

**User's and Programming Guide**  
**HP ESG-D Series Options UND and UN5**  
**Signal Generators**  
**Dual Arbitrary Waveform Generator and**  
**Multi-Channel CDMA Personality**



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## 6. Programming Command Cross-Reference



# **1 The Dual Arbitrary Waveform Generator**

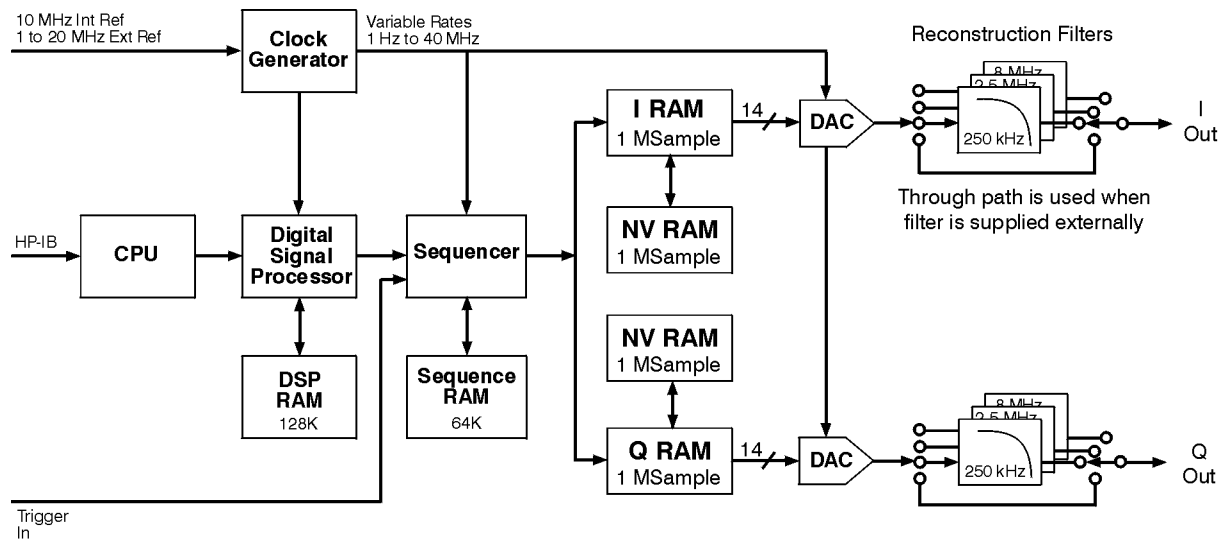
This guide describes features specific to the Dual Arbitrary Waveform Generator (Option UND) and the Multi-Channel, Multicarrier CDMA Personality (Option UN5). This includes an overview of the Dual Arbitrary Waveform Generator and the Multi-Channel, Multicarrier CDMA Personality, as well as information regarding the use of the waveform generator's hardkeys and softkeys, functions, theory of operation, a SCPI command reference, a SCPI command cross-reference, and programming examples.

## Overview

This section contains overviews of both the Dual Arbitrary Waveform Generator (Option UND) the Multi-Channel, Multicarrier CDMA Personality (Option UN5).

### The Dual Arbitrary Waveform Generator (Option UND)

Option UND allows you to drive the instrument's internal I/Q modulator to create vector-modulated signals. The Dual Arbitrary Waveform Generator uses 14-bit DACs for superior fidelity, as well as sample rates ranging from 1 Hz to 40 MHz and 1 Megasample memory per channel.



The Dual Arbitrary Waveform Generator has a digital signal processor capable of simulating optional digital communication formats, such as Multi-channel, Multicarrier CDMA (Option UN5). Alternately, external simulations (Omnisys, for example) can generate the I/Q waveforms and these, in turn, can be downloaded into the I RAM and Q RAM and sequenced for “playback.”

Different waveforms can be saved as separate segments and subsequently sequenced to create a chain of repeating waveform types. All of this can be done using simple table editors. The information can be stored to the signal generator's internal memory and recalled on demand.

Waveform triggering is included with Option UND. Trigger types include continuous, single, gated, and (while using waveform sequences) segment advance. The retrigger mode is adjustable, as well as the gate active trigger polarity for gated triggers. The trigger source can be set to the signal generator's front panel trigger hardkey, the HP-IB interface, or an external trigger signal supplied to the rear panel PATTERN TRIG IN connector. External triggers include adjustable polarity, delay, and delay time.

Waveform markers are included with Option UND. The signal generator has two markers that you can place on a waveform segment; markers provide auxiliary output signals that are synchronized with a waveform segment. You can construct these output signals as a trigger signal to synchronize another instrument to a given portion of a waveform.

Additive White Gaussian Noise is available with Option UND. AWGN can be used to create noise signals with adjustable bandwidth, waveform length and noise seed (fixed or random).

Multitone waveforms are available with Option UND. You can generate multitone waveforms with adjustable frequency spacing, frequency offset, phase, and tone on/off state.

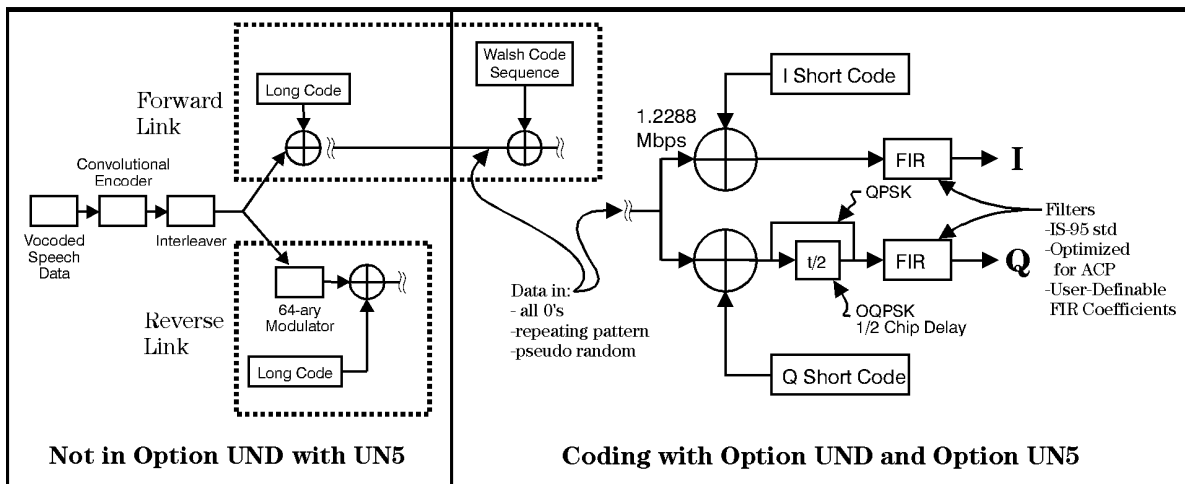
### Multi-Channel, Multicarrier CDMA Personality (Option UN5)

The Multi-Channel, Multicarrier CDMA Personality (Option UN5) provides multi-channel, multicarrier CDMA (IS-95 CDMA) for basestation amplifier characterization.

Multi-channel CDMA signal generation is simplified by the inclusion of 9-, 32-, and 64-channel pre-defined waveforms, offering precise signal statistics while optimizing measurement accuracy.

Multicarrier CDMA signal generation is simplified by the inclusion of 3- and 4-carrier pre-defined waveforms, offering precise signal statistics while optimizing measurement accuracy.

#### CDMA Physical Layer



pk78b

Mobile component test is simplified using pre-defined Pilot and Reverse channel signals, and the ability to generate multiple pilot channels (Walsh 0, different PN offset) at equal or differing power levels. You can also generate a single reverse channel for mobile amplifier testing.

Option UN5 also allows for custom, user-defined multi-channel and multicarrier CDMA signals. The multi-channel capabilities include the simulation of fully loaded cells by generating up to 256 Walsh-coded channels, as well as the ability to define power, PN offset, and data for each Walsh-coded channel. Multicarrier capabilities include the ability to generate multicarrier CDMA setups employing up to twelve carriers with individually defined carrier types, channel configurations, frequency offsets, and power levels. Option UN5 also includes the ability to download or enter user-defined FIR filter coefficients.

Waveform triggering is included with Option UN5. Trigger types include continuous, single, and gated. The retrigger mode is adjustable, as well as the gate active trigger polarity for gated triggers. The trigger source can be set to the signal generator's front panel trigger hardkey, the HP-IB interface, or an external trigger signal supplied to the rear panel PATTERN TRIG IN connector. External triggers include adjustable polarity, delay, and delay time.

## **2 Using Functions**

This chapter contains procedures that show you how to use some of the major functions of the dual arbitrary waveform generator (Option UND) and the multi-channel, multicarrier CDMA Personality (Option UN5).

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## Table Editor Basics

Option UND provides several table editors that enable you to:

- edit a CDMA channel setup (for details, see [page 2-4](#))
- edit a multicarrier CDMA setup (for details, see [page 2-14](#))
- create a user-defined FIR filter (for details, see [page 2-27](#))
- create multitone waveforms (for details, see [page 2-39](#))
- build and edit waveform sequences (for details, see [page 2-43](#))
- edit waveform segments (for details, see [page 2-44](#))

While each of these table editors performs a different function, they are all used in basically the same way, and most of the table editors have several editing softkeys in common.

### Common Edit Functions

<b>Edit Item</b>	Enables you to use the front-panel knob and arrow keys to edit the value of a selected entry. After highlighting the value you want to edit, press this softkey.
<b>Insert Row</b>	Inserts a row for data above the currently selected row.
<b>Delete Row</b>	Deletes the currently selected row of data.
<b>Goto Row</b>	Displays a new page of softkeys so that you can quickly move to the first, middle, or last row of data. This is especially helpful in a large table, or when using the filter table editor mirror function.
<b>Restore Default Filter</b>	Enables you to reset factory default values for a filter.
<b>Load/Store or Load Store</b>	Displays a new page of softkeys that enables you to load data from a stored file, save data to a file, or delete a stored file.
<b>Delete All Rows</b>	Clears all data from a table.

---

**CAUTION** There is no “undo” command. Once you delete data from a table, you cannot retrieve it.

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## Creating Custom CDMA States

Using this procedure, you will create a custom, forward 33 channel CDMA signal at IS-97 power levels with a traffic channel carrying user-defined data at a Walsh code of 45.

The signal generator provides a quick and easy solution to creating custom CDMA states. Rather than building the entire 33 channel set up from scratch, you will start with a forward 32 channel CDMA template and modify the template by adding one channel and changing some of the template's default values. (Options UND and UN5 are both required.)

### Setting up a CDMA Template

The first step in creating a customized CDMA state is setting up a template that can be modified to fill your requirements. Follow these steps to set up a forward 32 channel CDMA template:

1. Preset the signal generator to normal preset conditions.
2. Press the front panel **Mode** key.
3. If you have multiple options and the **Arb Waveform Generator** softkey is visible, press it next.
4. Press **CDMA, Setup Select**. The default CDMA template is set to **9 Ch Fwd**. Press **32 Ch Fwd**. This sets up a template containing 32 forward CDMA channels.

## Modifying a CDMA Template

Follow these steps to modify the standard forward 32 channel CDMA template that was loaded in the previous steps. You will be inserting a traffic channel, modifying the new channel's Walsh code to 45, changing the random data to user-defined data, and adjusting the overall code domain power to IS-97 levels.

1. Press **CDMA Define, Edit Channel Setup**. This opens the table editor used to modify a CDMA channel setup. The following illustration shows the 32 channel CDMA template in the CDMA Channel Setup table editor.

FREQUENCY		4.000 000 000 00 GHz		AMPLITUDE		-135.00 dBm		Edit Item
L				RF OFF		MOD ON		Insert Row▶
								Delete Row
CDMA Channel Setup				Total Power: 0.00dB				
	Type	Walsh	Power	PN Offset	Data			Adjust. Code Domain Power▶
1	Pilot	0	-7.00 dB	0	00000000			Display Code Domain Power▶
2	Paging	1	-12.95 dB	0	RANDOM			Goto Row▶
3	Traffic	8	-15.95 dB	0	RANDOM			
4	Traffic	9	-15.95 dB	0	RANDOM			
5	Traffic	10	-15.95 dB	0	RANDOM			
6	Traffic	11	-15.95 dB	0	RANDOM			
7	Traffic	12	-15.95 dB	0	RANDOM			
8	Traffic	13	-15.95 dB	0	RANDOM			
9	Traffic	14	-15.95 dB	0	RANDOM			
10	Traffic	15	-15.95 dB	0	RANDOM			More (1 of 2)

2. As shown in the previous illustration, row 8 is a Traffic channel. Select row 8 by pressing the front-panel down arrow key until Traffic is highlighted. You are now ready to insert a new Traffic channel on table row 8.

