location: Press **Utility**, **Power On/Preset**, **Preset Language**, **HP8657D NADC** or press **Utility**, **HP-IB/RS-232**, **Remote Language**, **HP8657D NADC**

SCPI Commands:

:SYSTem:LANGuage “NADC”

:SYSTem:LANGuage?

:SYSTem:PRESet:LANGuage “NADC”

:SYSTem:PREset:LANGuage?

HP8657D PDC

This softkey is one of the choices in both the Preset Language menu and the Remote Language menu. The **HP8657D PDC** softkey is a language choice for the signal generator that is compatible with the remote language commands used by the HP 8656D with PDC digital modulation capabilities. Refer to the programming guide for specifics on which commands are implemented. Choosing **HP8657D PDC** in the Preset Language menu allows you to select this remote language as the default after a normal preset. Choosing **HP8657D PDC** in the Remote Language menu allows you to immediately change the signal generator to use this remote language.

Softkey Location: Press **Utility**, **Power On/Preset**, **Preset Language**, **HP8657D PDC** or press **Utility**, **HP-IB/RS-232**, **Remote Language**, **HP8657D PDC**

SCPI Commands:

:SYSTem:LANGuage “PDC”

:SYSTem:LANGuage?

:SYSTem:PRESet:LANGuage “PDC”

:SYSTem:PREset:LANGuage?

HP8657J PHS

This softkey is one of the choices in both the Preset Language menu and the Remote Language menu. The **HP8657J PHS** softkey is a language choice for the signal generator that is compatible with the remote language commands used by the HP 8657J with PHS digital modulation capabilities. Refer to the programming guide for specifics on which commands are implemented. Choosing **HP8657J PHS** in the Preset Language menu allows you to select this remote language as the default after a normal preset. Choosing **HP8657J PHS** in the Remote Language menu allows you to immediately change the signal generator to use this remote language.

Softkey Location: Press **Utility**, **Power On/Preset**, **Preset Language**, **HP8657J PHS** or press **Utility**, **HP-IB/RS-232**, **Remote Language**, **HP8657J PHS**

SCPI Commands:

:SYSTem:LANGuage “PHS”

:SYSTem:LANGuage?

:SYSTem:PRESet:LANGuage “PHS”

:SYSTem:PRESet:LANGuage?

HP-IB Address

Press this softkey to change the signal generator’s HP-IB address. The HP-IB address is set to 19 at the factory. You can change the address to any number between 0 and 30. To enter a new value, press **Utility**, **HP-IB/RS-232**, **HP-IB Address** and rotate the front panel knob, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey.

The HP-IB address setting is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **HP-IB/RS-232**, **HP-IB Address**

SCPI Commands:

:SYSTem:COMMunicate:GPIB:ADDRess <number>

:SYSTem:COMMunicate:GPIB:ADDRess?

HP-IB/RS-232

Pressing this softkey reveals a menu of choices for HP-IB and RS-232 configuration. In this menu, you have the following options:

- Change the HP-IB address of the signal generator.
- Change the remote language of the signal generator.
- Set the baud rate for the RS-232 serial port (AUXILIARY INTERFACE connector).
- Reset the RS-232 serial I/O.
- Turn the RS-232 echo on or off.
- Set the RS-232 handshake protocol.
- Control RS-232 RTS and CTS behavior.

Softkey Location: Press **Utility**, **HP-IB/RS-232**

Install Option 1EH

If you want to install an Option 1EH baseband generator, press this softkey once you have installed the hardware in your signal generator. Then press the **Confirm Change** softkey. The signal generator will reboot and return to preset mode. If you do not want to install the baseband generator, press **Return**. Once you have installed the baseband generator, calibrate the baseband generator by pressing the **Calibrate Options 1EH,UN3,UN4,HO3** softkey.

If an Option 1EH, UN3, UN4, or HO3 baseband generator is already installed (by the factory or through this softkey), this softkey is inactive.

NOTE: Option 1EH is an obsolete I/Q baseband generator that has been replaced by the Option UN3 and UN4 I/Q baseband generators.

Softkey Location: Press **Utility**, **Instrument Adjustments**, **Install/Remove Options**, **Install Option 1EH**

Install Option HO3

If you want to install an Option HO3, press this softkey once you have installed the hardware in your signal generator. Then press the **Confirm Change** softkey. The signal generator will reboot and return to preset mode. If you do not want to install Option HO3, press **Return**. Once you have installed Option HO3, calibrate by pressing the **Calibrate Options 1EH,UN3,UN4,HO3** softkey.

If Option HO3 is already installed this softkey is inactive.

Softkey Location: Press **Utility**, **Instrument Adjustments**, **Install/Remove Options**, **Install Option HO3**

Install Option UN3

If you want to install an Option UN3 baseband generator, press this softkey once you have installed the hardware in your signal generator. Then press the **Confirm Change** softkey. The signal generator will reboot and return to preset mode. If you do not want to install the baseband generator, press **Return**. Once you have installed the baseband generator, calibrate the baseband generator by pressing the **Calibrate Options 1EH,UN3,UN4,HO3** softkey.

If an Option 1EH, UN3, UN4, or HO3 baseband generator is already installed (by the factory or through this softkey), this softkey is inactive.

Softkey Location: Press **Utility**, **Instrument Adjustments**, **Install/Remove Options**, **Install Option UN3**

Install Option UN4

If you want to install an Option UN4 baseband generator, press this softkey once you have installed the hardware in your signal generator. Then press the **Confirm Change** softkey. The signal generator will reboot and return to preset mode. If you do not want to install the baseband generator, press **Return**. Once you have installed the baseband generator, calibrate the baseband generator by pressing the **Calibrate Options 1EH,UN3,UN4,HO3** softkey.

If an Option 1EH, UN3, UN4, or HO3 baseband generator is already installed (by the factory or through this softkey), this softkey is inactive.

Softkey Location: Press **Utility**, **Instrument Adjustments**, **Install/Remove Options**, **Install Option UN4**

Install/Remove Options

Pressing this softkey reveals a menu of softkeys for the following functions:

- Install a baseband generator (Option 1EH, UN3, UN4, or HO3) in your signal generator.
- Remove a baseband generator (Option 1EH, UN3, UN4, or HO3) from your signal generator.
- Calibrate your baseband generator (Option 1EH, UN3, UN4, or HO3).

Softkey Location: Press **Utility**, **Instrument Adjustments**, **Install/Remove Options**

Instrument Adjustments

Pressing this softkey reveals a menu of front panel adjustments for the signal generator. The softkeys in this menu provide the following capabilities:

- Adjust the ratio between the front panel knob and the step size for the arrow keys
- Adjust the internal reference oscillator (for use by service personnel only)
- Install and remove the baseband generator (Options 1EH, UN3, UN4, or HO3)

Softkey Location: Press **Utility**, **Instrument Adjustments**

Instrument Info/Help Mode

Pressing this softkey reveals a menu of softkeys for the following functions:

- Display diagnostic information about your signal generator
- Turn on and off the display of information about the status of the modulation modes
- Toggle the help mode between single and continuous

Softkey Location: Press **Utility**, **Instrument Info/Help Mode**

Inverse Video Off On

The normal display mode for the signal generator is dark text on a light background. Press this softkey to toggle inverse video on (light text on a dark background).

Inverse video is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **Display**, **Inverse Video Off On**

SCPI Commands:

:DISPlay:INVerse ON|OFF|1|0>

:DISPlay:INVerse?

List

This softkey lets you specify that only sweep list files are to be listed on the display when **Memory Catalog** is selected. The sweep list files are stored to memory using the **Store List To File** softkey in the Sweep/List menu.

Catalog type is a persistent state; it is not changed by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **Memory Catalog**, **Catalog Type**, **List**

SCPI Commands:

:MEMory:CATalog:LIST?

Memory Catalog

Pressing this softkey displays the catalog of user files. In addition, it reveals a menu for choosing the type of files that are displayed and for file management. In this menu you can choose to display files by type (all files, instrument state files only, or binary files only), and you can copy and delete files.

Softkey Location: Press **Utility**, **Memory Catalog**

Mod Status Info Off On

Press this softkey to toggle on and off the modulation status display. When the modulation status is set to on, information about the status of all of the modulations available is shown at any time that you have accessed one of the modulation menus. When the modulation status is set to off, the information about the status of all the modulations is never displayed.

Softkey Location: Press **Utility**, **Instrument Info/Help Mode**, **Mod Status Info Off On**

Status after Normal Preset: On

Off

Press this softkey to turn the RTS line off. In this mode, the instrument will ignore the state of the CTS line (3-wire connection). This setting is not compatible with the HP 83300A Remote Interface.

RTS is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **HP-IB/RS-232**, **RS-232 Pace**, **RTS/CTS**, **Off**

SCPI Commands:

:SYSTem:COMMunicate:SERial:CONTrol:RTS OFF

:SYSTem:COMMunicate:SERial:CONTrol:RTS?

Page Down

Press this softkey to move down one page at a time in the displayed catalog of files.

Softkey Location: **Utility**, **Memory Catalog**, **Page Down** or press **Utility**, **Memory Catalog**, **Goto Row**, **Page Down**

Page Up

Press this softkey to move up one page at a time in the displayed catalog of files.

Softkey Location: **Utility**, **Memory Catalog**, **Page Up** or press **Utility**, **Memory Catalog**, **Goto Row**, **Page Up**

PN9 Mode Preset Normal Quick

Pressing this softkey toggles the preset state of the bursted PN9 between normal and quick (truncated) modes. Quick PN9 is available for DECT and TETRA formats only.

Softkey Location: **Utility**, **Power On/Preset**, **PN9 Mode Preset Normal Quick**

SCPI Commands:

:SYSTem:PRESet:PN9 NORMal|QUICk

:SYSTem:PRESet:PN9?

Power On Last Preset

This softkey toggles the power-on state of the signal generator between **Last** and **Preset**.

- If you choose **Last**, each time you cycle power to the signal generator it will turn on in the same condition as when you turned power off. The signal generator must not receive commands for a second before the power is turned off to guarantee that the most recent state is saved.
- If you choose **Preset**, each time you cycle power to the signal generator it will turn on in either the factory-defined preset condition or in a user-defined preset condition. You make the choice between factory- and user-defined preset with the **Preset Normal User** softkey.

The power-on state is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **Power On/Preset**, **Power On Last Preset**

SCPI Commands:

:SYSTem:PON:TYPE PRESet|LAST

:SYSTem:PON:TYPE?

Power On/Preset

Pressing this softkey reveals a menu of choices for preset conditions. In this menu, you have the following options:

- Set the signal generator to power on in the same state as it was when you powered off, or to power on in the instrument preset state. (Refer to the **Power On Last Preset** softkey description, in this section.)
- Set the signal generator to preset to a factory-defined state or to a user-defined state. (Refer to the **Preset Normal User** softkey description, in this section.)
- Set up your own user-defined preset state. (Refer to the **Save Use Preset** softkey description, in this section.)
- Set the signal generator to preset to the SCPI programming language or to an HP 8648 or HP 8656/57-compatible language. (Refer to the **Preset Language** softkey description, in this section.)
- Set the signal generator's reverse power protection to the factory-defined state or to an HP 8648-equivalent state. (Refer to the **Reverse Power Protection Normal HP8648** softkey description.)

Softkey Location: Press **Utility**, **Power On/Preset**

Preset Language

Pressing this softkey reveals a menu of choices for selecting the programming language that is implemented after the **Preset** key is pressed. You can choose between SCPI, which is the language chosen for the signal generator for remote implementation of all features, HP 8648-compatible, and four versions of HP 8656/57-compatible languages. The HP 8648- and 8656/67-compatible languages are provided for remote implementation of some features so that this signal generator can be compatible with systems that use those instruments. Refer to the programming guide for specifics on which commands are implemented.

The preset language is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **Power On/Preset**, **Preset Language**

SCPI Commands:

:SYSTem:PRESet:LANGuage?

Preset Normal User

This softkey toggles the preset state between the factory-defined and the user-defined states. The instrument state conditions for the factory-defined preset state are described in the **Preset** section. You choose the instrument state conditions for the user-defined preset state. Refer to the **Save User Preset** softkey description in this section.

The preset state is a persistent state; it is not changed by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **Power On/Preset**, **Preset Normal User**

SCPI Commands:

:SYSTem:PRESet:TYPE NORMal|USER

:SYSTem:PRESet:TYPE?

Recall Ref Osc Setting

This softkey is provided for adjusting the internal reference oscillator. This adjustment is for use by service personnel only. Refer to the calibration guide for more information.

Softkey Location: Press **Utility**, **Instrument Adjustments**, **Reference Oscillator Adjustment**, **Recall Ref Osc Setting**

Receive Pace None Xon

This softkey in the RS-232 Pace menu determines whether any pacing is acknowledged by the RS-232 receive channel. If Xon pacing is used, the system will send an Xoff character to suspend the transmitting of data when its buffer is nearly full. When the system is ready to receive further input, an Xon character is sent to the transmitting device. Xon pacing is not recommended if binary data will be queried from the signal generator via RS-232. Toggle **Receive Pace None Xon** to **None** to turn off Xon pacing.