### Adding a New Channel Type

1. Press **Insert Row**. You are now offered the choice between Pilot, Sync, Paging, and Traffic channels.
2. Press **Traffic**. You now have a new traffic channel inserted on table row 8, at Walsh code 38, at a power level of -15.95 dB with a 0 PN offset, transmitting random data. The channel that formally occupied table row 8 has moved (along with the cursor) to table row 9 (and the channel formerly occupying table row 9 has moved to table row 10, and so on, down to table row 33). The total number of channels is now 33. Your display will look like this:

FREQUENCY		4.000 000 000 00 GHz		AMPLITUDE		-135.00 dBm		Pilot
I				RF OFF		HOLD ON		Sync
CDMA Channel Setup						Total Power: 0.11dB		Paging
	Type	Walsh	Power	PN Offset	Data			
1	Pilot	0	-7.00 dB	0	00000000			
2	Paging	1	-12.95 dB	0	RANDOM			
3	Traffic	8	-15.95 dB	0	RANDOM			
4	Traffic	9	-15.95 dB	0	RANDOM			
5	Traffic	10	-15.95 dB	0	RANDOM			
6	Traffic	11	-15.95 dB	0	RANDOM			
7	Traffic	12	-15.95 dB	0	RANDOM			
8	Traffic	38	-15.95 dB	0	RANDOM			
9	Traffic	13	-15.95 dB	0	RANDOM			
10	Traffic	14	-15.95 dB	0	RANDOM			

3. Press the **Return** hardkey.

### Modifying the Walsh Code

1. Use the front-panel knob or the arrow keys to highlight the Walsh code value (38) on table row 8.
2. Press **Edit Item**. Walsh Code: 38 appears in the active entry area of the display.
3. Using the numeric keypad, press **45** and terminate the entry with the **Enter** softkey. The Walsh code for the channel on table row 8 has now been set to 45.

### Modifying the Data

1. Use the front-panel knob or arrow keys to highlight the Data value (RANDOM) on table row 8.
2. Press **Edit Item**. Data: RANDOM appears in the active entry area of the display.
3. Using the front-panel knob, the up- and down-arrow keys, or the numeric keypad enter **00001000** and press the **Enter** softkey to terminate the entry. The data value on table row 8 has now been changed from RANDOM to 00001000.

## Modifying the Code Domain Power

You will now adjust the overall code domain power of the custom CDMA state's channels to conform to IS-97 levels.

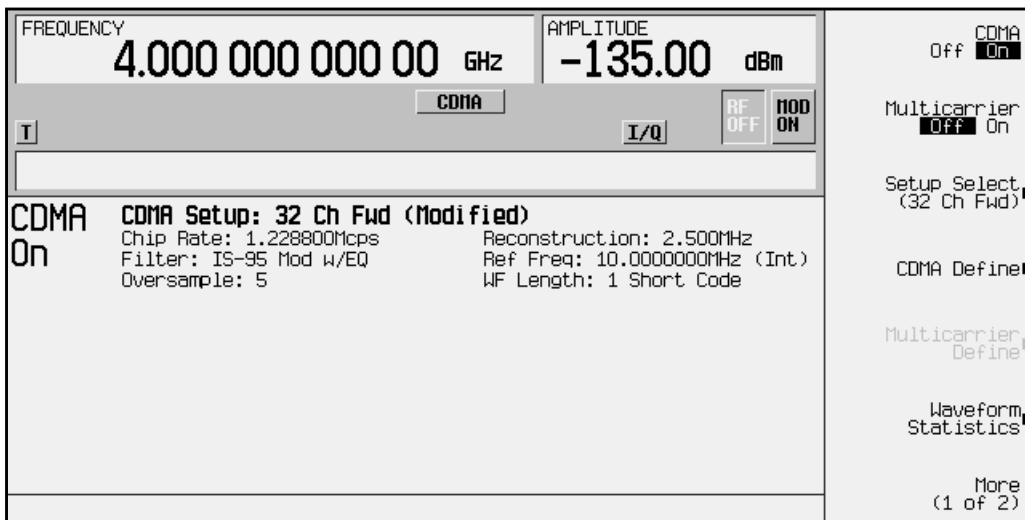
1. Press **Adjust Code Domain Power**.
2. Press **IS-97 Levels**. The signal generator's firmware calculates the power levels of all 33 channels and adjusts them to conform to IS-97 power levels, as shown in the illustration below.

FREQUENCY		4.000 000 000 00 GHz		AMPLITUDE		-135.00 dBm		Edit Item
RF OFF		NOO ON		Insert Row		Delete Row		
CDMA Channel Setup				Total Power: 0.00dB				
Type	Walsh	Power	PN Offset	Data	Adjust Code Domain Power			
1	Pilot	0	-7.00 dB	0	00000000	Display Code Domain Power		
2	Paging	1	-13.09 dB	0	RANDOM	Goto Row		
3	Traffic	8	-16.09 dB	0	RANDOM	More (1 of 2)		
4	Traffic	9	-16.09 dB	0	RANDOM			
5	Traffic	10	-16.09 dB	0	RANDOM			
6	Traffic	11	-16.09 dB	0	RANDOM			
7	Traffic	12	-16.09 dB	0	RANDOM			
8	Traffic	45	-16.09 dB	0	00001000			
9	Traffic	13	-16.09 dB	0	RANDOM			
10	Traffic	14	-16.09 dB	0	RANDOM			

## Applying the Custom Channel Setup and Activating the New Custom CDMA State

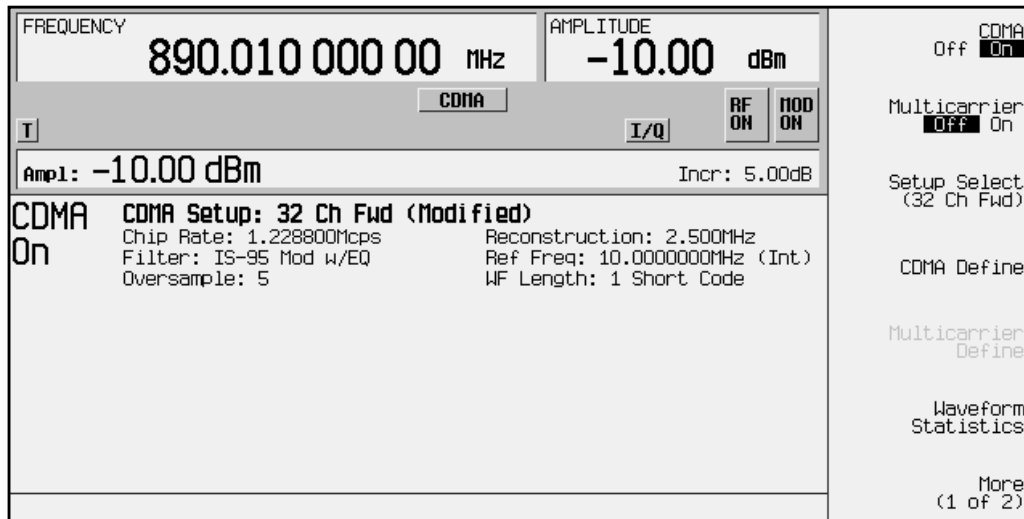
You now have a custom, forward 33 channel CDMA signal at IS-97 power levels, with a traffic channel carrying user-defined data at a Walsh code of 45 on table row 8. Follow the instructions below to apply the modified channel setup and activate the new CDMA state.

1. Press the **Return** hardkey once, to return to the previous menu.
2. Press **Apply Channel Setup**. This updates the waveform to the custom CDMA state you created and modified during the previous steps. Notice that the display shows that the CDMA setup has been changed from **CDMA Setup: 32 Ch Fwd** to the amended **CDMA Setup: 32 Ch Fwd (Modified)**. Press **Return**.
3. Press **CDMA Off On** until **On** is highlighted. After waveform generation, the new waveform is stored in volatile memory, and is ready for application to the RF output.



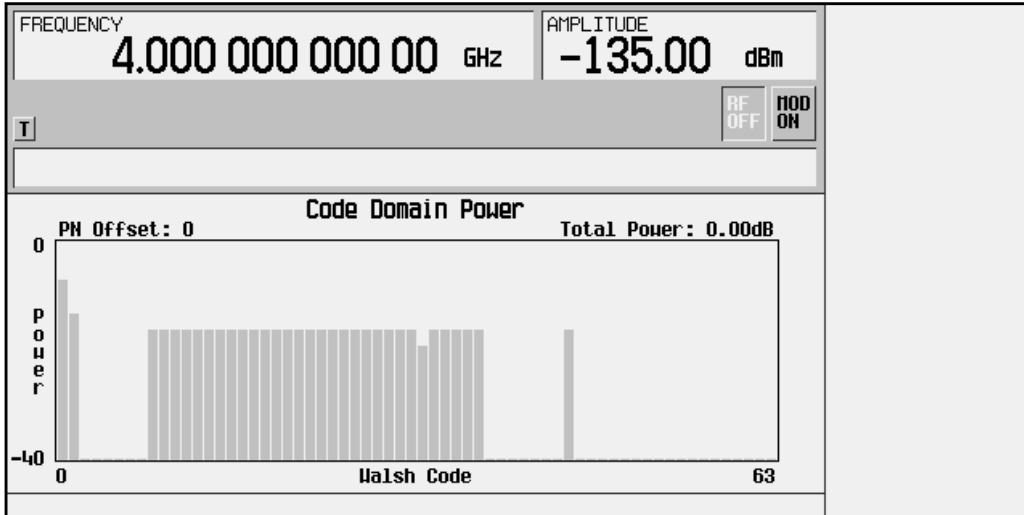
## Applying the Custom CDMA State to the RF Output

1. To set the signal generator's RF output frequency to 890.01 MHz, press **Frequency, 890.01, MHz**.
2. To set the signal generator's RF output power to  $-10.0$  dBm, press **Amplitude,  $-10.0$ , dBm**.
3. If **Mod On/Off** is set to **Off**, press **Mod On/Off** to **On**. The **MOD ON** annunciator appears on the signal generator's display.
4. To activate the RF output, press **RF On/Off** to **On**. The **RF ON** annunciator appears on the signal generator's display. See the following illustration.



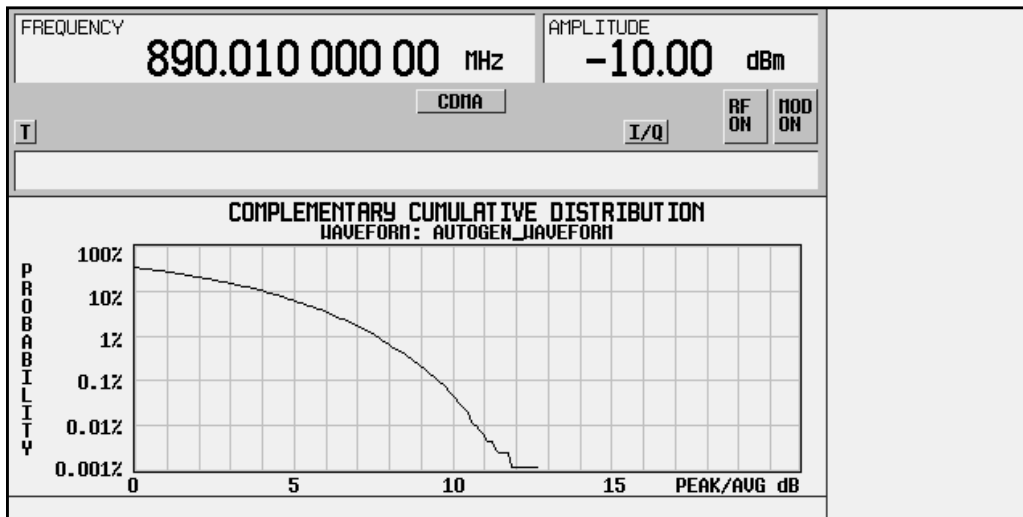
## Viewing Code Domain Power and Waveform Statistics

The signal generator can display a graphical representation of code domain power and Complementary Cumulative Distribution Function. To view this representation, press **Mode**, **ARB Waveform Generator** (if it appears), **CDMA**, **CDMA Define**, **Edit Channel Setup**, **Display Code Domain Power**. The following illustration depicts your customized CDMA waveform's code domain power.



Code domain power is displayed as a graph depicting power (in decibels) on the y-axis and Walsh Code on the x-axis. PN Offset is also displayed along with total code domain power. After viewing the code domain power, press **Return** 3 times to return to the top-level CDMA menu where **CDMA Off On** is the first softkey.