Pace is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **HP-IB/RS-232**, **RS-232 Pace**, **Receive Pace None Xon**

SCPI Commands:

:SYSTem:COMMunicate:SERial:RECeive:PACE XON|NONE

:SYSTem:COMMunicate:SERial:RECeive:PACE?

Reference Oscillator Adjustment

Pressing this softkey reveals a menu of softkeys for adjusting the internal reference oscillator. This adjustment is for use by service personnel only.

Softkey Location: Press **Utility**, **Instrument Adjustments**, **Reference Oscillator Adjustment**

Ref Osc Coarse

This softkey is provided for adjusting the internal reference oscillator. This adjustment is for use by service personnel only. Refer to the calibration guide for more information.

Softkey Location: Press **Utility**, **Instrument Adjustments**, **Reference Oscillator Adjustment**, **Ref Osc Coarse**

Ref Osc Fine

This softkey is provided for adjusting the internal reference oscillator. This adjustment is for use by service personnel only. Refer to the calibration guide for more information.

Softkey Location: Press **Utility**, **Instrument Adjustments**, **Reference Oscillator Adjustment**, **Ref Osc Fine**

Remote Language

Pressing this softkey reveals a menu of choices for immediately changing the signal generator's remote language. You can choose between SCPI, which is the language chosen for the signal generator for remote implementation of all features, HP 8648-compatible, and four versions of HP 8656/57-compatible languages. The HP 8648- and 8656/67-compatible languages are provided for remote implementation of some features so that this signal generator can be compatible with systems that use those instruments. Refer to the programming guide for specifics on which commands are implemented.

Softkey Location: Press **Utility**, **HP-IB/RS-232**, **Remote Language**

Status after Normal Preset: SCPI

SCPI Commands:

:SYSTem:LANGuage?

Remove Options 1EH,UN3,UN4,HO3

If you want to remove the baseband generator (Options 1EH, UN3, UN4, or HO3), press this softkey once you have removed the hardware from your signal generator. Then press the **Confirm Change** softkey. The signal generator will reboot and the **Mode** hardkey menus will be deleted. If you do not want to remove the baseband generator, press **Return** to cancel this operation.

If you have accidently pressed **Confirm Change** and do not want to remove the baseband generator, press the appropriate install option softkey in this same menu and then press **Confirm Change**.

If your signal generator was shipped from the factory without Option 1EH, UN3, UN4, or HO3 installed, and you have not installed any of these options, this softkey is inactive.

Softkey Location: Press **Utility**, **Instrument Adjustments**, **Install/Remove Options**, **Remove Options 1EH,UN3,UN4,HO3**

Reset RS-232

Press this softkey to perform a clean-up on the RS-232 buffer which will discard any unprocessed SCPI input received over RS-232 and places the RS-232 connection in a mode which can detect the optional remote interface. All other RS-232 communication parameters (such as baud rate) are unaffected.

Softkey Location: Press **Utility**, **HP-IB/RS-232**, **Reset RS-232**

SCPI Commands:

:SYSTem:COMMunicate:SERial:RESet

Reverse Power Protection Normal HP8648

This softkey toggles the reverse power protection mode between the normal mode for the signal generator and the HP 8648-compatible mode.

When you have selected **Normal** and you trip the reverse power protection circuit, a caution message is displayed and the front panel is locked. Eliminate the source of the excess reverse power detected at the RF OUTPUT connector. Then press the **Reset RPP** softkey to continue normal signal generator operation.

When you have selected **HP8648** and you trip the reverse power protection circuit, a caution message is displayed and the front panel is locked. However, any command sent over HP-IB will reset the RPP circuit and return you to normal signal generator operation. This mode is provided for compatibility with systems that use the HP 8648. It is only available when you have selected HP8648A/B/C/D remote language. At all other times reverse power protection is set to **Normal**. Operate in this mode with *caution*. Repeatedly tripping the RPP can cause damage to the signal generator. It is still best to eliminate the source of the excess reverse power and then reset the reverse power protection circuit by pressing the **Reset RPP** softkey.

The RPP reset mode is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **Power On/Preset**, **Reverse Power Protection Normal HP8648**

SCPI Commands:

:OUTPut:PROTection:MODE "NORMAL"|"HP8648"

:OUTPut:PROTection:MODE?

:OUTPut:PROTection:TRIPped?

:OUTPut:PROTection:CLEar

RS-232 Baud Rate

Press this softkey to set the baud rate in bits per second for the rear panel RS-232 connector (this connector is labeled AUXILIARY INTERFACE). To change the baud rate press the softkey. A menu is displayed of baud rates that are allowed. Press the softkey for the desired value. The baud rate is now set to the new value and the value is displayed below the **RS-232 Baud Rate** softkey.

Baud rate is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **HP-IB/RS-232**, **RS-232 Baud Rate**

SCPI Commands:

:SYSTem:COMMunicate:SERial:BAUD <number>

:SYSTem:COMMunicate:SERial:BAUD?

RS-232 Echo Off On

This softkey toggles the echo function on and off for the RS-232 serial port (AUXILIARY INTERFACE connector). When echo is set to on, every character sent to the signal generator is immediately sent back. No editing capability is available.

Echo is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **HP-IB/RS-232**, **RS-232 Echo Off On**

SCPI Commands:

:SYSTem:COMMunicate:SERial:ECHO ON|OFF|1|0

:SYSTem:COMMunicate:SERial:ECHO?

RS-232 Pace

Pressing this softkey reveals a menu of choices for setting the RS-232 handshake protocol. In this menu you can choose transmit pacing, receive pacing, and RTS/CTS control.

Softkey Location: Press **Utility**, **HP-IB/RS-232**, **RS-232 Pace**

RTS/CTS

Pressing this softkey reveals a menu of choices for controlling the RTS/CTS behavior. This feature is used with RS-232 connections, including the HP 83300A Remote Interface.

RTS is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **HP-IB/RS-232**, **RS-232 Pace**, **RTS/CTS**

SCPI Commands:

:SYSTem:COMMunicate:SERial:CONTrol:RTS?

RTS/CTS Pacing

Press this softkey to turn the RTS line on and instruct the signal generator to monitor the state of the CTS line (hardware handshaking). The signal generator monitors CTS and suspends transmission if this line transitions to its logically low state. Up to 16 characters may still be transmitted after the low transition. The signal generator will drop RTS if its receive buffer is nearly full. RTS will be raised again when there is sufficient room in the buffer. This setting is not compatible with an HP 83300A Remote Interface. Do not attempt to use this setting with a 3-wire connection.

RTS is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **HP-IB/RS-232**, **RS-232 Pace**, **RTS/CTS**, **RTS/CTS Pacing**

SCPI Commands:

:SYSTem:COMMunicate:SERial:CONTrol:RTS STANdard

:SYSTem:COMMunicate:SERial:CONTrol:RTS?

RTS On

Press this softkey to turn the RTS line on. In this mode, the instrument will ignore the state of the CTS line (3-wire connection). This setting is intended for use with an HP 83300A Remote Interface, but it will also work with a 3-wire connection. **RTS On** is the default setting for the signal generator.

RTS is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **HP-IB/RS-232**, **RS-232 Pace**, **RTS/CTS**, **ON**

SCPI Commands:

:SYSTem:COMMunicate:SERial:CONTrol:RTS ON

:SYSTem:COMMunicate:SERial:CONTrol:RTS?

Save User Preset

Use this softkey to establish your user-defined preset state. Set up all of the instrument state conditions that you want for your unique preset state. When you have defined the instrument state to suit your needs, press **Save User Preset**. Only one user-defined preset state is allowed, so when you save the instrument state you will save over any previously-saved state. Your instrument state will be recalled by the signal generator any time you press **Preset** as long as you have set the **Preset Normal User** softkey to **User**. For additional information about the **Preset Normal User** softkey, refer to its description in this section.

The user's state definition is a state file; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **Power On/Preset**, **Save User Preset**

SCPI Commands:

:SYSTem:PRESet[:USER]:SAVE

SCPI

This softkey is one of the choices in both the Preset Language menu and the Remote Language menu. Press either the **Preset Language** softkey or the **Remote Language** softkey to view these menus. SCPI (Standard Commands for Programmable Instruments) is the language chosen for remote implementation of all supported instrument features. Choosing **SCPI** in the Preset Language menu allows you to select this remote language as the default after a normal preset. Choosing **SCPI** in the Remote Language menu allows you to immediately change the signal generator to use this remote language.

Softkey Location: Press **Utility**, **Power On/Preset**, **Preset Language**, **SCPI** or press **Utility**, **HP-IB/RS-232**, **Remote Language**, **SCPI**

SCPI Commands:

:SYSTem:PRESet:LANGuage “SCPI”

:SYSTem:PRESet:LANGuage?

:SYSTem:LANGuage “SCPI”

:SYSTem:LANGuage?

Screen Saver Delay

This softkey sets the period of time before the screen saver is activated. The screen saver delay is set to 1 hour at the factory. You can change the delay by pressing **Utility**, **Display**, **Screen Saver Delay**. The current value for delay is displayed in the active entry area. To enter a new value, rotate the front panel knob, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. The range of values allowed is 1 through 12 hours in 1 hour increments.

Screen saver delay is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **Display**, **Screen Saver Delay**

SCPI Commands:

:SYSTem:SSAVer:DELay <val>

:SYSTem:SSAVer:DELay?

Screen Saver Mode

This softkey toggles between **Light Only** and **Light & Text** mode for the screen saver. When you set the screen saver to **Light Only**, only the display light is turned on and off. When you set the screen saver to **Light & Text**, the display light and the text are turned on and off.

Screen saver mode is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **Display**, **Screen Saver Mode**

SCPI Commands:

:SYSTem:SSAVer:MODE LIGHt|TEXT

:SYSTem:SSAVer:MODE?

Screen Saver Off On

This softkey toggles the signal generator's screen saver on and off. With the screen saver on, the display is turned off after a period of time with no input from the front panel. The display turns back on when any front panel key is pressed. The screen saver is set to **Off** at the factory. You can turn it on by pressing **Utility**, **Display Screen Saver**. Each time you press **Screen Saver Off On** the selection toggles between **Off** and **On**.

You can adjust the screen saver mode to turn the light on and off or to turn both the light and text on and off. Refer to the **Screen Saver Mode** softkey description in this section.

The screen saver delay is set to 1 hour at the factory. You can change the delay time. Refer to the **Screen Saver Delay** softkey description in this section.

Screen saver is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **Display**, **Screen Saver Off On**

SCPI Commands:

:SYSTem:SSAVer:STATe ON|OFF|1|0

:SYSTem:SSAVer:STATe?

State

This softkey lets you specify that only instrument state files are to be listed on the display when **Memory Catalog** is selected.

Catalog type is a persistent state; it is not changed by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **Memory Catalog**, **Catalog Type**, **State**

SCPI Commands:

:MEMory:CATalog:STATe?

Step/Knob Ratio

This softkey sets the ratio between the increment value of the step keys and the front panel knob. For example, if you set the increment value for frequency to 1 MHz and set the step/knob ratio to 10/1, when frequency is the active function the up and down arrow keys will change the frequency in 1 MHz steps and the front panel knob will change the frequency in 1/10th of 1 MHz steps. This ratio only applies when you have a function active that has an associated increment value.

To change the step/knob ratio, press **Utility**, **Instrument Adjustments**, **Step/Knob Ratio**. The number displayed in the active entry area represents the arrow keys step size in the ratio. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey.

The step/knob ratio is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **Instrument Adjustments**, **Step/Knob Ratio**

Store Ref Osc Setting

This softkey is provided for adjusting the internal reference oscillator. This adjustment is for use by service personnel only. Refer to the calibration guide for more information.

Softkey Location: Press **Utility**, **Instrument Adjustments**, **Reference Oscillator Adjustment**, **Store Ref Osc Setting**

Transmit Pace None Xon

This softkey in the RS-232 Pace menu determines whether any pacing is acknowledged by the RS-232 transmit channel. If Xon pacing is used, the system will suspend transmitting data upon receiving an Xoff character until an Xon character is received. The signal generator may not be responsive to other channels, or to the front panel, while transmission is suspended. Xon pacing is not recommended if binary data will be sent to the signal generator via RS-232. Toggle **Transmit Pace None Xon** to **None** to turn off Xon pacing.

Pace is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility**, **HP-IB/RS-232**, **RS-232 Pace**, **Transmit Pace None Xon**

SCPI Commands:

:SYSTem:COMMunicate:SERial:TRANsmit:PACE XON|NONE

:SYSTem:COMMunicate:SERial:TRANsmit:PACE?

View Next Error Message

If the **ERR** annunciator is turned on in the display, you have at least one error message stored in the error message queue. Use this softkey to display the first error message in the queue. (The first error message is the oldest error.) There may be more than one error message in the queue; the number of error messages is displayed along with the first message. If there is more than one message, continue pressing this softkey to view the rest of the error messages. If you wish to back up and view a message you have already seen, press **View Previous Error Message**. Press any front panel key to remove the error message from the display and return to normal signal generator operation.

The error queue can contain up to 30 error messages. When the front panel error queue overflows, error messages are deleted beginning with the oldest ones first. When the SCPI error queue overflows, newer error messages are not recorded.