Complementary Cumulative Distribution Function is a representation of the probable occurrence of power peaks compared to average power. To view the Complementary Cumulative Distribution Function for your CDMA waveform, press **Waveform Statistics**, **Plot CCDF**. The following illustration depicts the Complementary Cumulative Distribution Function for your CDMA waveform.



## Storing a Custom CDMA State to Memory

Using this procedure, you will learn how to store a custom CDMA state to the signal generator's memory catalog. For this example, use the custom, forward 33 channel CDMA state you created in the previous procedure. If you have not created this custom CDMA state, refer to the previous section, "Creating Custom CDMA States." (Options UND and UN5 are both required.)

1. In the top-level CDMA menu, press **CDMA Define**.
2. Press **Store Custom CDMA State**. This softkey displays the signal generator's catalog of CDMA files.
3. Press **Store To File** to open a menu of letters and symbols that you can use to name the file.

FREQUENCY		890.010 000 00 MHz		AMPLITUDE		-10.00 dBm		Enter	
		CDMA		RF ON		MOD ON		Editing Keys	
I/Q								A B C D E F G	
Store to:								H I J K L M N	
Catalog of CDMA Files		106432 bytes used		169476 bytes free				O P Q R S T U	
		File Name		Type		Size		V W X Y Z _ \$	
								& # + - [ ] █	



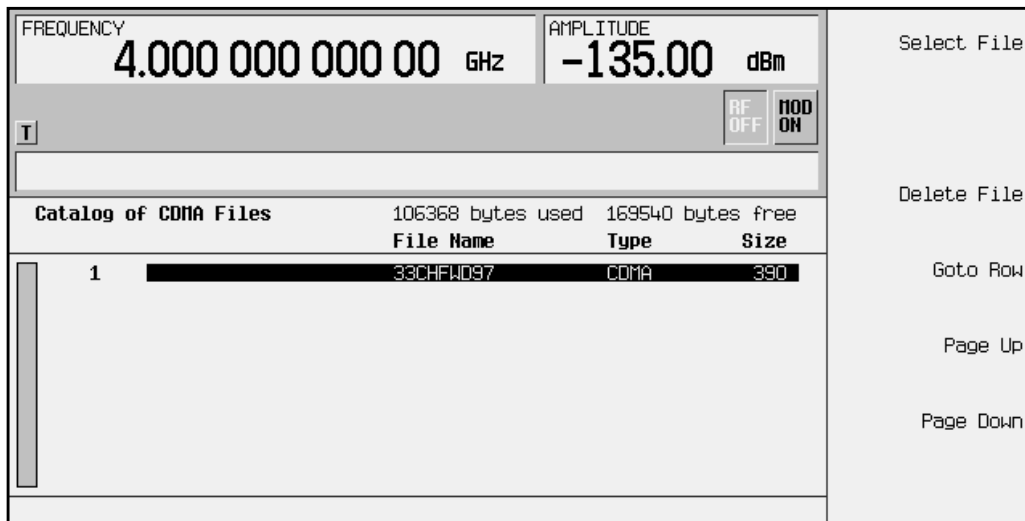
- Name this file 33CHFWD97 (33 channel forward at IS-97 levels). If there is already a file highlighted in the CDMA catalog, press Edit Keys, Clear Text. Press 3, 3, ABCDEFG, C, HIJKLM, H, ABCDEF, F, VWXYZ\_\$, W, ABCDEFG, D, 9, 7 and terminate the entry by pressing Enter. You now have a file called 33CHFWD97 stored in the signal generator's volatile ARB memory, as shown in the following illustration.

FREQUENCY		890.010 000 00 MHz		AMPLITUDE		-10.00 dBm		Store To File
		CDMA		RF ON		MOD ON		
I		I/Q						
Catalog of CDMA Files		106880 bytes used		169028 bytes free				Delete File
		File Name		Type		Size		Goto Row▶
1		33CHFWD97		CDMA		390		Page Up
								Page Down

## Recalling Custom CDMA States

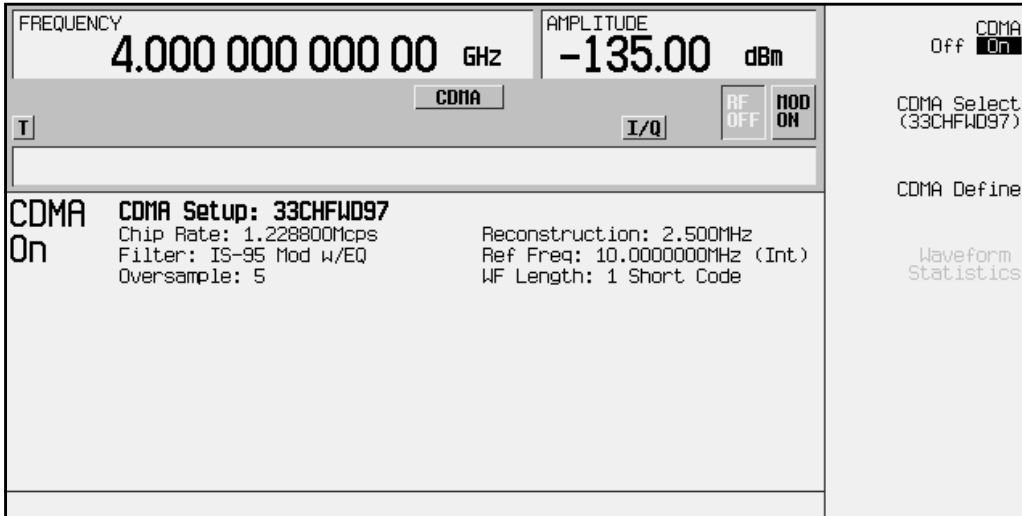
Using this procedure, you will recall a custom CDMA state from the signal generator's memory. For this example, use the custom, forward 33 channel CDMA state created in the procedure titled, "Creating Custom CDMA States" and stored using the procedure titled, "Storing Custom CDMA States." If you have not created and stored a custom CDMA state, refer to these previous sections. (Options UND and UN5 are both required.)

1. Preset the signal generator to normal preset conditions.
2. Press the front panel **Mode** key.
3. If you have multiple options and the **Arb Waveform Generator** softkey is visible, press it next.
4. Press **CDMA**, **CDMA Select**. The default CDMA template is set to **9 Ch Fwd**. Press **Custom CDMA State**. This opens a catalog of custom CDMA states, as shown in the following illustration.



5. Use the front-panel knob or the arrow keys to highlight the file **33CHFWD97**, then press **Select File**. The custom CDMA state **33CHFWD97** is selected.

- To activate the recalled custom CDMA state, press **CDMA Off On** to **On**. The firmware generates the custom CDMA waveform in ARB memory. After waveform generation, the custom CDMA state is available to be modulated on the RF output. See the following illustration.



- At signal generator preset, **Mod On/Off** is set to **On**. If you did not start this procedure by presetting the signal generator, press **Mod On/Off** to **On**.

---

**NOTE** The RF output amplitude and frequency settings are not saved as part of a custom CDMA state file. At signal generator preset (or line power cycle), the RF output frequency is reset to the signal generator’s highest specified value and the RF output amplitude is reset to –135 dBm. Before activating the RF output, make adjustments to the RF output frequency and amplitude as required.

---

- To activate the RF output, press **RF On/Off** to **On**.

---

## Creating Custom Multicarrier CDMA Waveforms

Using this procedure, you will create a custom 5-carrier CDMA waveform.

The signal generator provides a quick and easy solution to creating custom multicarrier CDMA waveforms. Rather than building the entire 5-carrier setup from scratch, you will start with a 3-carrier CDMA template and modify the template by adding two additional carriers and changing some of the template's default values. (Options UND and UN5 are both required.)

### Opening the Multicarrier CDMA Setup Table Editor

1. Preset the signal generator.

Press **Preset** to return the signal generator to normal preset conditions.

2. Activate the multicarrier CDMA mode.

Press the front panel **Mode** key. (If you have multiple options and the **Arb Waveform Generator** softkey is visible, press it next.) Press **CDMA**. Press **Multicarrier Off On** until **On** is highlighted.

3. Open the Multicarrier CDMA Setup table editor.

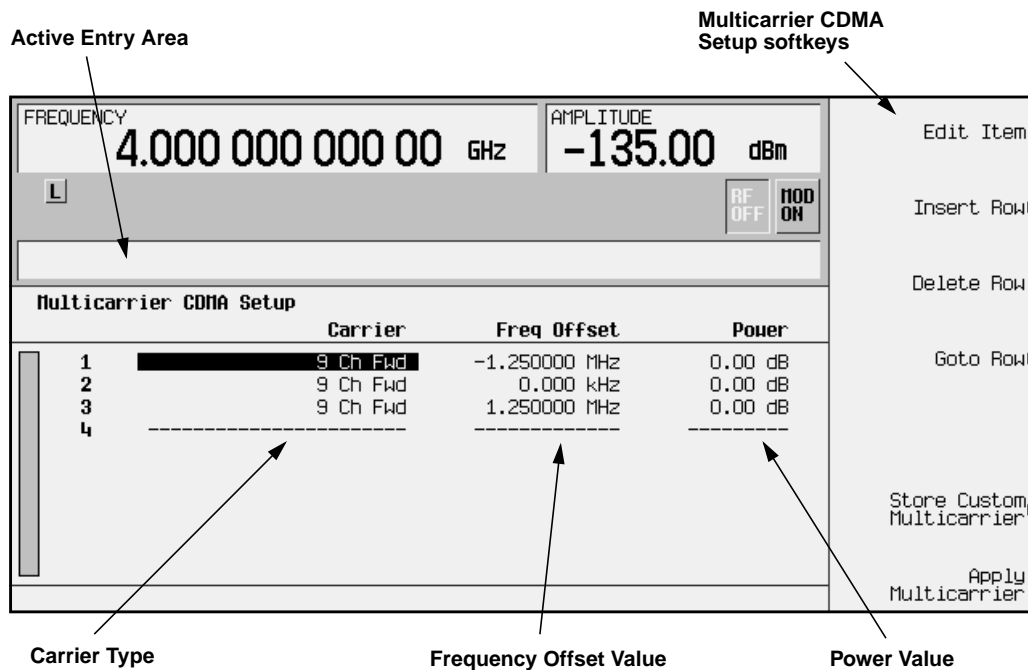
Press **Multicarrier Define**. This opens the Multicarrier CDMA Setup table editor. The 3-carrier CDMA template is automatically placed in the table editor when the table editor is opened.

**Understanding the Multicarrier CDMA Setup Table Editor**

You can use the Multicarrier CDMA Setup table editor to create multicarrier CDMA waveforms containing up to 12 carriers. Along with the arrow keys and the front-panel knob, the Multicarrier CDMA Setup softkeys are used to move throughout the table entries, edit the values, insert/delete table rows, and to apply and store the custom multicarrier CDMA setup.

The following values are definable for each individual carrier:

- Carrier Type - Pilot, 9 channel forward, 32 channel forward, 64 channel forward, reverse, or custom CDMA carriers
- Frequency Offset - adjustable from -7.5 to 7.5 MHz.
- Power Level - adjustable from -40.0 to 0.00 dB.

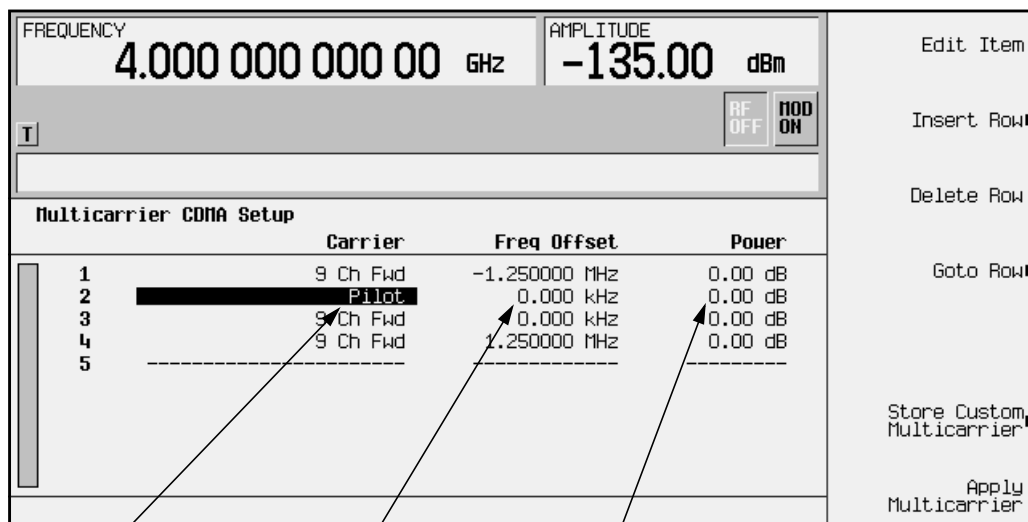


## Modifying a Multicarrier CDMA 3-Carrier Template

Use the following steps to modify the standard 3-carrier CDMA template that was loaded in the previous steps. You will be inserting one pilot carrier and another 32 channel forward carrier, and modifying the frequency offset and power values for both new carriers.