You can scroll through the error messages in reverse order. Refer to the **View Previous Error Message** softkey description.

Softkey Location: Press **Utility**, **Error Info**, **View Next Error Message**

SCPI Commands:

:SYSTem:ERRor[:NEXT]?

View Previous Error Message

If the **ERR** annunciator is turned on in the display, you have at least one error message stored in the error message queue. Use this softkey to display the newest error message first. Continue pressing this softkey to view additional error messages in order of newest to oldest. Press any front panel key to remove the error message from the display and return to normal signal generator operation.

Softkey Location: Press **Utility**, **Error Info**, **View Previous Error Message**

White Pixels Screen Test

This softkey is provided for factory use in testing the display. Pressing this softkey sets all of the pixels on the display to white. Pressing the front panel Local key returns the display to normal operation.

Softkey Location: Press **Utility**, **Display**, **White Pixels Screen Test**

6 Options and Accessories

This chapter describes the options that can be ordered for your signal generator at the time of shipment, the options that can be retrofitted to your existing signal generator, and the upgrades and the accessories that you can order.

Signal Generator Options

This section describes the options available for your signal generator. You can order these options with your signal generator by ordering the option number shown, or you can order these options post-sales by requesting the HP part number that is provided.

Front Handles (Option 1CN)

This kit contains two handles and the necessary hardware to attach the handles to the front of the signal generator. Instructions for assembling the parts are included with the kit. To order this kit after receipt of your signal generator, order HP part number 5063-9227.

Rack Mount Flanges without Handles (Option 1CM)

This kit contains two flanges and the necessary hardware to rack mount the signal generator in an HP System II or System II Plus cabinet. Instructions for assembling the parts are included with the kit. To order this kit after receipt of your signal generator, order HP part number 5063-9214.

Rack Mount Flanges with Handles (Option 1CP)

This kit contains two handles, two flanges, and the necessary hardware to rack mount the signal generator in an HP System II or System II Plus cabinet. Instructions for assembling the parts are included with the kit. To order this kit after receipt of your signal generator, order HP part number 5063-9221.

Three Year Warranty (Option W30)

If you order Option W30 at the point of sale, you will receive a service contract that extends your return-to-HP repair benefits beyond the end of the warranty period for an additional two years. This additional support is not available as a post-sales option.

I/Q Baseband Generator (Option UN3)

If you order Option UN3 at the point of sale, your signal generator will include an I/Q baseband generator which makes the following digital modulation formats available: DECT, GSM, NADC, PDC, PHS, and TETRA. Pre-modulation filtering selections are provided and PRBS capability with 1 Mbyte of pattern RAM. In addition to providing the modulation formats for modulating data based on the specifications of the standards, framing management capabilities are also provided.

I/Q Baseband Generator (Option UN4)

If you order Option UN4 at the point of sale, your signal generator will include an I/Q baseband generator which makes the following digital modulation formats available: DECT, GSM, NADC, PDC, PHS, and TETRA. Pre-modulation filtering selections are provided and PRBS capability with 8 Mbytes of pattern RAM. In addition to providing the modulation formats for modulating data based on the specifications of the standards, framing management capabilities are also provided.

Move All Front Panel Connectors to Rear Panel (Option 1EM)

If you order Option 1EM at the point of sale, all of the front panel connectors will be moved to the rear panel. If you order Option 1EM in combination with Option UN3 or UN4, all of the front panel connectors will be moved to the rear panel and, in addition, some of the connectors will be changed from BNC to SMB connectors. (For details on the connectors, see Chapter 4.)

High Stability Timebase (Option 1E5)

If you order Option 1E5 at the point of sale, the standard timebase reference assembly will be replaced with a high-stability timebase reference assembly. The high-stability timebase reference assembly has improved specifications over the standard assembly including warranted specifications for aging rate. (The aging rate specification is typical for the standard assembly.) Refer to Chapter 9, “Specifications,” for more information.

Delete Standard Manual Set (Option 0B0)

All instruments are supplied with one complete manual set (HP part number E4400-90080) which includes the following documents:

- User's Guide (HP part number E4400-90081)
- Programming Guide (HP part number E4400-90082)
- Quick Reference Guide (HP part number E4400-90083)
- Calibration Guide (HP part number E4400-90084)

If you order Option 0B0, at the point of sale, you will receive your signal generator with no documentation. If you later decide to purchase the documentation, you can order individual manuals by requesting the part numbers listed or you can order the complete manual set by ordering HP part number E4400-90080.

Extra Manual Set (Option 0B1)

All instruments are supplied with one complete manual set (HP part number E4400-90080) which includes the following documents:

- User's Guide (HP part number E4400-90081)
- Programming Guide (HP part number E4400-90082)
- Quick Reference Guide (HP part number E4400-90083)
- Calibration Guide (HP part number E4400-90084)

If you order Option 0B1, at the point of sale, you will receive an additional set of this documentation. After shipment of your order, you can order additional copies of these documents by requesting the individual part numbers or you can order the complete set by ordering HP part number E4400-90080.

NOTE Service documentation is not part of the standard manual set. The service documentation is available as Options 0BW, 0BV, and 0BX.

Assembly-Level Service Guide (Option 0BW)

All instruments are supplied with one complete manual set (HP part number E4400-90080) which includes the following documents:

- User's Guide (HP part number E4400-90081)
- Programming Guide (HP part number E4400-90082)
- Quick Reference Guide (HP part number E4400-90083)
- Calibration Guide (HP part number E4400-90084)

If you order Option 0BW, at the point of sale, you will also receive the service guide (HP part number E4400-90014). This document provides the information required to troubleshoot and repair the signal generator to the assembly level. After shipment of your order, you can order additional copies of any of these documents by requesting the individual part numbers.

Component-Level Information Package (Option 0BV)

All instruments are supplied with one complete manual set (HP part number E4400-90080) which includes the following documents:

- User's Guide (HP E4400-90081)
- Programming Guide (HP part number E4400-90082)
- Quick Reference Guide (HP part number E4400-90083)
- Calibration Guide (HP part number E4400-90084)

If you order Option 0BV, at the point of sale, you will also receive the component-level information package (HP part number E4400-90015.) This document provides schematics, component locator diagrams, and part lists for the signal generator. After shipment of your order, you can order additional copies of any of these documents by requesting the individual part numbers.

Assembly-Level Service Guide and Component-Level Information Package (Option 0BX)

All instruments are supplied with one complete manual set (HP part number E4400-90080) which includes the following documents:

- User's Guide (HP E4400-90081)
- Programming Guide (HP part number E4400-90082)
- Quick Reference Guide (HP part number E4400-90083)
- Calibration Guide (HP part number E4400-90084)

If you order Option 0BX, at the point of sale, you will also receive the service guide (HP part number E4400-90014) and the component-level information package (HP part number E4400-90015). These documents provide you with the

information required to troubleshoot and repair the signal generator to the assembly level, and also with schematics, component locator diagrams, and parts lists for the signal generator. After shipment of your order, you can order additional copies of any of these documents by requesting the individual part numbers.

User's Guide - Traditional Chinese for Taiwan (Option AB0)

In addition to the standard English language manual set, if you order Option AB0, at the point of sale, you will receive, at no charge, a subset of the user's guide translated into traditional Chinese for Taiwan. After shipment of your order, you can order additional copies of this document by requesting HP part number E4400-90030. This document is not free of charge when you order it after shipment of your signal generator.

User's Guide - Korean (Option AB1)

In addition to the standard English language manual set, if you order Option AB1, at the point of sale, you will receive, at no charge, a subset of the user's guide translated into Korean. After shipment of your order, you can order additional copies of this document by requesting HP part number E4400-90029. This document is not free of charge when you order it after shipment of your signal generator.

User's Guide - Chinese (Option AB2)

In addition to the standard English language manual set, if you order Option AB2, at the point of sale, you will receive, at no charge, a subset of the user's guide translated into Chinese. After shipment of your order, you can order additional copies of this document by requesting HP part number E4400-90028. This document is not free of charge when you order it after shipment of your signal generator.

User's Guide - German (Option ABD)

In addition to the standard English language manual set, if you order Option ABD, at the point of sale, you will receive, at no charge, a subset of the user's guide translated into German. After shipment of your order, you can order additional copies of this document by requesting HP part number E4400-90033. This document is not free of charge when you order it after shipment of your signal generator.

User’s Guide - Spanish (Option ABE)

In addition to the standard English language manual set, if you order Option ABE, at the point of sale, you will receive, at no charge, a subset of the user’s guide translated into Spanish. After shipment of your order, you can order additional copies of this document by requesting HP part number E4400-90032. This document is not free of charge when you order it after shipment of your signal generator.

User’s Guide - Japanese (Option ABJ)

In addition to the standard English language manual set, if you order Option ABJ at the point of sale, you will receive, at no charge, a subset of the user’s guide translated into Japanese. After shipment of your order, you can order additional copies of this document by requesting HP part number E4400-90031. This document is not free of charge when you order it after shipment of your signal generator.

Signal Generator Accessories

This section describes the accessories for the signal generator that can be ordered at any time.

Transit Case (HP Part Number 9211-1296)

The transit case is a sturdy, carrying container designed to protect your signal generator from physical damage during transportation. The interior of the container is lined with compressible foam that is form-fitting to the exterior shape of the signal generator.

Remote Interface (HP 83300A)

The remote interface is an accessory to the signal generator consisting of a keypad which is connected by a 1 meter cable to the AUXILIARY INTERFACE rear panel connector (RS-232). This keypad lets you recall instrument states. (This is the same recall function provided by the front panel keys.) The remote interface is a convenient accessory for use in production environments where multiple instrument states are repetitively utilized.

RS-232 Cable Kit

This kit contains the appropriate hardware (cable, adapters, and null modem) to connect the signal generator RS-232 interface to a computer controller. This hardware will be required for downloading firmware from the HP SoCo Web site. To order this kit, request HP part number E4400-60049.

Upgrade and Retrofit Kits

This section describes the kits available for upgrading an existing signal generator feature and the kits available to retrofit a feature to your signal generator. You can order these kits post-sales by requesting the option number or the HP part number that is provided.

Firmware Upgrade Kit

This kit contains the latest firmware available for the signal generator. Disks are included in the kit in both DOS and UNIX formats. Instructions for downloading the firmware are included. To order this kit, request HP part number E4400-60046.

Firmware Upgrade Kit with Documentation

This kit contains the latest firmware available for the signal generator. Disks are provided in the kit in both DOS and UNIX formats. Instructions for downloading the firmware are included. In addition, the standard documentation set for the signal generator is provided. To order this kit, request HP part number E4400-60055.

Option 1EH to Option UN3 Upgrade Kit (Option 001)

This kit contains all of the hardware and the instructions to upgrade a signal generator from Option 1EH to Option UN3. Option 1EH is an I/Q baseband generator that is no longer available. Option UN3 contains the same I/Q baseband generator capability as Option 1EH with the addition of DECT and TETRA digital modulation formats, PRBS, 1 Mbyte of pattern RAM, and pre-modulation filtering. To order this kit, request HP part number E4400-60040 or order Option 001.

Option 1EH to Option UN4 Upgrade Kit (Option 002)

This kit contains all of the hardware and the instructions to upgrade a signal generator from Option 1EH to Option UN4. Option 1EH is an I/Q baseband generator that is no longer available. Option UN4 contains the same I/Q baseband generator capability as Option 1EH with the addition of DECT and TETRA

digital modulation formats, PRBS, 8 Mbytes of pattern RAM, and pre-modulation filtering. To order this kit, request HP part number E4400-60056 or order Option 002.

Standard Digital to Option UN4 Retrofit Kit (Option 003)

This kit contains all of the hardware and the instructions to retrofit a standard digital version of the signal generator (HP ESG-DX000A) with Option UN4 (I/Q baseband generator with 8 Mbytes of pattern RAM). To order this kit, request HP part number E4400-60031 or order Option 003.

7 Operation

This chapter contains detailed information that will help you learn how to operate your signal generator. Much of the information provided here is supporting material for the digital modulation modes (Options UN3 and UN4).

Framed Data Pattern Transmissions (Options UN3 and UN4)

Signal generators equipped with Options UN3 or UN4 can be configured to generate framed data transmissions in any of the following formats: DECT, GSM, NADC, PDC, PHS, or TETRA. Many data patterns can be internally-generated (PN9, PN15, fixed 4-bit repeating sequences, set patterns of ones and zeroes, DECT-specific patterns) or you can choose to supply your own data (download a binary file or input data using the DATA INPUT connector). If you elect to supply your own data file, it should be created to exactly fill the data fields of your chosen timeslots. If the end of the file does not coincide with the end of a frame, data will be truncated in one of the following ways:

- Enough frames will be generated to transmit as much of the data pattern as will fit into complete frames. The remaining bits of the data pattern (which are too few to completely fill a frame) are truncated.
- If two files of unequal sizes are selected for the same framed transmission, enough frames will be generated to transmit as much of the data pattern of the largest file as will fit into complete frames. The remaining bits of the data pattern are truncated. The smaller file will be repeated as many times as necessary to completely fill these frames. Data will be truncated for the smaller file to coincide with the end of the last frame.
- If a user's file and a PN9 file are selected for the same framed transmission and the user's file is shorter than the PN9, 511 frames will be generated to transmit the PN9. The end of the PN9 data will coincide with the end of the 511th frame. The smaller user's file will be repeated as many times as necessary to completely fill these 511 frames. Data will be truncated for the smaller file to coincide with the end of the last frame.
- If a user's file and a PN9 file are selected for the same framed transmission and the user's file is longer than the PN9, enough frames will be generated to transmit as much of the data pattern as will fit into complete frames. The remaining bits of the data pattern (which are too few to completely fill a frame) are truncated. The PN9 data will be repeated as many times as necessary to completely fill these frames.