### 1. Add the first new carrier.

Using the front-panel knob or the arrow keys, move the cursor until the second 9 channel forward carrier (in table row 2) is highlighted. Press **Insert Row, Pilot**. This inserts a pilot carrier between the first two 9 channel forward carriers. Press **Return**. The new pilot carrier has a default frequency offset of 0.000 kHz and a default power level of 0.00 dB, as shown in the following figure.



New Pilot Carrier    Frequency Offset 0.000 MHz    Power 0.000 dB

2. Modify the frequency offset value.

Highlight the new pilot carrier's frequency offset value and press **Edit Item**. Then, using the numeric keypad, enter **-625** and press the **kHz** terminator. Note that after you enter the new frequency offset value, the cursor moves downward in the same column, ready to modify the next entry in the same category, as shown in the following figure.

Frequency Offset -625.000 kHz

FREQUENCY		4.000 000 000 00 GHz		AMPLITUDE		-135.00 dBm		RF OFF		MOD ON		Edit Item	
												Insert Row▶	
												Delete Row	
												Goto Row▶	
<b>Multicarrier CDMA Setup</b>													
	<b>Carrier</b>	<b>Freq Offset</b>	<b>Power</b>										
1	9 Ch Fwd	-1.250000 MHz	0.00 dB										
2	Pilot	-625.000 kHz	0.00 dB										
3	9 Ch Fwd	0.000 kHz	0.00 dB										
4	9 Ch Fwd	1.250000 MHz	0.00 dB										
5	-----	-----	-----										
												Store Custom Multicarrier▶	
												Apply Multicarrier	

3. Modify the power level.

Highlight the pilot carrier's power value and press **Edit Item**. Then enter **-10** and press the **dB** terminator. The following figure shows the modified power value.

Power -10.00 dB

FREQUENCY		AMPLITUDE	
4.000 000 000 00 GHz		-135.00 dBm	
RF OFF		MOD ON	
Multicarrier CDMA Setup			
	Carrier	Freq Offset	Power
1	9 Ch Fwd	-1.250000 MHz	0.00 dB
2	Pilot	-625.000 kHz	-10.00 dB
3	9 Ch Fwd	0.000 kHz	0.00 dB
4	9 Ch Fwd	1.250000 MHz	0.00 dB
5	-----	-----	-----



4. Add the second new carrier.

Move the cursor until the third 9 channel forward carrier (table row 4) is highlighted. Press **Insert Row**, **32 Ch Fwd**. This inserts a 32 channel forward carrier between the second and third 9 channel forward carriers. Press **Return**. The new 32 channel forward carrier has a default frequency offset of 1.250000 MHz and a default power level of 0.00 dB, as shown in the following figure.

The screenshot shows the 'Multicarrier CDMA Setup' screen. At the top, the frequency is set to 4.000 000 000 00 GHz and the amplitude is -135.00 dBm. The 'RF' is OFF and 'MOD' is ON. The main table lists the following carriers:

Carrier	Carrier	Freq Offset	Power
1	9 Ch Fwd	-1.250000 MHz	0.00 dB
2	Pilot	-625.000 kHz	-10.00 dB
3	9 Ch Fwd	0.000 kHz	0.00 dB
4	<b>32 Ch Fwd</b>	1.250000 MHz	0.00 dB
5	9 Ch Fwd	1.250000 MHz	0.00 dB
6	-----	-----	-----

Navigation options on the right include: Edit Item, Insert Row, Delete Row, Goto Row, Store Custom Multicarrier, and Apply Multicarrier.

Labels below the screen with arrows pointing to the highlighted row 4:

- New 32 Ch Fwd Carrier Type
- Frequency Offset 1.250000 MHz
- Power 0.000 dB

5. Modify the frequency offset.

Highlight the new 32 channel forward carrier's frequency offset value and press **Edit Item**. Then enter 625 and press the **kHz** terminator.

Frequency Offset 625.000 kHz

FREQUENCY		4.000 000 000 00 GHz		AMPLITUDE		-135.00 dBm		Edit Item
T				RF OFF		MOD ON		Insert Row
Multicarrier CDMA Setup								
	Carrier	Freq Offset	Power					
1	9 Ch Fwd	-1.250000 MHz	0.00 dB					
2	Pilot	-625.000 kHz	-10.00 dB					
3	9 Ch Fwd	0.000 kHz	0.00 dB					
4	32 Ch Fwd	625.000 kHz	0.00 dB					
5	9 Ch Fwd	1.250000 MHz	0.00 dB					
6	-----	-----	-----					
Store Custom Multicarrier								
Apply Multicarrier								

6. Modify the power level.

Highlight the new 32 channel forward carrier's power value and press **Edit Item**. Then enter -5 and press the **dB** terminator.

Power -5.00 dB

FREQUENCY		4.000 000 000 00 GHz		AMPLITUDE		-135.00 dBm		Edit Item
T				RF OFF		MOD ON		Insert Row
Multicarrier CDMA Setup								
	Carrier	Freq Offset	Power					
1	9 Ch Fwd	-1.250000 MHz	0.00 dB					
2	Pilot	-625.000 kHz	-10.00 dB					
3	9 Ch Fwd	0.000 kHz	0.00 dB					
4	32 Ch Fwd	625.000 kHz	-5.00 dB					
5	9 Ch Fwd	1.250000 MHz	0.00 dB					
6	-----	-----	-----					
Store Custom Multicarrier								
Apply Multicarrier								

## Applying and Activating the Custom Multicarrier CDMA Setup

You now have a custom 5-carrier CDMA signal. Follow the instructions below to apply and activate the custom multicarrier CDMA setup.

### 1. Apply the new custom multicarrier CDMA setup.

Press **Apply Multicarrier**. (Note that it is not necessary to apply the new setup unless **CDMA Off On** is set to **On**. **Apply Multicarrier** is used to apply changes made to the multicarrier CDMA setup while CDMA is activated.) This updates the waveform to the custom multicarrier CDMA state you created and modified during the previous steps. Press **Return**. Notice that the display shows that the Multicarrier Setup has been changed from **Multicarrier Setup: 3 Carriers** to the amended **Multicarrier Setup: 3 Carriers (Modified)**.

### 2. Activate the new custom multicarrier CDMA setup.

Press **CDMA Off On** until **On** is highlighted. After waveform generation, the new multicarrier CDMA waveform is stored in volatile memory, and is ready for application to the RF output.



## Applying the Custom Multicarrier CDMA Waveform to the RF Output

In the previous steps, you generated a custom 5-carrier CDMA waveform and stored it in volatile memory. Follow the instructions below to apply the modified multicarrier CDMA setup to the signal generator's RF output.

1. Set the signal generator's RF output frequency to 890.01 MHz.

Press **Frequency**, using the numeric keypad enter 890.01, and press the **MHz** terminator softkey.

2. Set the signal generator's RF output power to  $-10.0$  dBm.

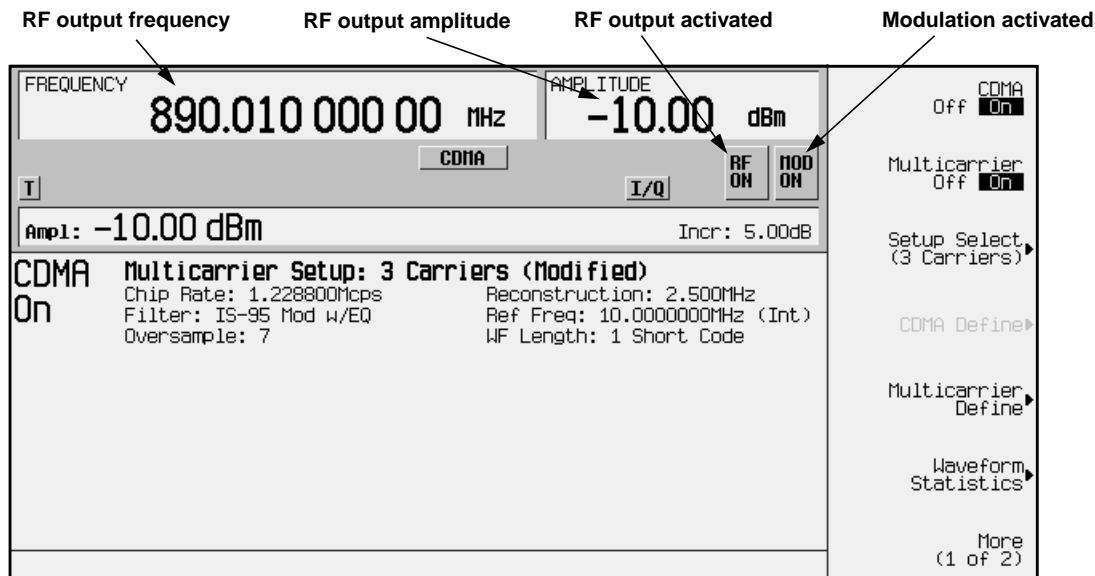
Press **Amplitude**, using the numeric keypad enter  $-10.0$ , and press the **dBm** terminator softkey.

3. Activate the modulation (if necessary).

If **Mod On/Off** is set to **Off**, press **Mod On/Off** to **On**. The **MOD ON** annunciator appears on the signal generator's display. (At normal signal generator preset, the **Mod On/Off** is set to **On**.)

4. Activate the RF output.

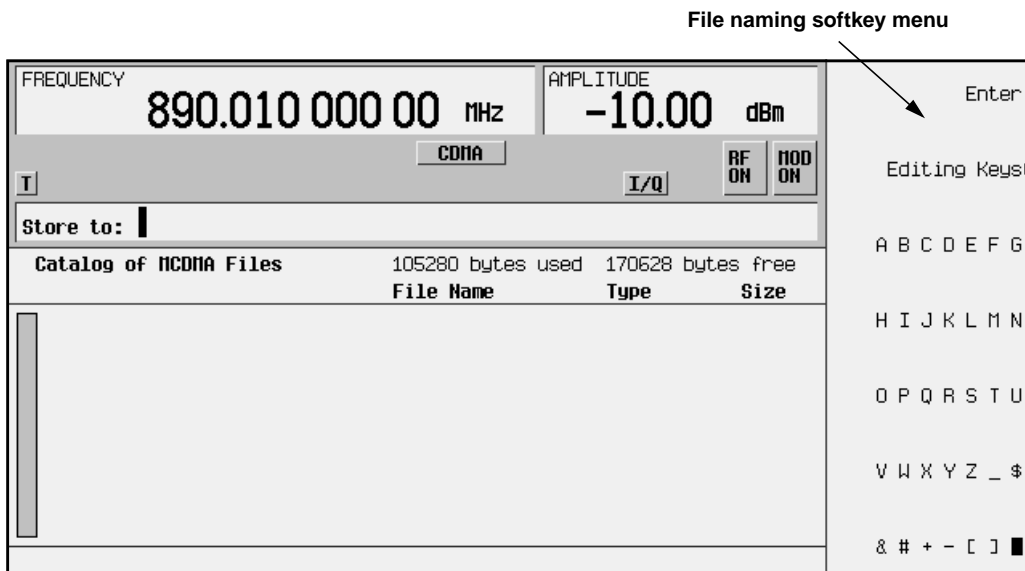
Press **RF On/Off** to **On**. The **RF ON** annunciator appears on the signal generator's display, as shown in the following figure.



## Storing a Custom Multicarrier CDMA Waveform

Using this procedure, you will learn how to store a custom multicarrier CDMA waveform to the signal generator’s memory. For this example, use the custom 5-carrier CDMA waveform you created in the previous procedure. If you have not created this custom multicarrier CDMA waveform, refer to the previous section, “[Creating Custom Multicarrier CDMA Waveforms](#)” on page 2-14. (Options UND and UN5 are both required.)

1. Prepare to store the custom multicarrier CDMA waveform you created in the previous section.  
 In the top-level CDMA menu (CDMA Off On is the top key), press **Multicarrier Define**.
2. Open the MCDMA memory catalog.  
 Press **Store Custom Multicarrier**. This softkey displays the signal generator’s catalog of MCDMA (multicarrier CDMA) files.
3. Open the file naming menu in the memory catalog.  
 Press **Store To File** to open a file naming softkey menu of letters and symbols that you can use to name the file.



## Storing a Custom Multicarrier CDMA Waveform

4. If there is already a file highlighted in the MCDMA catalog, press **Edit Keys**, **Clear Text**. Using the numeric keypad and the file naming (letter and symbol) softkeys, name this file **5CARRIER** and terminate the entry by pressing **Enter**. You now have a file called **5CARRIER** stored in the signal generator's MCDMA memory, as shown in the following illustration.

Custom Multicarrier CDMA file "5CARRIER"  
stored in MCDMA catalog

File Name	Type	Size
5CARRIER	MCDM	240

## Recalling Custom Multicarrier CDMA Waveforms

Using this procedure, you will recall a custom multicarrier CDMA state from the signal generator's MCDMA memory catalog. For this example, recall 5CARRIER, the custom 5-carrier CDMA waveform created in the procedure titled, "Creating Custom Multicarrier CDMA Waveforms" on page 2-14 and stored using the procedure titled, "Storing a Custom Multicarrier CDMA Waveform" on page 2-23. If you have not created and stored a custom multicarrier CDMA waveform, refer to these previous sections. (Options UND and UN5 are both required.)

1. Preset the signal generator.

Press **Preset** to return the signal generator to normal preset conditions.

2. Activate the multicarrier CDMA mode.

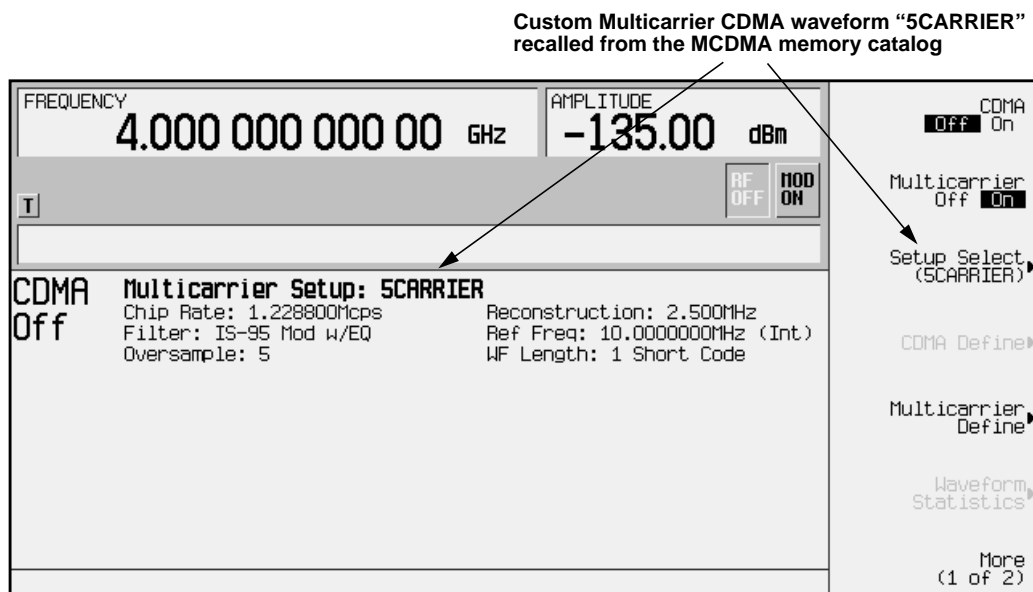
Press the front panel **Mode** key. If you have multiple options and the **Arb Waveform Generator** softkey is visible, press it next. Press **CDMA**. Press **Multicarrier Off On** until **On** is highlighted.

3. Open the multicarrier CDMA (MCDMA) memory catalog.

Press **Setup Select**. The default multicarrier CDMA template is set to **3 Carriers**. Press **Custom CDMA Carrier** to open the MCDMA memory catalog.

4. Choose a custom multicarrier CDMA waveform from the MCDMA memory catalog.

Use the front-panel knob or the arrow keys to highlight the file 5CARRIER, then press **Select File**. The custom multicarrier CDMA waveform 5CARRIER is selected, as shown in the following figure.



**Recalling Custom Multicarrier CDMA Waveforms****5. Activate the custom multicarrier CDMA waveform.**

To activate the recalled custom multicarrier CDMA waveform, press **CDMA Off On** to **On**. The firmware generates the custom multicarrier CDMA waveform in ARB memory. After waveform generation, the custom multicarrier CDMA state is available to be modulated on the RF output.

**6. Activate the modulation.**

At signal generator preset, **Mod On/Off** is set to **On**. If you did not start this procedure by presetting the signal generator, press **Mod On/Off** to **On**.

---

**NOTE** The RF output amplitude and frequency settings are not saved as part of a custom multicarrier CDMA state file. At signal generator preset (or line power cycle), the RF output frequency is reset to the signal generator's highest specified value and the RF output amplitude is reset to  $-135$  dBm. Before activating the RF output, make adjustments to the RF output frequency and amplitude as required.

---

**7. Activate the RF output.**

To activate the RF output, press **RF On/Off** to **On**.

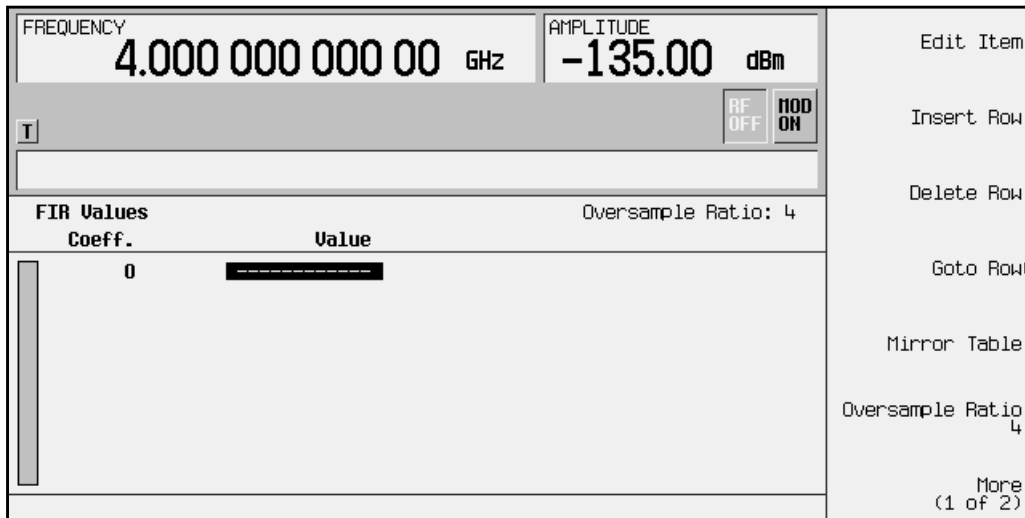


## Creating a User-Defined FIR Filter Using the FIR Table Editor

Using this procedure you will create and store an 8-symbol, windowed sinc function filter with an oversample ratio of 4. (Options UND and UN5 are both required.)

### Accessing the Table Editor

1. Preset the signal generator to normal preset conditions.
2. Press the front panel **Mode** key.
3. If you have multiple options and the **Arb Waveform Generator** softkey is visible, press it next.
4. Press **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**. The FIR table editor should now be displayed. The following illustration shows the FIR table editor.



## Entering the Coefficient Values

The FIR table editor creates a filter from values that you provide. In this example, the values you'll enter are listed after step 2.

1. Notice that the Value field for coefficient 0 is already highlighted. Use the numeric keypad to type the first value from the list. As you press the numeric keys, the numbers are displayed in the active entry area. (If you make a mistake, you can correct it using the backspace key.)

Terminate your entry by pressing the **Enter** softkey. Notice that the value for coefficient 0 is now displayed in the Value field and a second row is automatically displayed with the Value field highlighted. (The following illustration shows the FIR table editor at this point in the process.)

FREQUENCY		4.000 000 000 00 GHz		AMPLITUDE		-135.00 dBm		Edit Item	
								Insert Row	
								Delete Row	
FIR Values (UNSTORED)				Oversample Ratio: 4				Goto Row	
Coeff.		Value						Mirror Table	
0		-0.000076						Oversample Ratio 4	
1		-----						More (1 of 2)	

2. Continue entering the coefficient values until all 16 are complete.

Coefficient	Value
0	-0.000076
1	-0.001747
2	-0.005144
3	-0.004424
4	0.007745
5	0.029610
6	0.043940
7	0.025852

Coefficient	Value
8	-0.035667
9	-0.116753
10	-0.157348
11	-0.088484
12	0.123414
13	0.442748
14	0.767329
15	0.972149

## Duplicating the First 16 Coefficients Using Mirror Table

In a windowed sinc function filter, the second half of the coefficients are identical to the first half in reverse order. The signal generator provides a mirror table function that automatically duplicates the existing coefficient values in the reverse order.

1. Press the **Mirror Table** softkey. The last 16 coefficients are automatically generated and the first of these coefficients (number 16) is highlighted. The following illustration shows the display at this point in the process.

FREQUENCY		4.000 000 000 00 GHz		AMPLITUDE		-135.00 dBm		Edit Item	
T				RF OFF		MOD ON		Insert Row	
FIR Values (UNSTORED)				Oversample Ratio: 4				Delete Row	
Coeff.		Value						Goto Row▶	
10		-0.157348						Mirror Table	
11		-0.088484						Oversample Ratio 4	
12		0.123414						More (1 of 2)	
13		0.442748							
14		0.767329							
15		0.972149							
16		0.972149							
17		0.767329							
18		0.442748							
19		0.123414							

## Setting the Oversample Ratio

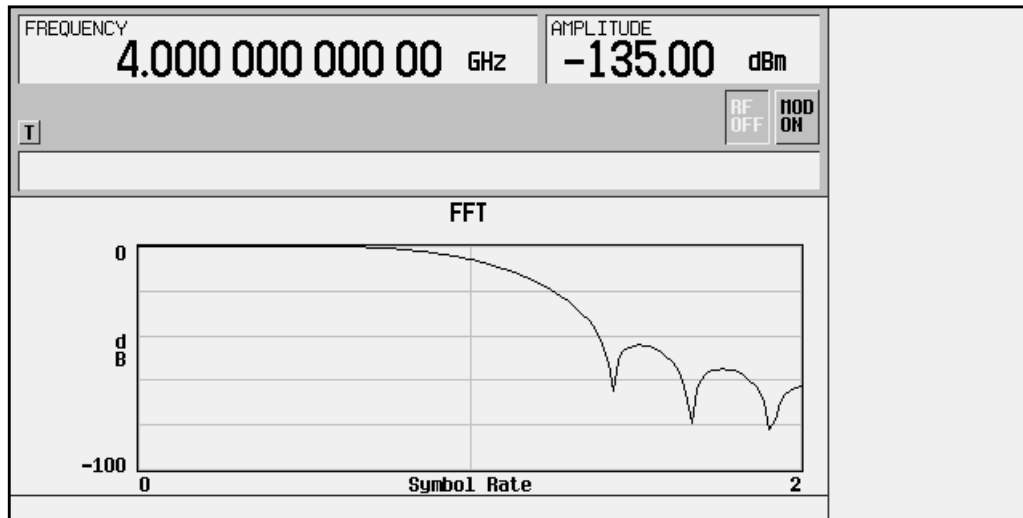
The oversample ratio (OSR) is the number of filter taps per symbol. Acceptable values range from 1 through 32, where the maximum combination of symbols and oversampling ratio is 1024. An FIR filter selected for use in CDMA, however, cannot have more than 256 coefficients so the number of symbols and the oversample ratio should be selected accordingly.

For this example, the desired OSR is 4, which is the default, so no action is necessary.

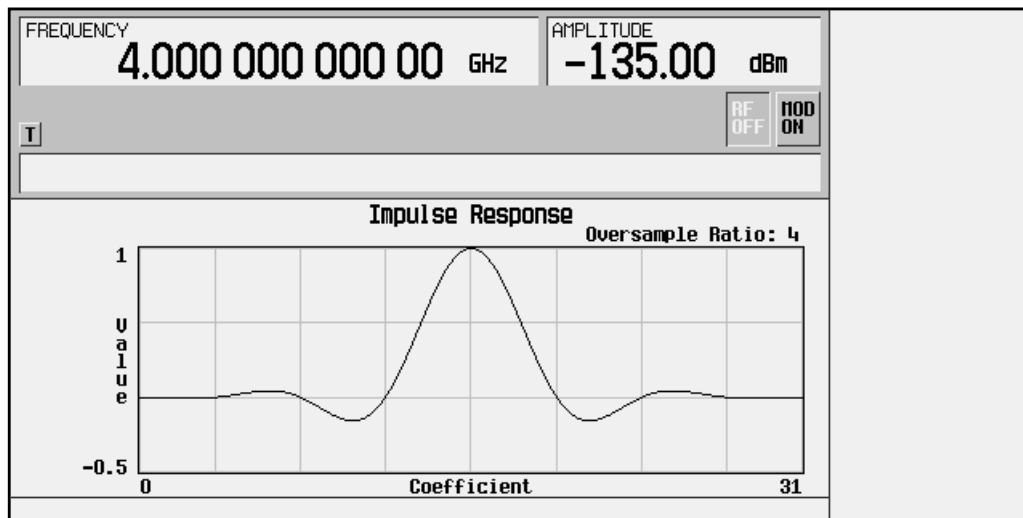
## Displaying a Graphical Representation of the Filter

The signal generator has the capability of graphically displaying the filter in both time and frequency dimensions.