The signal generator has the capability of transmitting the framed data continuously or outputting a single frame. If only one timeslot is on, selecting a single framed transmission will output the following sequences:

- 4-Bit Patterns (FIX4) - A single frame is generated. The 4-bit pattern repeats until the data fields are completely filled. Each trigger transmits the same frame.
- Other Patterns (fixed patterns of equal quantities of ones and zeroes) or DECT-Specific Patterns - A single frame is generated. The selected pattern repeats until the data fields are completely filled. Each trigger transmits the same frame.

- PN9 - A single frame is generated. The data fields are filled with the leading bits of the PN9 sequence. A trigger causes the frame to be transmitted. The data fields of this frame are then filled sequentially with the next series of PN9 data bits. A trigger causes the frame to be transmitted. This process continues, transmitting the entire PN9 sequence frame by frame. The last bit of the PN9 sequence in a data field is immediately followed by the first bit of a second PN9 sequence.
- PN15 - A single frame is generated. The data fields are filled with the leading bits of the PN15 sequence. A trigger causes the frame to be transmitted. The data fields of this frame are then filled sequentially with the next series of PN15 data bits. A trigger causes the frame to be transmitted. This process continues, transmitting the entire PN15 sequence frame by frame. The last bit of the PN15 sequence in a data field is immediately followed by the first bit of a second PN15 sequence.
- User File - The user's file should have the appropriate data to fill an integer number of timeslots. If not, the remaining bits are truncated. Depending on the size of the file, more than one frame can possible be generated.
- External Data - External data is clocked into the data fields of the timeslot. A single frame is generated.

Data Dependencies

There are some situations where combinations of data patterns, or usage of particular data patterns, will cause the data to be truncated or discontinuous. Because a discontinuous data pattern will make bit error rate testing invalid, it is important to be aware of these situations.

- If more than eight timeslots are turned on in a DECT frame and the data pattern chosen is PN9 or PN15, the PN9/15 pattern in the first eight timeslots will be continuous but the remaining timeslots will contain a discontinuous PN9/15 pattern. The discontinuous PN9/15 pattern consists of enough frames for one PN9/15 pattern. The end of the data will not coincide with the end of the frame so enough of a second PN9/15 pattern is generated to fill the remaining data fields in the current frame.
- Any time a downlink timeslot type is selected for a TETRA frame and the data pattern chosen is PN15, the PN15 pattern will be discontinuous. A discontinuous PN15 pattern consists of as many complete frames of PN15 data as can be generated. The remaining bits that do not completely fill a frame are truncated.
- Any combination of external data and a PN15 data pattern will cause a discontinuous PN15 pattern.
- Any combination of user's files and a PN15 data pattern will cause a discontinuous PN15 pattern.

Digital Modulation Input/Output Relationships (Options UN3 and UN4)

Signal generators equipped with Options UN3 or UN4 can be configured to internally-generate pattern or framed data, the baseband generator's clock can be internally- or externally-supplied, and the external data clock can be set to a normal bit clock or a symbol clock for the NADC, PDC, PHS, and TETRA formats. Combinations of these selections will affect the inputs required and the outputs available. The following tables specify the input requirements and the outputs available for pattern data mode and framed data mode. (Note: Instruments with Option 1EM will have all connectors positioned on the rear panel.)

Table 7-1. Pattern Data Mode

Data	BBG Data Clock	External Data Clock	Front Panel Inputs			Rear Panel Outputs		
			DATA CLOCK	SYMBOL SYNC	DATA	DATA CLK OUT	SYMBOL SYNC OUT	DATA OUT
Internal	Internal	NA	NA	NA	NA	Internal Bit Clock	Internal Symbol Clock	Internally Generated Data
Internal	External	Normal	User's Bit Clock	NA	NA	Internal Bit Clock	Internal Symbol Clock	Internally Generated Data
Internal	External	Symbol	User's Symbol Clock	NA	NA	Internal Bit Clock	Internal Symbol Clock	Internally Generated Data
External	Internal	NA	NA	User's Symbol Clock[1]	User's External Data[1]	Internal Bit Clock	User's Symbol Clock	User's External Data
External	External	Normal	User's Bit Clock	User's Symbol Clock	User's External Data	Internal Bit Clock	User's Symbol Clock	User's External Data
External	External	Symbol	User's Symbol Clock[2]	User's Symbol Clock[2]	User's External Data	Internal Bit Clock	User's Symbol Clock	User's External Data

1. The front panel SYMBOL SYNC and DATA inputs must be clocked by the internal bit clock output from the rear panel DATA CLK OUT.
2. When the user's symbol clock is supplied to the DATA CLOCK input, it must also be supplied to the SYMBOL SYNC input via a tee.

Table 7-2. Framed Data Mode

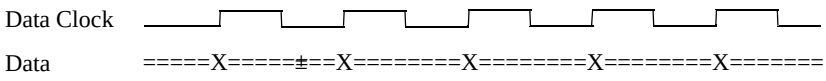
Data	BBG Data Clock	External Data Clock	Front Panel Inputs			Rear Panel Outputs		
			DATA CLOCK	SYMBOL SYNC	DATA	DATA CLK OUT	SYMBOL SYNC OUT	DATA OUT
Internal	Internal	NA	NA	NA	NA	Internal Bit Clock	Internal Symbol Clock	Framed Internally Generated Data
Internal	External	Normal	User's Bit Clock	NA	NA	Internal Bit Clock	Internal Symbol Clock	Framed Internally Generated Data
Internal	External	Symbol	User's Symbol Clock	NA	NA	Internal Bit Clock	Internal Symbol Clock	Framed Internally Generated Data
External[1]	Internal	NA	NA	NA	User's External Data[2]	Internal Bit Clock	Internal Symbol Clock	Internally Framed User's External Data
External[1]	External	Normal	User's Bit Clock	NA	User's External Data	Internal Bit Clock	Internal Symbol Clock	Internally Framed User's External Data
External[1]	External	Symbol	User's Symbol Clock	NA	User's External Data	Internal Bit Clock	Internal Symbol Clock	Internally Framed User's External Data

1. In all configurations where data is externally supplied, the rear panel EVENT 2 output must be used to gate the data into the internally-generated frame data.
2. The front panel DATA input from the user's external data source must be clocked by the internal bit clock output from the rear panel DATA CLK OUT and be correctly phased with SYMBOL SYNC OUT.

Data Clock Timing Patterns (Options UN3 and UN4)

GSM and DECT

The diagram shows both the DATA CLOCK INPUT signal and the DATA INPUT pattern (one bit per symbol). Notice that the data should change (zero to one or one to zero) on the rising edge of the data clock and the data must be stable on the falling edge of the data clock.



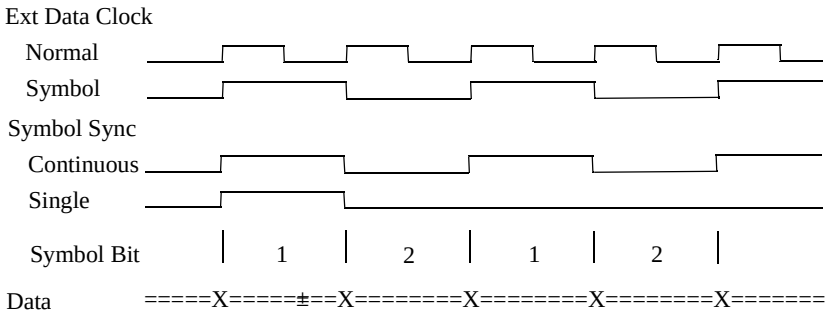
where X is data transition; = is data valid 0 or 1

NADC, PDC, PHS, and TETRA

The following timing diagram shows the following information:

- external DATA CLOCK INPUT signal in normal and symbol modes
- SYMBOL SYNC INPUT signal in continuous and single modes
- symbol bits (2 bits per symbol)
- DATA INPUT pattern

Notice that the data should change (zero to one or one to zero) on the rising edge of the data clock and the data must be stable on the falling edge of the data clock.

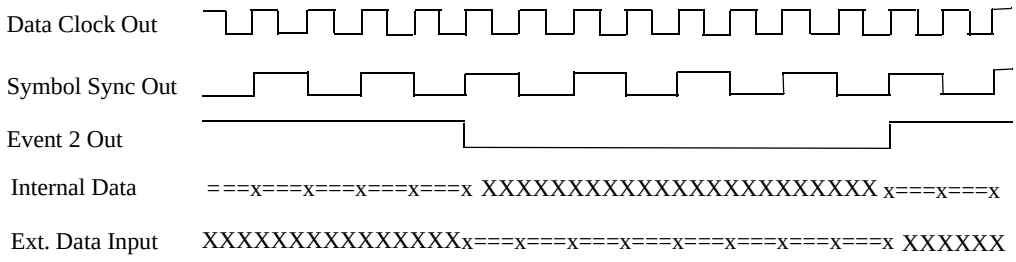


where X is data transition; = is data valid 0 or 1

Internally-Framed External User Data

The following timing diagram shows the following information:

- DATA CLOCK OUT signal
- SYMBOL SYNC OUT signal in continuous mode (only applies to digital modulation modes with 2 bits per symbol)
- EVENT 2 OUT signal
- internal data pattern
- external data pattern



where x is data transition; = is data valid 0 or 1; X is data “don’t care”

Frame/Pattern Triggering (Options UN3 and UN4)

The PATTERN TRIG IN connector is used to trigger the internal digital modulation data generator to start an unframed, continuous data pattern or a framed data output. This input accepts a CMOS low to CMOS high edge trigger. The minimum trigger input pulse width, high or low, is 100 ns.

The input trigger edge is latched and then sampled by the falling edge of the data bit clock to synchronize the trigger with the data bit clock timing.

The minimum delay from the trigger rising edge to the first bit of the frame is 1.5 to 2.5 bit clock periods. Trigger delay resolution is one data bit clock period. Setting the trigger delay equal to the frame bit count minus two will allow the frame to start within plus or minus one half of a bit clock of the trigger edge.

For example: The GSM frame bit count total is 1250. If you set the delay to 1248, the frame will start within one half of a bit clock of the trigger edge.

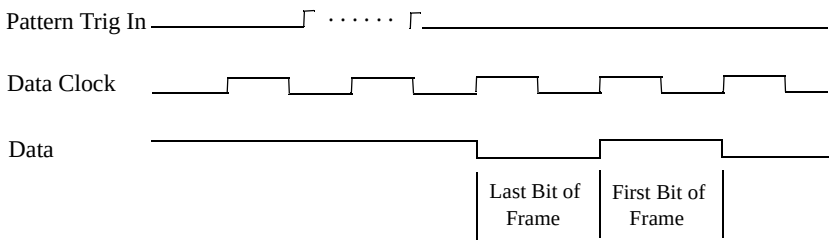
You can also set the external delay bits function to a value greater than zero. One data bit clock period of delay is added per external delay bit to the start of the frame from the trigger. For delays set longer than the frame length, after a delay period is triggered, subsequent trigger pulses occurring up to seven bit clocks before that delay period ends will be ignored.

NOTE: The phase and frequency of the trigger and the frame start can be held constant by using the same frequency reference for both the signal generator and the external trigger source. To keep the phase constant but *not* aligned, use the HP ESG-D series internal 10 MHz reference or an external 10 MHz reference for both sources. Or use an external 13 MHz reference in GSM only. To keep the phase constant *and* aligned, use the HP ESG-D series internal data clock or an external data clock for both sources.

Three examples follow with timing diagrams to demonstrate the frame/pattern triggering function. In all examples, external delay is off, the frame trigger is external, and the frame repeat function is set to single. (A continuous setting always causes the pattern trigger input to be ignored.)

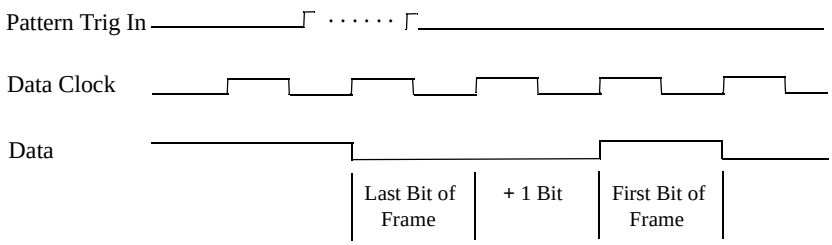
Example 1

In this example, the timing diagram shows the trigger occurring on time (1.5 to 2.5 bit clocks before the present frame ends) to generate continuous frame timing. The rising edge of the trigger is shown to occur at any time after the last bit clock falling edge and before the next bit clock falling edge.