1. To view the filter frequency response (calculated using a fast Fourier transform), press **More (1 of 2), Display FFT**. The following graph will be displayed:



2. To return to the menu keys, press **Return**.
3. Display the filter impulse response in time by pressing **Display Impulse Response**. The following graph will be displayed:

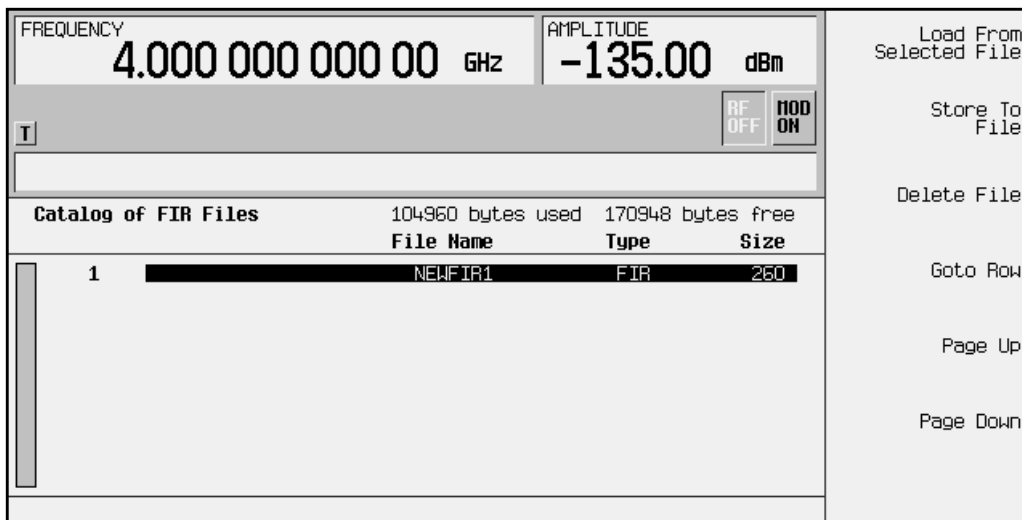


4. To return to the menu keys, press **Return**.

## Storing the Filter to Memory

The filter is now complete and can be stored to non-volatile memory for future use. At any time you can check the information at the top of the FIR table editor to determine whether the current table has been stored. Your current table should display the following text: FIR Values (UNSTORED). If you attempt to exit the table editor mode without first storing to a file, the signal generator will first prompt you to confirm that you want to exit without storing to a file. If you do *not* want to exit after all, press Return. To store the file, perform the following steps.

1. Press Load/Store, Store To File. The catalog of FIR files is displayed along with the amount of memory available.
2. For this example, you'll title the file NEWFIR1. The file name is created by pressing the softkey containing the desired character, then selecting the softkey with that character from the subsequent menu. For example, press the HIJKLMN softkey. Then press the bottom softkey, N. N is displayed in the active entry area following the Store to: text.
3. Continue entering the characters for the file name until NEWFIR1 is displayed in the active entry area. (Use the numeric keypad to enter the number 1.)
4. Press Enter when the file name is complete. The contents of the current FIR table editor are stored to a file in non-volatile memory. Observe the display:



The NEWFIR1 file is the first file name listed. (If you have previously stored other FIR files, additional file names will be listed below NEWFIR1.) The file type is FIR and the size of the file is 260 bytes. The amount of memory used is also displayed. The number of files that can be saved depends on the size of the files and the amount of memory used. Memory is also shared by signal generator state files and list sweep files.

This filter can now be used to customize a modulation or it can be used as a basis for a new filter design. (Refer to the additional filter examples in this chapter.)

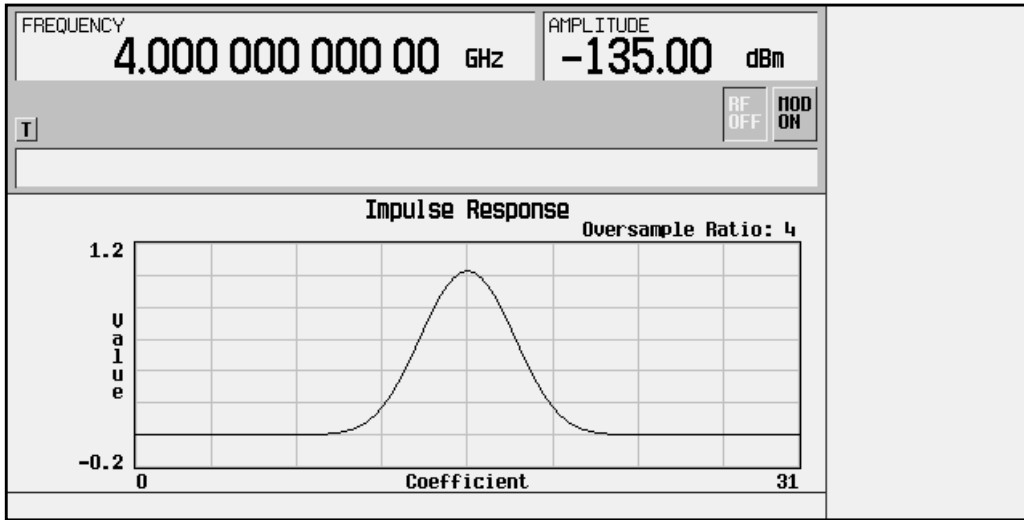
## Modifying an FIR Filter Using the FIR Table Editor

FIR filters stored in signal generator memory can easily be modified using the FIR table editor. You can load the FIR table editor with coefficient values from user-defined FIR files stored in the signal generator's memory, or from one of the default FIR filters. Then you can modify the values, and store the new files. In this example, you'll load the FIR table editor with the values for a default Gaussian filter and then modify it. (Options UN5 and UN5 are both required.)

### Loading a Default Gaussian FIR File

1. Preset the signal generator to normal preset conditions.
2. Press the front panel **Mode** key.
3. If you have multiple options and the **Arb Waveform Generator** softkey is visible, press it next.
4. Set the oversample ratio for the filter. (In this case, set it to 4). Press **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **Oversample Ratio**. If the oversample ratio is not already set to 4, press **4** and terminate the value with the **Enter** key.
5. To select a Gaussian filter, press **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **More (1 of 2)**, **Load Default FIR**, **Gaussian**.
6. Set the filter BbT to 0.300 (if **Filter BbT** is not already set to this value). Press **Filter BbT** and rotate the front-panel knob until 0.300 is displayed.
7. Set the number of filter symbols to 8 (if **Filter Symbols** is not already set to this value). Press **Filter Symbols** and rotate the front-panel knob until 8 is displayed.
8. Press **Generate**. The FIR table editor should now contain the coefficient values for the specified Gaussian filter.

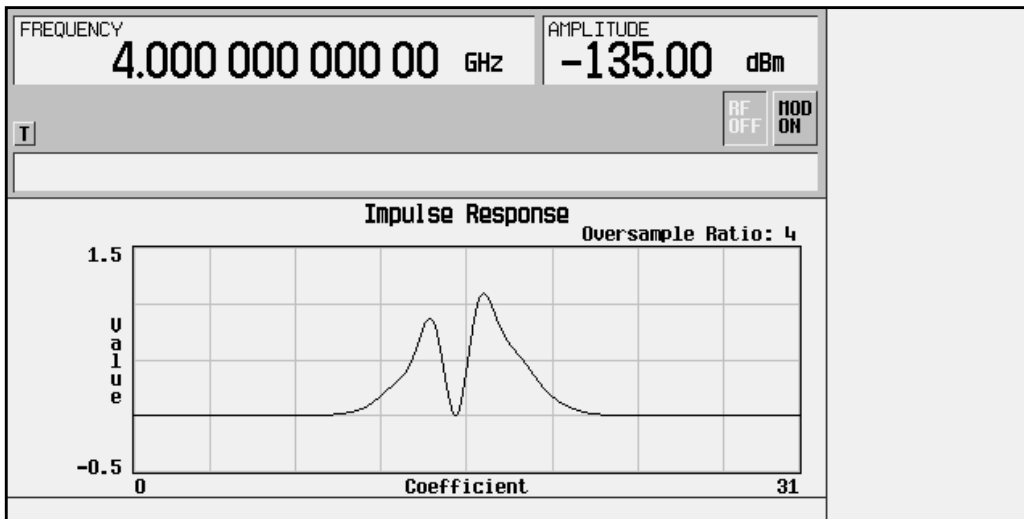
- Press **Display Impulse Response** for a graphic representation of the filter impulse response as shown here:



- To return to the menu keys, press **Return**.

### Modifying the Coefficients

- The value for coefficient 0 should be highlighted. Use the front-panel knob to scroll down until coefficient 15 is highlighted.
- Press **0**, **Enter** to change the value of the coefficient to 0.
- Press **Display Impulse Response** to see the effects of the change:



Notice that the graphic display can provide a useful troubleshooting tool (in this case indicating a missing coefficient value for a proper Gaussian response).

- To return to the menu keys, press **Return**.

**Modifying an FIR Filter Using the FIR Table Editor**

5. In addition to changing existing values, you can also insert and delete rows of coefficients and change the oversample ratio. Press **More (2 of 2)** to access these softkeys.
6. Change coefficient 15 back to its original value.
  - a. Use the front-panel knob to highlight row 15.
  - b. Press **1**, **Enter**.

**Storing the Filter to Memory**

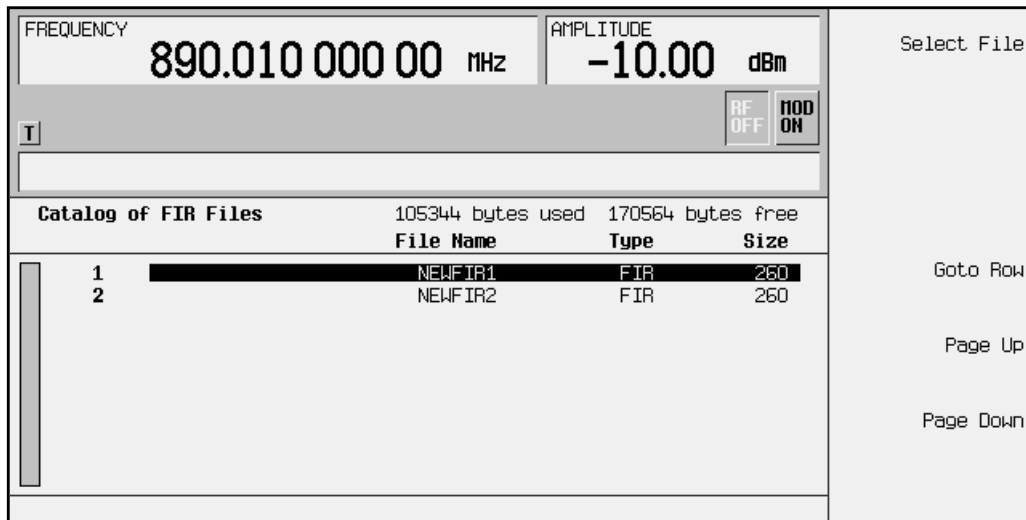
1. Press **More 1 of 2**, **Load/Store**, **Store To File**. The catalog of FIR files is displayed along with the amount of memory available.
2. Name the file NEWFIR2.
3. Press **Enter** when the file name is complete. The contents of the current FIR table editor are stored to a file in non-volatile memory, and the catalog of FIR files is updated to show the new file.



## Applying a User-Defined FIR Filter to a CDMA State

Custom FIR filters can be created using the FIR table editor feature or they can be created externally and downloaded into signal generator memory. Once the filter is stored in memory, it can be selected for use with CDMA modulation. This example requires that at least one FIR file be already stored in memory. For an example of creating and storing an FIR filter, see “Creating a User-Defined FIR Filter Using the FIR Table Editor” on page 2-27. (Options UND and UN5 are both required.)

1. Preset the signal generator to normal preset conditions.
2. Press the front panel **Mode** key.
3. If you have multiple options and the **Arb Waveform Generator** softkey is visible, press it next.
4. Press **CDMA**, **CDMA Define**, **Filter**, **Select**, **User FIR**. The catalog of FIR files should now be displayed. The following illustration shows an example of the catalog.



In this example there are two FIR files listed: NEWFIR1, and NEWFIR2. (These files were created in the previous examples.)

5. Scroll down in the list until the desired filter is highlighted. In this example, NEWFIR2 is the desired filter. You can use the front-panel knob or the arrow keys as well as the Goto Row function.

## Applying a User-Defined FIR Filter to a CDMA State

6. Press **Select File**. The highlighted filter is now selected for use in CDMA modulation. The following illustration shows our example displayed.

FREQUENCY		AMPLITUDE		Select (NEWFIR2@FIR) ▶	
890.010 000 00 MHz		-10.00 dBm			
L		RF OFF		MOD ON	
Freq: 890.010 000 00 MHz		Incr: 100.00000kHz		Define User FIR ▶	
CDMA Off	CDMA Setup: 9 Ch Fwd (Modified)			Filter Factor N/A	
	Chip Rate: 1.228800Mcps	Reconstruction: 2.500MHz		Optimize FIR For (N/A)	
	Filter: User FIR	Ref Freq: 10.000000MHz (Int)			
	Oversample: 5	WF Length: 1 Short Code			
				Restore Default Filter	

The filter you selected is NEWFIR2. You can see the name displayed in the Filter field near the left of the display. The **Select** softkey (at the top and right) displays **User FIR** to indicate that a user-defined FIR filter has been selected.

Once you have set the other CDMA parameters to your satisfaction, turn on both CDMA and the RF output and your user-defined filter is in use.

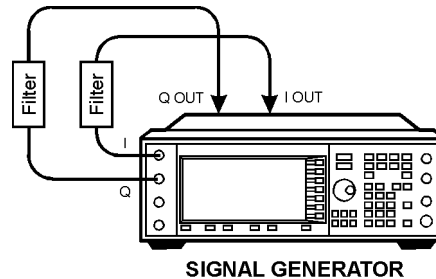
7. Notice that the oversample ratio has remained at the default value of 5. If you have designed your filter with a different oversample ratio, it will resample the filter to the specified oversample ratio unless you change the oversample ratio in the CDMA Define menu. In this example, the filter oversample ratio is 4, so make the following changes:

Press **Return**, **More (1 of 2)**, **Oversample Ratio**. Rotate the front-panel knob until the number 4 is displayed in the active entry area.

Notice that although you can design a filter with an oversample ratio of up to 32 taps per symbol, the oversample ratio range possible with CDMA modulation is 2 through 8.

## Using External Reconstruction Filters

You can use external reconstruction filters with the arbitrary waveform generator and the CDMA waveform generator by following the instructions listed in this section. Refer to the illustration below.



1. Using four 50-ohm BNC cables of identical length and filters with matching filter delay values, connect the filters between the rear-panel I-OUT and Q-OUT connectors and the front-panel I and Q input connectors.
2. Press **I/Q**, **I/Q Source**, **Ext I/Q**. This connects the input of the I/Q modulator to the front-panel I and Q input connectors.
3. For CDMA signals, press **Mode**, **ARB Waveform Generator** (if it appears), **CDMA**, **CDMA Define**, **Reconstruction Filter**, **Through**. This disables the internal reconstruction filters.

For arbitrary waveform generator signals, press **Mode**, **ARB Waveform Generator** (if it appears), **Dual ARB**, **ARB Setup**, **Reconstruction Filter**, **Through**.

---

**NOTE** This step is not necessary as long as you are using a reconstruction filter that has a smaller bandwidth than the active internal reconstruction filter. For example, if the internal reconstruction filter is set to 2.5 MHz and you would like to use a 1 MHz external filter, it is not necessary to set the internal reconstruction filter to **Through**.

---

## Using the Multitone Waveform Generator

The examples in this section provide information on how to create a multitone waveform (on [page 2-39](#)), and how to use a stored multitone waveform (on [page 2-42](#)).

### Table Editor Basics

While the following examples provide information specific to the multitone table editor (shown in the following figure), they do not go into detail on every possible way to edit information. The section “[Table Editor Basics](#)” on page 2-2 covers in detail many of the features common to most table editors.

Offset from center frequency, as defined in Initialize Table menu.

Multitone softkey menu

Active entry area

FREQUENCY		AMPLITUDE	
4.000 000 000 00 GHz		-135.00 dBm	
T		RF OFF MOD ON	
Multitone Setup: default			
Tone	Freq Offset	Phase	State
1	-35.000 kHz	0	On
2	-25.000 kHz	0	On
3	-15.000 kHz	0	On
4	-5.000 kHz	0	On
5	5.000 kHz	0	On
6	15.000 kHz	0	On
7	25.000 kHz	0	On
8	35.000 kHz	0	On

Multitone  
Off On

Initialize Table

Edit Phase

Toggle State

Apply Multitone

Goto Row

More (1 of 2)

Tone Number

Relative Phase

State column indicates whether a tone is turned on or off.

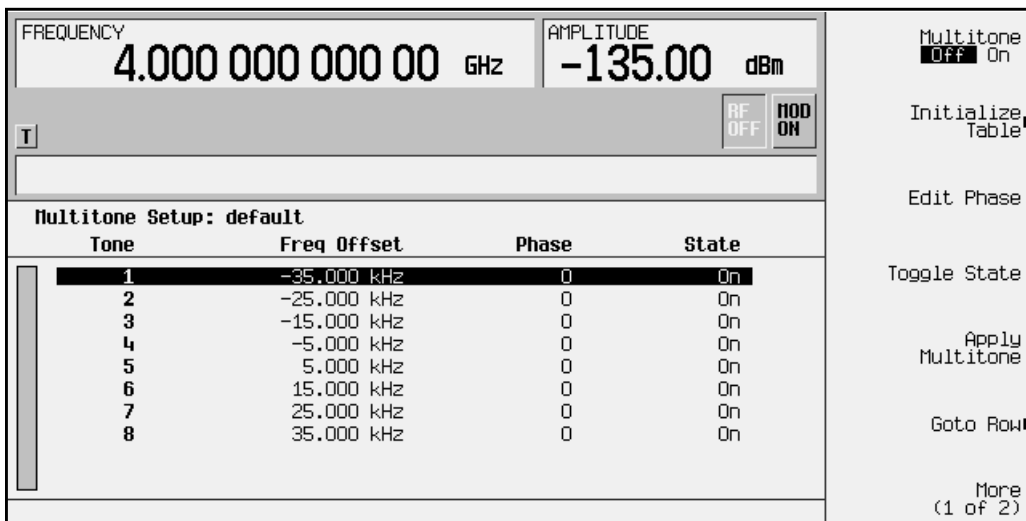
## Creating a Multitone Waveform

The following example walks you through creating and storing a simple 5-tone waveform. You can use this example to familiarize yourself with the various parameters that are available to customize this type of waveform.

### Initialize the Multitone Table Editor

The first step in creating a multitone waveform is to set the number of tones and the frequency spacing between those tones. This is termed initializing the table editor, because this is the only way to set the frequencies and number of tones, and when you change either the number of tones or the frequency spacing, the phase of *all* tones is set to zero, and *all* tones are turned on.

1. Preset the signal generator, then press **Mode**, **ARB Waveform Generator** (if it appears), **Multitone**. The signal generator displays the multitone table editor, which will look similar to the following figure.



2. Press the softkey **Initialize Table**, then select **Number of Tones**.
3. Using the front-panel knob, change the number of tones to 5.
4. Press the softkey **Freq Spacing**.

Tones are evenly spaced about zero. When there are an even number of tones defined (as shown in the previous figure), the center two tones are placed on either side of zero. For an odd number of tones (as you specified in step 3), the center tone is placed *at* zero.

Also, if you set the frequency spacing less than approximately 5 kHz, the ALC can interact with the tones, causing some distortions as evidenced by intermodulation products outside the desired tones. To eliminate this effect, turn off the ALC.

5. Using the front-panel number keys, enter **20**, then press the **kHz** softkey to terminate the entry.

Note that the **Freq Spacing** softkey now displays the new spacing value, but that the values in the table editor have not changed.

6. To enter the new values into the table editor, press the softkey **Done**.

Note that there are now five tones listed in the table editor, and that the values listed in the `Freq Offset` column are 20 kHz apart, with the center tone at 0.000 kHz.

#### Set the Phase

When the table is first initialized, all phases are 0; this is a phase aligned condition, and the peaks of each tone will all add up to a high peak at points in the waveform. By changing the phases in the table editor, you can make different levels of peaks. You can view this peak information using the `View Statistics → CCDF` function (**Mode**, **ARB Waveform Generator** (if it appears), **Multitone**, **More 1 of 2**, **Waveform Statistics**, **Plot CCDF**).

1. Using the front-panel arrow keys, highlight the entry for the third tone.
2. Select the softkey **Edit Phase**.
3. Using the front-panel number keys, enter 123, then press the `deg` softkey to terminate the entry.

The third tone is updated with a phase of 123 degrees, and tone 4 is highlighted.

#### Remove any Unwanted Tones

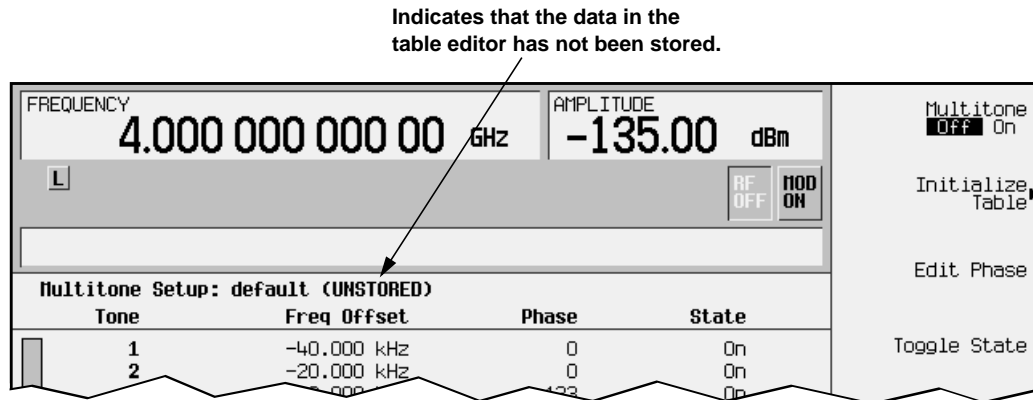
You can remove a tone to view, for example, the intermodulation caused by the remaining tones.

- Select the softkey **Toggle State**.

Note that in the `State` column, the fourth tone is now `Off`.

**Save the Multitone Setup.**

Now that you have created a custom multitone waveform, you can save it for future use. When changes made to the default table have not been stored, (UNSTORED) appears as shown in the following figure. Also, when you load and edit a Multitone setup table from a stored file (see “Using a Stored Multitone Waveform” on page 2-42 for how to do this), (Modified) is displayed after the file name until you store the waveform.



1. In the softkey menu, press **More 1 of 2, Load/Store, Store To File**. The catalog of files appears, with the name of stored files, and amount of memory used and available (in bytes).
2. Name the file (as described in “Storing a Custom CDMA State to Memory” on page 2-10), and press **Enter**.

## Using a Stored Multitone Waveform

Once you have created and stored a multitone waveform, you can use that information as described in the following steps.

### Selecting a Multitone Waveform

1. Press the front panel **Mode** key, and then press **Arb Waveform Generator** [if it appears], **Multitone**.
2. To display the catalog of stored multitone files, press **(More 1 of 2)**, **Load/Store**.
3. Highlight the file you want to use, then press **Load From Selected File**, and **Confirm Load From File**. The information from the file is loaded and displayed in the table editor, as shown in the example below.

The screenshot shows the signal generator's display with the following information:

- Frequency: 4.000 000 000 00 GHz
- Amplitude: -135.00 dBm
- Buttons: RF OFF, MOD ON
- Right-side menu: Load/Store, Waveform Statistics
- Table Title: Multitone Setup: FIVE TONE

Tone	Freq Offset	Phase	State
1	-40.000 kHz	0	On
2	-20.000 kHz	0	On
3	0.000 kHz	123	On
4	20.000 kHz	0	Off
5	40.000 kHz	0	On

### Turning On a Multitone Modulation

Once you have selected a multitone waveform, use the following steps to turn it on.