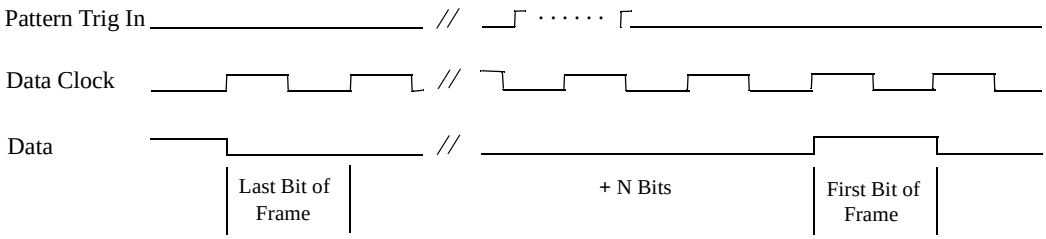


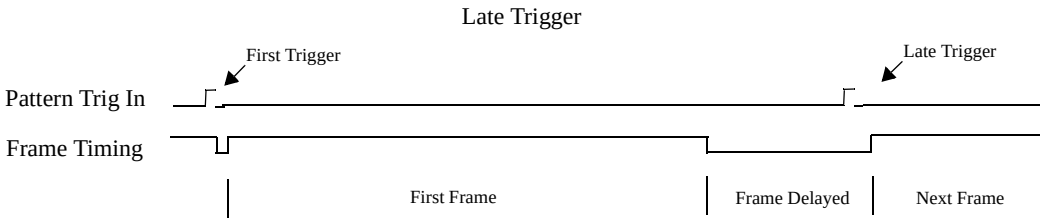
Example 2

In this example, two timing diagrams are shown. In the first, the trigger occurs late (1.5 to 0.5 bit clocks before the present frame ends). The outcome is an additional guard bit inserted between the last bit of the present frame and the first bit of the next frame.



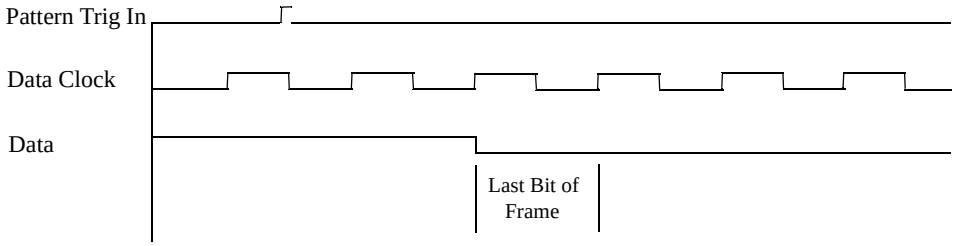
This timing diagram shows the trigger occurring between N – 1.5 to N – 2.5 bit clocks after the current frame ends. The first bit of the next frame begins N bit clocks after the current frame ends.

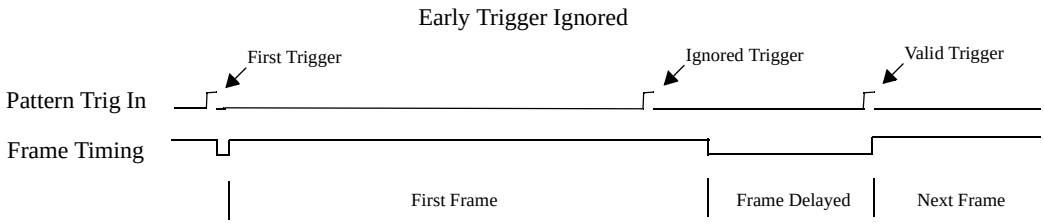




Example 3

This timing diagram shows the trigger occurring before the present frame ends. Trigger input is masked from the frame start until 2.5 bit clocks before the frame ends. Any triggers occurring during the mask are ignored. The next frame is delayed until the next valid trigger occurs. (For PHS the mask is shortened to 6.5 bit clocks before the frame ends to allow more margin before frames are delayed.)





Frame/Pattern Triggering (Option 1EH)

The PATTERN TRIG IN connector is used to trigger the internal digital modulation data generator to start a single pattern output or to stop and re-synchronize a pattern that is being continuously output. The input levels are TTL.

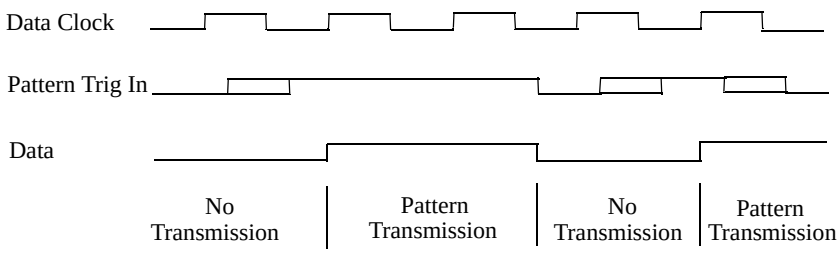
Triggering a Single Pattern

To trigger a single pattern, the trigger must be sampled low on a data clock rising edge and then be sampled high on the next, or some later, clock rising edge. The trigger must remain high until after the pattern ends. If the trigger is high, the pattern will stop after the last bit. When the trigger makes the next low to high transition, the pattern is reset to the first bit and re-started.

If the trigger transitions from high to low before the pattern ends, the pattern will reset to the first bit and re-start at the next low to high trigger transition. If the PATTERN TRIG IN signal is held high and only pulse it low and then high to trigger the pattern, the pattern will not be reset due to an inappropriate high to low trigger transition.

If there is no input to the PATTERN TRIG IN connector, it is internally pulled to a high state. A single pattern is output once the pattern repeat is set to single. This allows the signal generator to internally-trigger a single pattern.

In the single pattern mode, when the complete pattern is transmitted, the I and Q outputs will continue to clock and send phase transitions controlled by the last symbol data and the symbol sync state in the pattern. If the pattern is reset before it finishes, the I and Q outputs will continue to clock and send phase transitions controlled by the first data bit and the symbol sync state in the pattern.

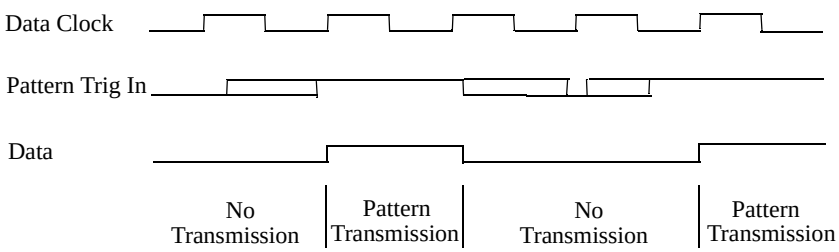


Triggering a Continuous Pattern

To trigger a continuous pattern, the trigger must be sampled low on a data clock rising edge and then be sampled high on the next, or some later, clock rising edge. (The same as for a single pattern.) The pattern runs while the trigger input remains high. When the trigger makes a high to low transition, the pattern stops and is reset to the first bit.

If there is no input to the PATTERN TRIG IN connector, it is internally pulled to a high state. A continuous pattern is output once the pattern repeat is set to continuous. The pattern will not start or run if the trigger is held low at the PATTERN TRIG IN connector. The signal generator does not have the capability to over-ride a low user input and force the pattern to run.

In the continuous pattern mode, while waiting for the trigger to be sampled high, the I and Q outputs will continue to clock and send phase transitions controlled by the first symbol data and the symbol sync state in the pattern.



Frame versus Pattern Length

The pattern generation of the PN9 sequences in the signal generator is RAM-based. As a result, framed patterns of PN9 data consist of multiple (511) frames. A pattern is reset to the beginning at each trigger. Therefore, if the pattern trigger occurs at the frame rate, and a multiple frame pattern is selected, only the first frame of that pattern will be transmitted.

If a pattern is to be a single frame in length, the data in the frame must be a four-bit pattern.

Userfile Applications

Digital Modulation Data Remote Programming with Userfiles

Use the following SCPI command line to enter a user file for remote programming of the source's digital modulation:

```
MMEM:DATA "filename"
```

Sample Command Line

A sample command line:

```
MMEM:DATA "filename",#ABC
```

"filename"	the file name
A	the number of numeric digits to follow in **B.**
B	specifies the number of data bytes in **C.**
C	the digital modulation data**.**

Example 1

In the following example, the data bytes are in ASCII.

```
MMEM:DATA "NEWDATAFILE",#1912SA4D789
                        AB  C
```

"NEWDATAFILE"	the file name
1	defines the number of numeric digits to follow in **B**. After the **#**, this number points to the single digit **9** which defines the number of bytes of modulation data. (This variable is represented by **A** in the sample command line.)
9	reserves the 9 data digits (**12SA4D789**) that indicate the bytes (in ASCII) that are stored in the modulation data (**C**). This variable is represented by **B** in the sample command line.
12SA4D789	the digital modulation data in ASCII. This variable is represented by **C** in the sample command line.

Example 2

In the following example, the data bytes are in ASCII.

```
MMEM:DATA "NEWDATAFILE1",#21012&A%4D789
                         A B      C
```

"NEWDATAFILE1" the file name

2 defines the number of numeric digits to follow in **B**. After the **#**, this number points to the double digit **10** which defines the number of bytes of modulation data. (This variable is represented by **A** in the sample command line.)

10 reserves the 10 data digits (**12&A%4D789**) that indicate the bytes (in ASCII) that are stored in the modulation data (**C**). This variable is represented by **B** in the sample command line.

12&A%4D789 the digital modulation data in ASCII. This variable is represented by **C** in the sample command line.

NOTE: A userfile must contain enough data to fill the entire field(s) for which it is selected. If a user file containing a data pattern with less than the required number of bits is selected, the resulting signal will not be usable. For example, if you want to fill the data field (E) of a normal GSM burst, the userfile must contain at least 114 bits of data (see the table below). If the data is downloaded using ASCII characters (which represent one byte of data per character), you must enter 15 bytes of data. The six least-significant bits of the 15th byte will be truncated.

Standard	Burst Type	Bits Required	Data Required in Bytes
NADC	Up TCH	260	33; 4 LSBs of 33rd byte are truncated.
GSM	Normal Burst	114	15; 6 LSBs of 33rd byte are truncated.
PDC	Up TCH	224	28
PHS	TCH	160	20
DECT	Traffic Bearer	320	40
TETRA	Uplink Normal	432	54

Querying the Userfile's Digital Modulation Data

Use the following SCPI command line to query a digital modulation userfile:

`MMEM:DATA?"filename"`

Sample Command Line

A sample command line:

`MMEM:DATA?"filename"`

`"filename"` the file name

Example 1

In the following example, the data bytes are returned in ASCII.

`MMEM:DATA?"NEWDATAFILE"`

`"NEWDATAFILE"` the file name

The data will be returned in the same **`#ABC`** format used in the earlier sample: **`#1912SA4D789`** (in ASCII).

Example 2

In the following example, the data bytes are in ASCII.

`MMEM:DATA?"NEWDATAFILE1"`

`"NEWDATAFILE1"` the file name

The data be returned in the same **`#ABC`** format used in the earlier sample: **`#21012&A%4D789`** (in ASCII).

Reviewing the Memory Catalog

The memory catalog can be used to review the existing userfiles and any new files that have been transferred to the source's mass memory. To review the memory catalog:

1. Switch the source's line power on.
2. Press **Utility** (located in the MENUS section of the instrument's front panel). If the instrument is in remote mode, first press the **Local** key to return the instrument to local control.
3. Press **Memory Catalog**.
4. Press **All** to review all the files in the system.

5. Press **Binary** to review all of the existing binary files.

Userfile Example Programs

The following userfile example programs are provided to help you understand how to apply basic SCPI concepts. Example Programs 1 through 4 were created in Rocky Mountain Basic (version 6.0). Example Program 5, which provides the same function as Example Program 4, is written in the C programming language.

Example Program 1, Send a File and Data to the Source's Userfile Directory

```
10 Sig_gen=719
20 LOCAL Sig_gen
30 CLEAR Sig_gen
40 CLEAR SCREEN
50 OUTPUT Sig_gen;"*RST"
60 OUTPUT Sig_gen;"MMEM:DATA ""NEWDATAFILE",#1912SA4D789"
70 END
```

Example Program 2, Query a File and Data in the Source's Userfile Directory

```
10 DIM A$[10000]
20 Sig_gen=719
30 LOCAL Sig_gen
40 CLEAR Sig_gen
50 CLEAR SCREEN
60 OUTPUT Sig_gen;"*RST"
70 OUTPUT Sig_gen;"MMEM:DATA?""NEWDATAFILE"""
80 ENTER Sig_gen;A$
90 PRINT A$
100 END
```

Example Program 3, Create a GSM Userfile

```
10 Sig_gen=719
20 LOCAL Sig_gen
30 CLEAR Sig_gen
```

```
40 CLEAR SCREEN
50 OUTPUT Sig_gen;”*RST”
60 OUTPUT Sig_gen;”RADIO:GSM ON”
70 OUTPUT Sig_gen;”RADIO:GSM:BURST:STATE ON”
80 OUTPUT Sig_gen;”RADIO:GSM:SLOT1:STATE ON”
90 OUTPUT Sig_gen;”RADIO:GSM:SLOT1 NORMAL”
100 OUTPUT Sig_gen;”RADIO:GSM:SLOT1:NORMAL:ENCR ““Newdata-
file”””
110 END
```

Example Program 4, Upload User Data Using Integer Arrays to the Source’s Userfile Directory

```
10 DATA 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
20 DATA 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27,
28, 29, 30, 31
30 INTEGER A(1:15), B(1:15)
40 READ A(*)
50 OUTPUT 719 USING “K, 15(B) “;”MMEM:DATA
““TESTDATA””,#215”,A(*)
60 OUTPUT 719;”MMEM:DATA?””TESTDATA”””
70 DIM A$[4]
80 ENTER &!( USING “K, 30(B)”;A$,B(*)
90 PRINT A$, B(*)
100 END
```

Example Program 5, Upload User Data Using Integer Arrays to the Source’s Userfile Directory (C Language Version)

```
#include <stdio.h>
#include <string.h>
/*
* The following routine must be substituted for one in the user’s
HPIB library.
*/
extern write_hpib(int address, int size, unsigned char* data);
```

```
/* HPIB Port Address */
#define HPIB_ADDRESS 719
/* SCPI string token for loading data into instrument */
#define FILE_LOAD_SCPI_TOKEN “MMEM:DATA \”%s\”,#%d%s”
/* File name to create int the instrument*/
#define FILE_NAME “Newdatafile”
/*
* The following is the binary data to load into the instrument. For
this example the data * is incremental, and in general would be more
random. This data can also be read from * a file by the programmer.
This data is similar to the Basic example (Example Program 4).
*/
unsigned char db[] = {
1,2,3,4,5,6,7,8,9,10,11,12,13,14
15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31
};
int
main(void)
{
int db_size= sizeof(db)/sizeof(unsigned char);
char token_string[128];
char db_size_string[64];
int db_size_string_length;
unsigned char data_buffer[512];

sprintf(db_size_string, “%d”, db_size);
db_size_string_length=strlen(db_size_string);
sprintf(token_string,
   FILE_LOAD_SCPI_TOKEN,
   FILE_NAME,
   db_size_string_length,
   db_size_string);
memcpy(data_buffer, token_string, strlen(token_string));
memcpy(data_buffer+strlen(token_string), db, db_size);
write_hpib(HPIB_ADDRESS,              strlen(token_string)+db_size,
data_buffer);
return 0;
}
```

8 Safety and Regulatory

This chapter provides product warranty information, regulatory declarations, and explanations of caution and warning statements marked on the instrument.

Safety Notes

The following safety notes are used throughout this manual. Familiarize yourself with each of the notes and its meaning before operating this instrument.

CAUTION Caution denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, would result in damage to or destruction of the product. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

WARNING **Warning denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.**

Instrument Markings

The following markings and caution and warning labels are used on the instrument. Be sure to observe all cautions and warnings.

WARNING **No user serviceable parts inside. Refer servicing to qualified personnel.**

The instruction manual symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the manual.

The CE mark is a registered trademark of the European Community (if accompanied by a year, it is the year when the design was proven).

The CSA mark is the Canadian Standards Association safety mark.

This symbol is used to mark the on position of the power line switch.

This symbol is used to mark the standby position of the power line switch.

This symbol indicates that the input power required is AC.

ISM 1-A

This is a symbol of an Industrial Scientific and Medical Group 1 Class A product. (CISPER 11, Clause 4)

General Safety Considerations

WARNING **No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers.**

CAUTION Always use the three-prong AC power cord supplied with this product. Failure to ensure adequate earth grounding by not using this cord may cause product damage.

Statement of Compliance

This product has been designed and tested in accordance with IEC Publication 1010, Safety Requirements for Electronic Measuring Apparatus, and has been supplied in a safe condition. The instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

Warranty

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by Hewlett-Packard. Buyer shall prepay shipping charges to Hewlett-Packard and Hewlett-Packard shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to Hewlett-Packard from another country.

Hewlett-Packard warrants that its software and firmware designated by Hewlett-Packard for use with an instrument will execute its programming instructions when properly installed on that instrument. Hewlett-Packard does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error-free.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HEWLETT-PACKARD SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HEWLETT-PACKARD SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

Assistance

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products. For any assistance, contact your nearest Hewlett-Packard sales and service office. Refer to the list of sales and service offices in Chapter 3.

Certification

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

Declaration of Conformity

DECLARATION OF CONFORMITY

according to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name:	*Hewlett-Packard Co.*
Manufacturer's Address:	*Microwave Instruments Division* *1400 Fountaingrove Parkway* *Santa Rosa, CA 95403-1799* *USA*

declares that the product

Product Name:	*Signal Generator*
Model Number:	*HP ESG-1000A, HP ESG-2000A,* *HP ESG-2000A, HP ESG-4000A,* *HP ESG-D1000A, HP ESG-D2000A,* *HP ESG-D3000A, HP ESG-D4000A,*
Product Options:	*This declaration covers all options of the above products.*

conforms to the following Product specifications:

Safety: IEC 1010-1:1990+A1 / EN 61010-1:1993
CAN/CSA-C22.2 No. 1010.1-92

EMC: CISPR 11:1990/EN 55011:1991 Group 1, Class A
IEC 801-2:1984/EN 50082-1:1992 4 kV CD, 8 kV AD
IEC 801-3:1984/EN 50082-1:1992 3 V/m, 27-500 MHz
IEC 801-4:1988/EN 50082-1:1992 0.5 kV Sig. Lines, 1 kV Power Lines

Supplementary Information:
The products herewith comply with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC and is marked accordingly.

Santa Rosa, California, USA 3 June 1996

Dixon Browder/Quality Manager

European Contact: Your local Hewlett-Packard Sales and Service Office or Hewlett-Packard GmbH, Department HQ-TRE, Herrenberger Strasse 130, D-71034 Böblingen, Germany (FAX +49-7031-14-3143)

Compliance with German Noise Requirements

This is to declare that this instrument is in conformance with the German Regulation on Noise Declaration for Machines (Laermangabe nach der Maschinenlaermrerordnung -3.GSGV Deutschland).

Acoustic Noise Emission/Geraeuschemission	
LpA < 70 dB	LpA < 70 dB
Operator position	am Arbeitsplatz
Normal position	normaler Betrieb
per ISO 7779	nach DIN 45635 t.19

9 Specifications

This chapter lists the specifications and supplemental characteristics for the HP ESG-D Series Signal Generators whose serial prefixes are listed on the title page.

HP ESG-D Series Signal Generators Specifications

Specifications describe the instrument's warranted performance and apply after a 45 minute warm-up. All specifications are valid over the signal generator's entire operating and environmental range while in phase noise mode 2, unless otherwise noted.

Supplemental characteristics (shown in italics and denoted typical or nominal) provide additional, non-warranted, information useful in applying the signal generator.

Frequency

Range:

HP ESG-D1000A: 250 kHz to 1000 MHz

HP ESG-D2000A: 250 kHz to 2000 MHz

HP ESG-D3000A: 250 kHz to 3000 MHz

HP ESG-D4000A: 250 kHz to 4000 MHz

Under-range: 100 kHz

Resolution: 0.01 Hz

Accuracy: Same as timebase

Switching Speed[1]**:**

Modulation On[2]**:** *< 45 ms, typical*

Modulation Off: *< 35 ms, typical*

1. To within 0.1 ppm of final frequency above 250 MHz or within 100 Hz below 250 MHz.
2. With digital modulation active, performance is typically 80 ms when crossing frequency bands at 500 kHz, 250, 500, or 700 MHz, 1, 2, 2.4, 3.2, or 3.7 GHz.

Phase Offset: *Phase is adjustable via HP-IB or from the front panel in nominal 0.1 degree increments.*

Frequency Bands:		
Band	**Frequency Range**	**N #**
1	250 kHz to ≤ 249.999 MHz	1
2	> 249.999 to ≤ 500 MHz	0.5
3	> 500 MHz to ≤ 1 GHz	1
4	> 1 to ≤ 2 GHz	2
5	> 2 to 4 GHz	4

Sweep Modes

Operating Modes: Frequency Step, Amplitude Step, and Arbitrary List

Dwell Time: 1 ms to 60 s

Number of Points: 2 to 401

Internal Reference Oscillator

Stability:		
	Standard (typical)	**High Stability (Option 1E5)**
Aging Rate	*< ±2 ppm/year*	< ±0.1 ppm/year or < ±0.0005 ppm/day after 45 days
Temperature (0 to 55°C)	*< ±1 ppm*	*< ±0.05 ppm, typical*
Line Voltage	*< ±0.1 ppm (+5%, –10%)*	*< ±0.002 ppm, typical (+5%, –10%)*

Timebase Reference Output:

Frequency: 10 MHz

Amplitude: > 0.35 V_{rms} into 50Ω load

External Reference Input:

Frequency: 1, 2, 5, 10 MHz ± *typically 10 ppm (typically 1 ppm, Opt. 1E5)*

Amplitude: > 0.15 V_{rms}

Input Impedance: 50Ω

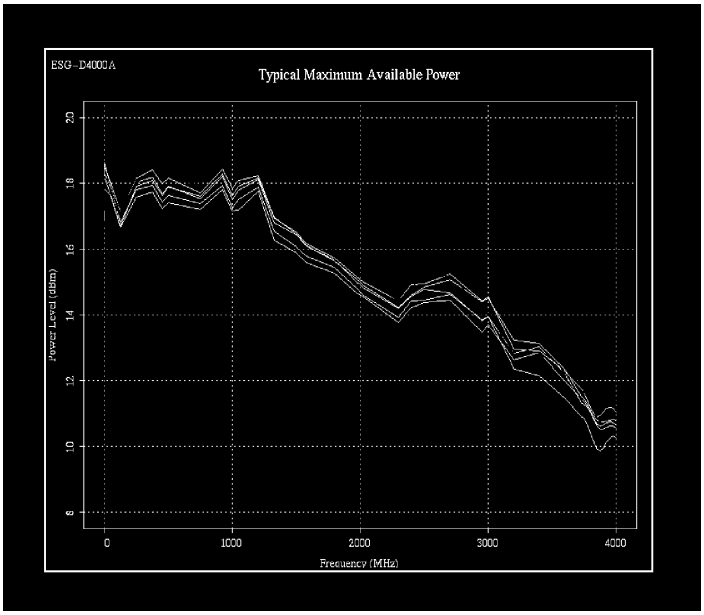
Output

Range:

250 kHz to 1000 MHz: +13 to –136 dBm

> 1000 MHz to 3000 MHz: +10 to –136 dBm

> 3000 MHz to 4000 MHz: +7 to –136 dBm



Resolution: 0.02 dB

Attenuator Hold Level Range:

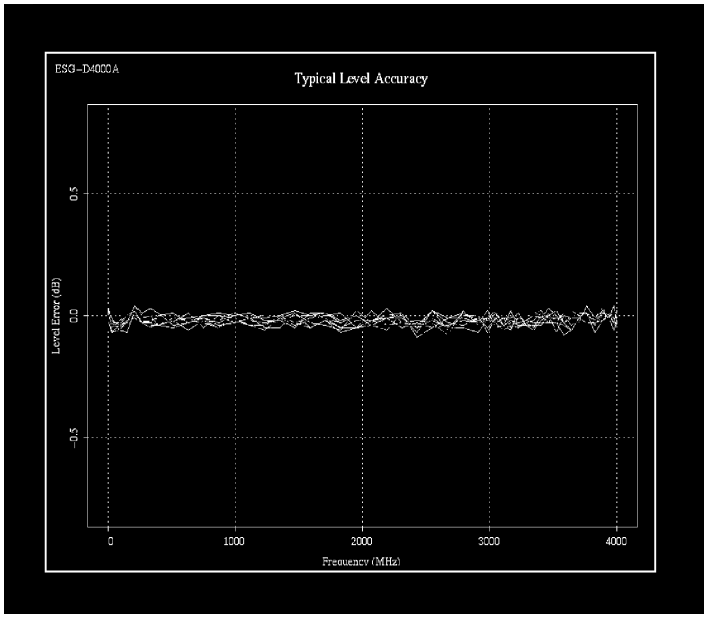
250 kHz to 1000 MHz: 23 dB

> 1000 MHz to 3000 MHz: 20 dB

> 3000 MHz to 4000 MHz: 17 dB

Level Accuracy[1]**:**		
	+7 to –127 dBm	**< –127 dBm**
250 kHz to 2 GHz:	±0.5 dB	±1.5 dB
> 2 to 4 GHz:	±0.9 dB	±2.5 dB

1. For 23° ±5°C. Accuracy degrades by 0.02 dB per degree C over the full temperature range and by 0.3 dB above +7 dBm.



Amplitude Switching Speed: *< 25 ms, typical*

When Using Power Search: *< 210 ms, typical*

Reverse Power Protection[1]**:**

250 kHz to 2000 MHz: 50 watts

> 2000 MHz to 4000 MHz: 25 watts

Maximum DC Voltage: 50 V

1. The reverse power protection circuitry triggers at nominally 1 watt.

SWR (typical)**:**

250 kHz to 2000 MHz: *< 1.4:1*

> 2000 to 4000 MHz: *< 1.9:1*

Output Impedance: 50Ω

Spectral Purity

SSB Phase Noise *(typical, at 20 kHz offset)***:**

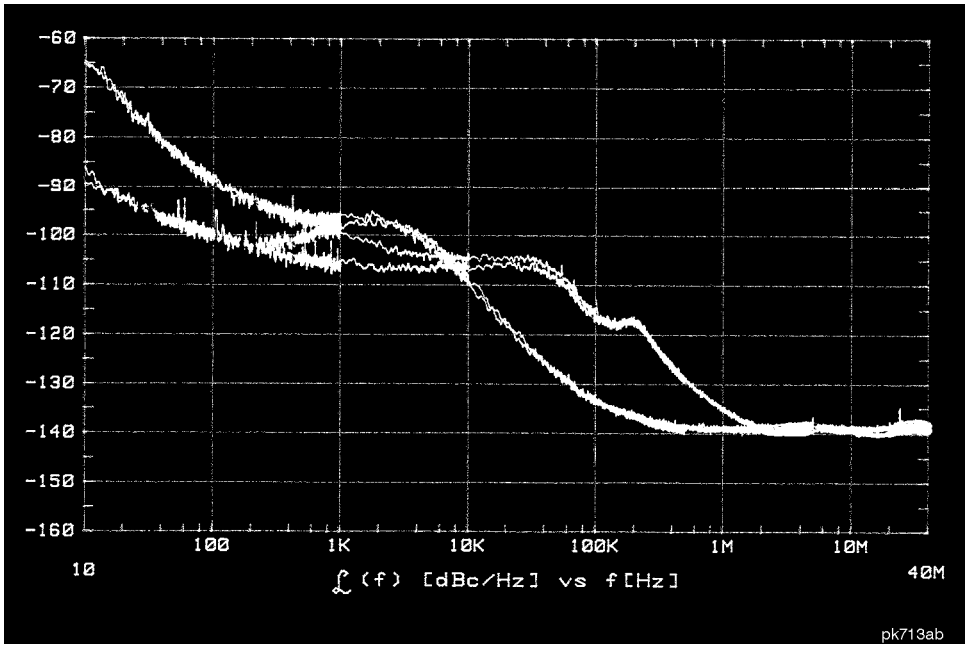
at 500 MHz: < *–120 dBc/Hz*

at 1000 MHz: < *–116 dBc/Hz*

at 2000 MHz: < *–110 dBc/Hz*

at 3000 MHz: < *–104 dBc/Hz*

at 4000 MHz: < *–104 dBc/Hz*



Typical Phase Noise Modes 1 and 2 Single Sideband Phase Noise at 1 GHz

Residual FM (CW mode, 0.3 to 3 kHz BW, CCITT, rms)**:**

Phase Noise Mode 1: < N x 2 Hz

Phase Noise Mode 2: < N x 4 Hz

Harmonics (≤ +4 dBm output level)**:** < –30 dBc

Nonharmonics (< +7 dBm output level)[1]**:**		
At Offsets:	> 3 kHz	*> 10 kHz (typical)*
250 kHz to 1000 MHz:	< –65 dBc	*< –75 dBc*
> 1000 to 2000 MHz:	< –59 dBc	*< –69 dBc*
> 2000 MHz:	< –53 dBc	*< –33 dBc*

1. Performance is typical for spurs at frequencies above the maximum operating frequency of the instrument. Performance typically is –60 dBc between 225 and 249.999 MHz. Specifications apply for FM deviations < 100 kHz and are not valid for ΦM. Performance is typically limited to –45 dBc at the symbol rate of π/4DQPSK modulating signals.

Subharmonics:

≤ 1000 MHz: None

> 1000 MHz: < –40 dBc

Frequency Modulation

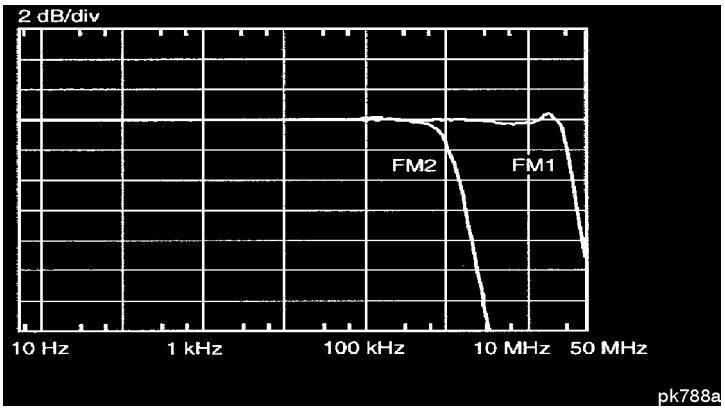
Maximum Deviation: N x 10 MHz

Resolution: 0.1% of deviation or 1 Hz, whichever is greater

Deviation Accuracy: < ±(3.5% of FM deviation setting + 20 Hz)
(1 kHz rate, deviation < N x 100 kHz)

Modulation Frequency Response[1]**:**		
Path	**Rates (deviation = 100 kHz)**	
	1 dB Bandwidth	**3 dB Bandwidth** *(typical)*
FM 1:	(dc/20 Hz to 100 kHz)	*dc/5 Hz to 10 MHz*
FM 2:	(dc/20 Hz to 100 kHz)	*dc/5 Hz to 1 MHz*

1. Since the internal modulation source operates over 0.1 Hz to 50 kHz, FM rates above 50 kHz must be supplied externally.



Typical FM 1 and FM 2 Frequency Response

Carrier Frequency Accuracy Relative to CW in DCFM[1]**:** ±0.1% of set deviation + (N x 1 Hz)

1. At the calibrated deviation and carrier frequency, within 5° C of ambient temperature at time of user calibration.

Distortion (1 kHz rate, THD, Deviations = N x 100 kHz)**:** < 1%

External Inputs: Ext 1 or Ext 2

Sensitivity: 1 Vpk for indicated deviation

Input Impedance: *50Ω , nominal*

Paths: FM 1 and FM 2 are summed internally for composite modulation. Either path may be switched to any one of the modulation sources: Int, Ext 1, Ext 2. The FM 2 path is limited to a maximum rate of 1 MHz. The FM 2 path must be set to a deviation less than FM 1.

Phase Modulation

Maximum Deviation: N x 90 radians

Resolution: 0.1% of set deviation

Deviation Accuracy (1 kHz rate)**:** < ±(5% of deviation + 0.01 radians)

Modulation Frequency Response:			
Phase Modulation Mode	**Maximum Deviation**	**Rates (3 dB BW)**	
		ΦM1	**ΦM2**
Normal	N x 90 radians:	dc - 100 kHz	dc - 100 kHz
High Bandwidth	N x 2π radians:	*dc - 1.5 MHz, typical*	*dc - 0.9 MHz, typical*
	N x π/2 radians:	*dc - 4 MHz, typical*	*dc - 1 MHz, typical*

Distortion (1 kHz rate, THD, deviations < N x 90 radians)**:** < 1%

External Inputs: Ext 1 or Ext 2

Sensitivity: 1 Vpk for indicated deviation

Input Impedance: *50Ω , nominal*

Paths: ΦM 1 and ΦM 2 are summed internally for composite modulation. Either path may be switched to any one of the modulation sources: Int, Ext 1, Ext2. The ΦM 2 path is limited to a maximum rate of 1 MHz. The ΦM 2 path must be set to a deviation less than ΦM 1.

Amplitude Modulation at fc > 500 kHz

AM is typical above 3 GHz or if wideband AM or I/Q modulation is simultaneously enabled.

Range (envelope peak ≤ maximum specified power)**:** 0 to 100%

Rates (3 dB bandwidth)**:** dc/10 Hz to 10 kHz

Resolution: 0.1%

Accuracy (1 kHz rate)**:** < ±(5% of setting + 1%)

Distortion (1 kHz rate, THD)**:**

30% AM: < 1.5%

90% AM: < 4%

External Inputs: Ext 1 or Ext 2

Sensitivity: 1 Vpk for indicated depth

Input Impedance: *50Ω , nominal*

Paths: AM 1 and AM 2 are summed internally for composite modulation. Either path may be switched to any one of the modulation sources: Int, Ext 1, Ext 2.

Wideband AM

Rate (1 dB bandwidth, *typical*)**:**

ALC On: *400 Hz to 10 MHz*

ALC Off: *dc to 10 MHz*

External Input: I input

Sensitivity: 0.5 V = 100%

Input Impedance: *50Ω , nominal*

Pulse Modulation

On/Off Ratio:

≤ 3 GHz: > 80 dB

< 3 GHz: > 60 dB

Rise/Fall Times: *150 ns, typical*

Minimum Width:

ALC On: *2 µs, typical*

ALC Off: *0.4 µs, typical*

Pulse Repetition Frequency:

ALC On: *10 Hz to 250 kHz, typical*

ALC Off: *dc to 1.0 MHz, typical*

Level Accuracy (relative to CW)[1]: *±0.5 dB, typical*

1. With ALC off, specifications apply after the execution of power search. With ALC on, specifications apply for repetition rates < 10 kHz and pulse widths ≥5 µs.

External Input: Ext 2

Input Voltage:

RF On: *> +0.5 V, nominal*

RF Off: *< +0.5 V, nominal*

Input Impedance: *50Ω, nominal*

Internal Pulse Generator:

Squarewave Rate: 0.1 Hz to 50 kHz

Period: 16 µs to 30s

Width: 8 µs to 30s

Resolution: 4 µs

Internal Modulation Source

Provides FM, ΦM, and AM modulation signals and LF Out.

Waveforms: Sine, Square, Ramp, Triangle, and Noise

Rate Range:

Sine: 0.1 Hz to 50 kHz

Square, Ramp, Triangle: 0.1 Hz to 10 kHz

Resolution: 0.1 Hz

Pulse Only: 4 µs

Frequency Accuracy: 0.005%

Swept Sine Mode (Frequency, Phase Continuous)**:**

Operating Modes: Triggered or Continuous Sweeps

Frequency Range: 0.1 Hz to 50 kHz

Sweep Time: 1 ms to 65s

Resolution: 1 ms

Dual Sinewave Mode:

Frequency Range: 0.1 Hz to 50 kHz

Amplitude Ratio: 0 to 100%

Resolution: 0.1%

LF Out (Internal Modulation Source)

Amplitude: 0 to 3 Vpk into 50Ω

Output Impedance: < 1Ω

External Modulation Inputs

Modulation Types:

Ext 1: FM, ΦM, AM, and Burst Envelope

Ext 2: FM, ΦM, AM, and Pulse

High/Low Indicator: (100 Hz to 10 MHz BW, AC-coupled inputs only) *Indicator is activated when input level error exceeds 3% (nominal)*

Simultaneous Modulation

All modulation types may be simultaneously enabled, except FM with ΦM, AM with burst envelope, and wideband AM with I/Q. AM, FM and ΦM can sum simultaneous inputs from any two sources (Int, EXT 1, and EXT 2.) Any given source (Int, EXT 1, or EXT 2) may only be routed to one activated modulation type.

Level Accuracy with Digital Modulation

(With ALC On; relative to CW; with PRBS modulated data; if using I/Q inputs, $\sqrt{I^2 + Q^2}$ = 0.5 V_{rms} nominal)[1]

1. The optimum I/Q input level is $\sqrt{I^2 + Q^2}$ = 0.5 V_{rms}. I/Q drive affects EVM, origin offset, spectral regrowth, and noise floor. Typically, level accuracy with ALC on will be maintained with drive levels between 0.25 and 1.0 V_{rms}.

π/4 DQPSK or QPSK Formats: ±0.15 dB
(Relative to CW; with raised cosine or root raised cosine filter and $\alpha \geq 0.35$; with 10 kHz < symbol rate < 1 MHz; at RF frequency > 25 MHz; power < maximum specified – 3 dB)

Constant Amplitude Formats (FSK, GMSK, etc)**:** No degradation in power level accuracy

Level Accuracy with ALC Off[1]**:** *±0.5 dB, typical*
(After power search is executed; relative to CW level with ALC on; if external I/Q is enabled: $\sqrt{I^2 + Q^2}$ = 0.5 V_{rms})

1. When applying external I/Q signals with ALC off, output level will vary directly with I/Q input level. Power search is an internal calibration routine used to set output power when ALC is off. The routine disables all modulation inputs, adjusts output power while applying 0.5 V_{rms} to the I/Q modulator, then enables modulation.

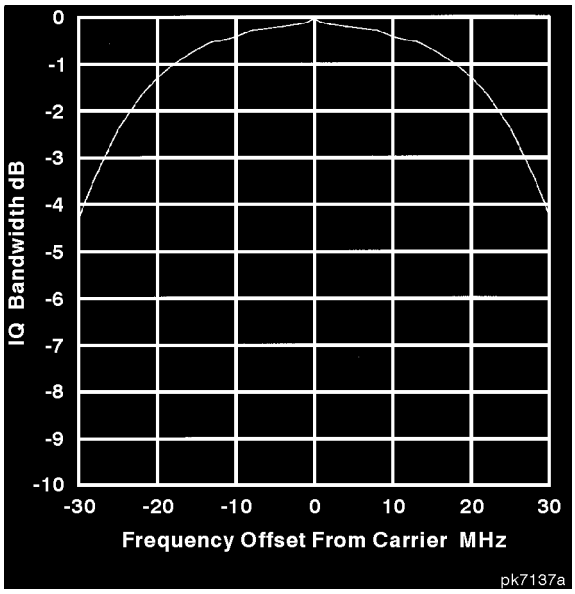
I/Q Modulation

I/Q Inputs:

Input Impedance: 50Ω

Full Scale Input[1]**:** $\sqrt{I^2 + Q^2} = 0.5\ V_{rms}$

1. The optimum I/Q input level is $\sqrt{I^2 + Q^2} = 0.5\ V_{rms}$. I/Q drive affects EVM, origin offset, spectral regrowth, and noise floor. Typically, level accuracy with ALC on will be maintained with drive levels between 0.25 and 1.0 V_{rms}.



Typical I/Q Frequency Response

Adjustments/Impairments *(nominal)***:**

DC Offset (I and Q independently adjustable)**:** *±100%*

I/Q Gain Ratio: *±4 dB*

DC Vector Accuracy[1]: (relative to full scale, power < +7 dBm)				
Frequency (GHz):	**< 0.6**	**0.6 to 2**	**2. to 3.7**	≤4
Static EVM (rms)[2]**:**	< 0.75%	< 0.5%	< 0.75%	< 1%
Magnitude Error (rms)[2]**:**	< 0.5%	< 0.35%	< 0.5%	< 0.75%
Phase Error (rms)[2]**:**	< 0.35°	< 0.25°	< 0.35°	< 0.5°
Origin Offset (dBc):	< –46	< –46	< –40	< –40

1. Valid for 10 days after executing internal calibration routine, when operated within ±5°C of calibration temperature.
2. Measured at full scale with origin offset removed.

External Burst Envelope

Input Voltage:

RF On: 0 V

RF Off: –1 V

Linear Control Range: 0 to –1 V

On/Off Ratio:

≤ 3 GHz: > 75 dB

> 3 GHz: > 60 dB

V_{IN}: ≤ –1.05 V

Rise/Fall Time: *< 2 µs with rectangular input, typical*

Minimum Burst Repetition Frequency:

ALC On: *10 Hz, typical*

ALC Off: DC

External Input: Ext 1

Input Impedance: *50Ω, nominal*

I/Q Baseband Generator (Options UN3 and UN4)

Data Structure:

Frames and timeslots may be configured as different types of traffic or control channels. The data field of a timeslot can accept a user file, PRBS (PN9 or PN15), or external data with the appropriate clock.

Internal Data:

Pseudorandom Patterns (meets ITU-T standard)**:**	Continuous PN9 (PRBS $2^9 - 1$) or PN15[1] (PRBS $2^{15} - 1$)
Repeating Sequence:	Any 4 bit sequence

1. PN15 is not continuous in bursted mode for TETRA applications.

Downloadable Data (User Files)**:**

Type: Serial Data

Minimum Size: Must fill entire field for which it was selected

Maximum Size: 1 Mbits (Option UN3), 8 Mbits (Option UN4)

External Data:

Type: Serial Data

Inputs: Data, Bit/Symbol Clocks; Accepts data rates ±5% of specified data rate

Reference Frequency:

Internal or External 1, 2, 5, 10 MHz reference

Data clock can be locked to the external 13 MHz (GSM)

Frame Trigger Delay Control:

Range: 0 to 65,000 bits

Resolution: 1 bit

Internal burst Shape Control:

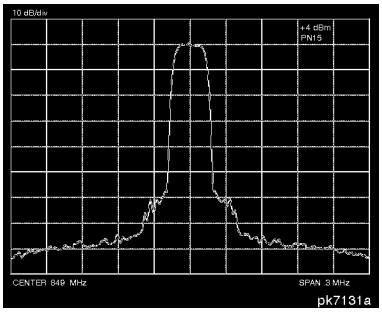
Rise/Fall Time Range: Up to 30 bits

Rise/Fall Delay Range: 0 to 63.5 bits (varies with standard)

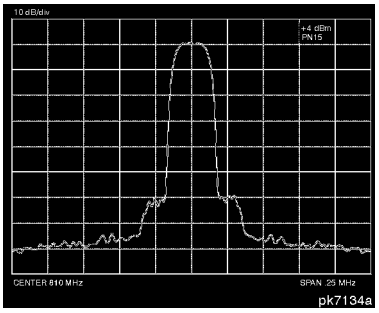
Specifications for Digital Communications Standards

	NADC		PDC		PHS		TETRA		DECT	GSM (DCS, PCS)	
Modulation Format	π/4 DQPSK								GFSK	GMSK	
Data Rate (default, kbits/sec)	48.6		42		384		36		1,152	270.83	
Adjustment Range (default, kbits/sec)	40 to 75.5		40 to 75.5		320 to 605		31 to 37.8		922 to 1209.6	163 to 300	
Filter	Root Raided Cosine or Raised Cosine								Gaussian		
Default Value	α = 0.35		α = 0.5		α = 0.5		α = 0.35		BbT = 0.5	BbT = 0.3	
Range (α or BbT)	Root Raided Cosine or Raised Cosine								Gaussian		
Error Vector Magnitude[1] (% rms)	Cont.	Burst	Cont.	Burst	Cont.	Burst	Cont.	Burst	NA	NA	
Low EVM Mode	1.4	1.9	1.9	1.8	1.5	1.5	1.5	1.9			
Low EVM Mode *(typical)*	*0.8*	*1.4*	*0.9*	*1.4*	*0.9*	*0.9*	*0.8*	*1.5*			
Low ACP Mode *(typical)*	*1.4*	*1.8*	*1.0*	*1.2*	*1.2*	*1.2*	*3.1*	*3.2*			
Global Phase Error[1] (rms/pk), *typical*	NA		NA		NA		NA		NA	0.8°/2.8° *0.8°/2.8°*	
Deviation Accuracy[1] (kHz)	NA		NA		NA		NA		6.1 *(2.5, typ)*	NA	
Channel Spacing (kHz)	30		25		300		25		1728	200	
Adj. Channel Power (ACP) (Low ACP Mode, dBc, typical)	Cont.	Burst	Cont.	Burst	Cont.	Burst	Cont.	Burst[2]	NA	Cont.	Burst
at Adjacent Channel[3]	*–35*	*–34*	--	--	--	--	*–68*	*–65*		*–38*	*–37*
at 1st Alternate Channel[3]	*–75*	*–73*	*–72*	*–70*	*–76*	*–75*	*–77*	*–76*		*–71*	*–70*
at 2nd Alternate Channel[3]	*–77*	*–77*	--	--	*–77*	*–76*	*–79*	*–78*		*–80*	*–79*
at 3rd Alternate Channel[3]	*–79*	*–78*	*–78*	*–78*	--	--	*–79*	*–79*		*–81*	*–82*
Supported Burst Types	Custom, Up/Down TCH		Custom, Up/Down TCH, Up Vox		Custom, TCH, Sync		Custom, Up Control 1&2, Up Normal, Down Normal, Down Sync		Custom Dummy B 1&2, Traffic B, Low Capacity	Custom, Normal, FCorr, Sync, Dummy, Access	
Scramble Capabilities					Yes		Yes				

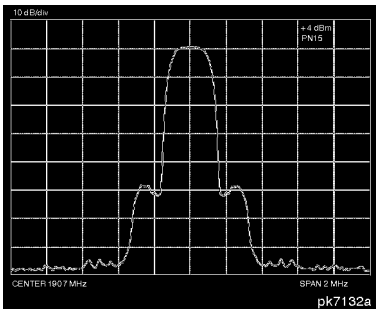
1. **Specifications apply for the frequency range, data rates, root raised cosine filter and filter factors (α or BbT) specified for each standard and at power levels ≤ +7 dBm (≤ +4 dBm for TETRA).**
2. **ACP for TETRA is measured over a 25 kHz bandwidth, with an 18 kHz root raised cosine filter applied.**
3. **The "channel spacing" determines the offset size of the adjacent and alternate channels: adjacent channel offset = 1 x channel spacing, 1st alternate channel = 2 x channel spacing, 2nd alternate channel = 3 x channel spacing, etc.**



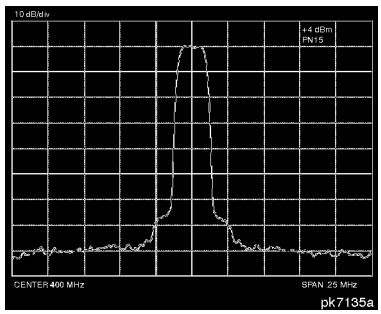
NADC Spectrum
Fc = 849 MHz
Span = 0.3 MHz
Scale = 10 dB/div
Level = +4 dBm



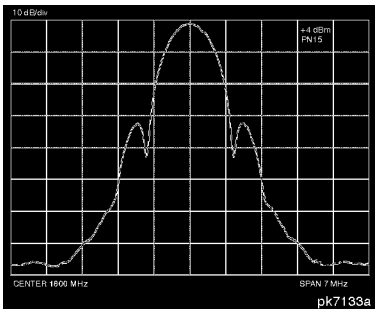
PDC Spectrum
Fc = 810 MHz
Span = 0.25 MHz
Scale = 10 dB/div
Level = +4 dBm



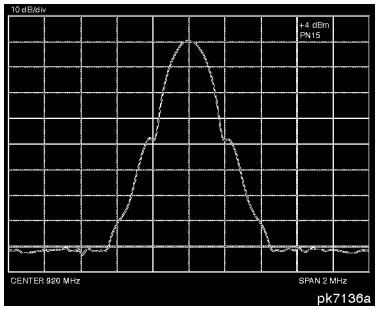
PHS Spectrum
Fc = 1907 MHz
Span = 2 MHz
Scale = 10 dB/div
Level = +4 dBm



TETRA Spectrum
Fc = 400 MHz
Span = 0.25 MHz
Scale = 10 dB/div
Level = +4 dBm



DECT Spectrum
Fc = 1800 MHz
Span = 7 MHz
Scale = 10 dB/div
Level = +4 dBm



GSM Spectrum
Fc = 920 MHz
Span = 2 MHz
Scale = 10 dB/div
Level = +4 dBm

Coherent Carrier Out

Coherent Carrier is modulated by FM or ΦM when enabled.

Range: 250 MHz to maximum carrier frequency

Level: *0 dBm ±5 dB, typical*

Impedance: 50Ω

Remote Programming

Interface: HP-IB (IEEE-488.2-1987) with Listen and Talk. RS-232

Control Languages: SCPI version 1992.0, also compatible with HP 8656B and 8657A/B/C/D/J[1] mnemonics.

1. HP ESG-D series does not implement HP 8657A/B 'Standby' or 'On' (R0 or R1, respectively) mnemonics.

Functions Controlled: All front panel functions except power switch and knobs.

IEEE-488 Functions: SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT0, C0, E2

ISO Compliant

The HP ESG-D Series RF signal generators are manufactured in an ISO 9001 registered facility in concurrence with Hewlett-Packard's commitment to quality.

General

Power Requirements: 90 to 132 V; 50, 60, or 400 Hz; 250 W maximum
198 to 254 V; 50 or 60 Hz; 250 W maximum

Operating Temperature Range: 0 to 55° C

Storage Temperature Range: –40 to +71 ° C

Shock and Vibration: Meets MIL STD 28800E Type III, Class 3

Leakage: Conducted and radiated interference meets MIL STD 461B RE02 Part 2 and CISPR 11. *Leakage is typically < 1 µV (nominally 0.1 µV with a 2-turn loop) at ≤ 1000 MHz, measured with a resonant dipole antenna one inch from any surface with output level < 0 dBm (all inputs/outputs properly terminated).*

Storage Registers: Up to 100 storage registers with sequence and register number displayed. Up to 10 sequences available.

Weight: < 12.7 kg (28 lb.) net, < 21 kg (46 lb.) shipping

Dimensions: 133 mm H x 426 mm W x 432 mm D
(5.25 in. H x 16.8 in. W x 17 in. D)

Accessories

Transit Case, HP Part Number 9211-1296

HP 83300A Remote Interface

Options

0B0	Delete Manual Set
0B1	Extra Manual Set
0BV	Add Component Level Information Package
0BW	Add Service Documentation (Assembly Level Repair)
0BX	Add Service Documentation and Component Level Information Package
1CM	Rack Flange Kit (without handles)
1CN	Front Handle Kit
1CP	Rack Flange Kit (with handles)
1E5	Add High Stability timebase
UN3	Add I/Q Baseband Generator with 1 Mbits of RAM (includes pre-mod filtering and PRBS)
UN4	Add I/Q Baseband Generator with 8 Mbits of RAM (includes pre-mod filtering and PRBS)
1EM	Move All Front Panel Connectors to Rear Panel
W30	Three Year Warranty

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