1. Press **Return** to open the Multitone menu.
2. In the Multitone menu, press the softkey **Multitone Off On** to highlight **On**.  
Note that the front-panel annunciators **M-Tone** and **I/Q** turn on.
3. Press the front panel **Frequency** hardkey and then set the desired frequency.
4. Press the front panel **Amplitude** hardkey and then set the desired amplitude.
5. If necessary, press the front panel **Mod On/Off** hardkey until the **MOD ON** annunciator appears. This applies the custom modulation to the carrier.
6. If the RF is not on (the **RF OFF** annunciator is on), press the front panel **RF On/Off** key. The display annunciator changes to **RF ON**, and the custom modulated signal is available at the **RF OUTPUT** connector.

---

**NOTE** If you edit parameters in a multitone modulation *after* you turn multitone on, select the softkey **Apply Multitone** to regenerate the updated multitone waveform.

---



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## Building a Waveform Sequence

Follow the guidelines in this section to learn how to build waveform sequences from waveform segments using the dual arbitrary waveform generator. (Options UN5 and UN5 are both required.)

In this example you will generate two different types of CDMA waveform segments, a 64 channel forward and a 9 channel forward signal. After you have the two waveform segments stored in NVARB memory, you will build a sequence using each one of these waveform segments.

---

<b>NOTE</b>	<p>There are two kinds of arbitrary waveform generator memory: ARB memory and NVARB memory.</p> <p>ARB memory is volatile. Data held in ARB memory is destroyed if the signal generator's line power is cycled.</p> <p>NVARB memory is non-volatile. Data held in NVARB memory is <i>not</i> destroyed if the signal generator's line power is cycled.</p> <p>For more information on ARB and NVARB memory, see <a href="#">“Managing Volatile and Non-Volatile ARB Memory”</a> on page 4-2.</p>
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## Generating the First Waveform

There are two ways to provide waveforms for use by the sequencing and playback sections of the signal generator. You can either download a waveform via HP-IB, or generate a waveform in either the CDMA (Option UN5 required) or Wideband CDMA (Option H97 required) formats. For information on downloading waveforms via HP-IB, see [“Downloading Waveform Files Into Memory”](#) on page 2-57. For information on generating waveforms in Wideband CDMA, see the *HP ESG-D Series Option H97 Manual Supplement*.

To generate the first waveform using the CDMA format:

1. Press the front panel **Preset** key.
2. Press **Mode**, **Arb Waveform Generator**, **CDMA**.
3. Press the **Setup Select** softkey, then press **64 Ch Fwd** to select a 64-channel forward CDMA template.
4. Press **CDMA Off On** until **On** is highlighted. The signal generator generates the 64 channel forward CDMA waveform and stores it in ARB (volatile) memory with the name `AUTOGEN_WAVEFORM` (the default name given to any waveform generated in the CDMA format).

---

<b>NOTE</b>	<p>There can only be one CDMA waveform in ARB memory at any given time.</p> <p>Therefore, you must rename this file, clearing the way for a second CDMA waveform.</p>
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5. Press Return, Dual ARB. This returns you to the main arbitrary waveform generator menu.

## Renaming the First Waveform as a Waveform Segment

1. Press **Waveform Segments**. This opens a menu that enables you to rename the waveform as a waveform *segment*. Later in the process, the two waveform segments, 64 channel forward and 9 channel forward, will be combined to form a waveform sequence.

FREQUENCY <b>4.000 000 000 00</b> GHz		AMPLITUDE <b>-135.00</b> dBm		Load <b>Store</b>
CDMA		I/Q	RF OFF	MOD ON
ARB (1/1)	884736 points free	NVARR (1/1)	1048576 points free	Store Segment To NVARR Memory
	Segment Points		Segment Points	Store All To NVARR Memory
AUTOGEN WAVEFORM ARB 163840				Set Markers▶
				Delete Segment
				Goto Row▶
				More (1 of 2)

2. Press **More (1 of 2)**, **Rename Segment**, **Editing Keys**, **Clear Text**. You are now ready to enter a new filename for the 64 channel forward CDMA waveform segment.
3. Press **64**, **ABCDEFGH**, **C**, **HIJKLMN**, **H**, **ABCDEFGH**, **F**, **Enter**. The waveform segment filename has now been changed to **64CHF**.

FREQUENCY <b>4.000 000 000 00</b> GHz		AMPLITUDE <b>-135.00</b> dBm		Rename Segment
CDMA		I/Q	RF OFF	MOD ON
ARB (1/1)	884736 points free	NVARR (1/1)	1048576 points free	Delete All ARB Files
	Segment Points		Segment Points	Waveform Statistics▶
64CHF ARB 163840				
				More (2 of 2)

## Generating the Second Waveform

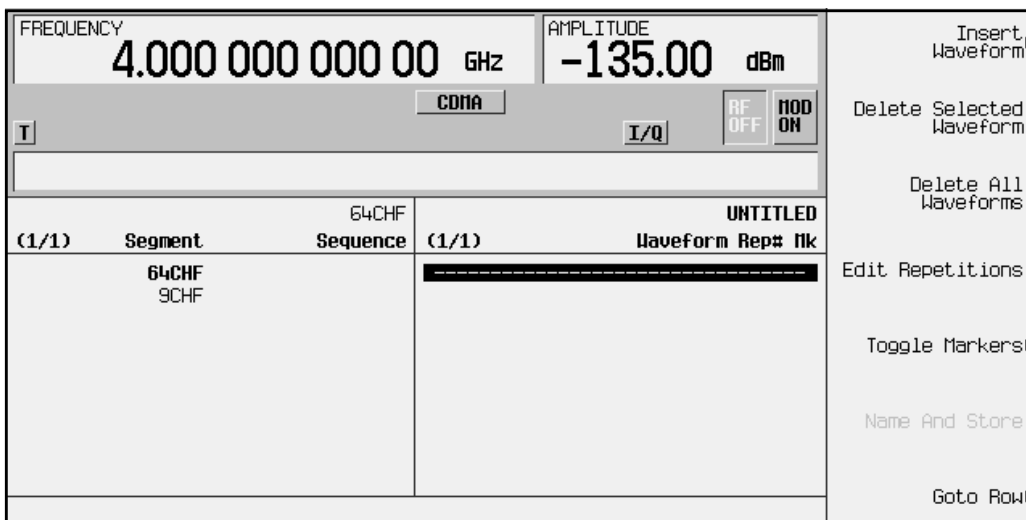
1. Press **Mode**, **Arb Waveform Generator**, **CDMA**.
2. Press **Setup Select**, then press **9 Ch Fwd** to select a 9-channel forward CDMA template.
3. The signal generator generates the 9 channel forward CDMA waveform and stores it in ARB (volatile) memory with the name `AUTOGEN_WAVEFORM`, the default name given to any waveform generated in the CDMA format. (This is why you renamed the 64 channel forward CDMA waveform, so as not to overwrite it with this 9 channel forward CDMA waveform.)
4. Press **Return**, **Dual ARB**. This will return you to the main arbitrary waveform generator menu.

## Renaming the Second Waveform as a Waveform Segment

1. Press **Waveform Segments**. This opens a menu that enables you to rename the waveform as a waveform segment. Use the front-panel knob to highlight `AUTOGEN_WAVEFORM`.
2. Press **More (1 of 2)**, **Rename Segment**, **Editing Keys**, **Clear Text**. You are now ready to enter a new name for the 9 channel forward CDMA waveform segment.
3. Press **9**, **ABCDEFGH**, **C**, **HIJKLMN**, **H**, **ABCDEFGH**, **F**, **Enter**. The name has now been changed to `9CHF`.
4. Press **Return**. This will take you to the main arbitrary waveform generator menu.

## Building a Waveform Sequence from Two Waveform Segments

1. Press **Waveform Sequences**, **Build New Waveform Sequence**. This opens a menu for building new waveform sequences. The left side of the display is a catalog listing of the waveform segments and sequences in ARB memory. The right side of the display is a sequential listing of waveform segments that define the waveform sequence.



- Press **Insert Waveform**. This moves the highlight bar over to the catalog listing of waveform segments. Use the arrow keys or the front-panel knob to highlight **64CHF**.
- Press **Insert Selected Waveform**. This inserts one repetition of the 64 channel forward CDMA waveform segment into the sequence playback listing on the right side of the display. Under the table heading **Waveform** you will see **ARB1:64CHF**, and under the table heading **Rep#** you will see **1**. The sequencer has now been programmed to play back one repetition of the 64 channel forward CDMA waveform segment.

FREQUENCY <b>4.000 000 000 00</b> GHz		AMPLITUDE <b>-135.00</b> dBm		Insert Selected Waveform
CDMA		I/Q		
T		RF OFF		MOD ON
		Show Waveform Sequence Contents		
(1/1)	Segment	64CHF Sequence	(UNSTORED) (1/1)	UNTITLED Waveform Rep# Nk
	64CHF			ARB:64CHF 1
	9CHF			
Done Inserting				
Waveform Segments				
Page Up				
Page Down				

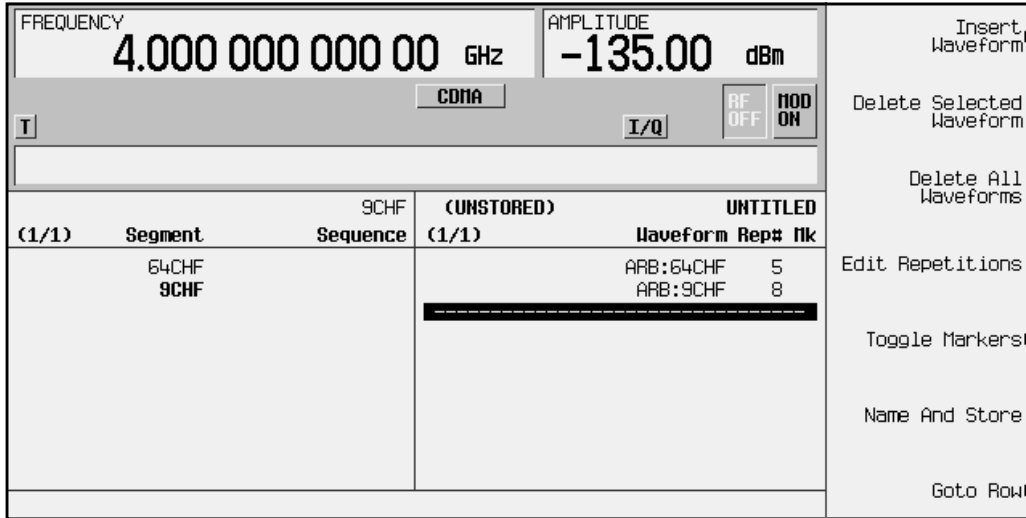
- Use the arrow keys or the front-panel knob to highlight the **9CHF** waveform segment. Press **Insert Selected Waveform**. This inserts one repetition of the 9 channel forward CDMA waveform segment into the sequence playback listing below the 64 channel forward waveform segment. Under the table heading **Waveform** you will see the addition of **ARB1:9CHF**, and under the table heading **Rep#** you will see an additional **1**.

FREQUENCY <b>4.000 000 000 00</b> GHz		AMPLITUDE <b>-135.00</b> dBm		Insert Selected Waveform
CDMA		I/Q		
T		RF OFF		MOD ON
		Show Waveform Sequence Contents		
(1/1)	Segment	9CHF Sequence	(UNSTORED) (1/1)	UNTITLED Waveform Rep# Nk
	64CHF			ARB:64CHF 1
	9CHF			ARB:9CHF 1
Done Inserting				
Waveform Segments				
Page Up				
Page Down				

- Press **Done Inserting**. The sequence has now been defined as one repetition of the 64 channel forward CDMA waveform segment followed by one repetition of the 9 channel forward CDMA waveform segment.

## Editing the First and Second Waveform Segment Repetitions

1. Use the front-panel knob or the arrow keys to highlight the ARBI:64CHF sequence entry. Press **Edit Repetitions**. Repetitions: 1 is displayed in the active entry area of the display. Press **5, Enter**. The number of repetitions for the sequence entry ARBI:64CHF has been changed to 5 and the highlight has moved over the sequence ARBI:9CHF entry.
2. Press **Edit Repetitions**. Repetitions: 1 is displayed in the active entry area of the display. Press **8, Enter**. The number of repetitions for the sequence entry ARBI:9CHF has been changed to 8.



## Naming and Storing the Waveform Sequence

1. Press **Name and Store**. Store: is displayed in the active entry area of the display.

- Using the alphabetical softkeys and the numeric keypad, name the sequence 64CHFX5+9CHFX8. After inputting the sequence name and pressing **Enter**, the sequence is automatically stored in the sequence (Seq) section of the signal generator's memory catalog.

FREQUENCY <b>4.000 000 000 00</b> GHz		AMPLITUDE <b>-135.00</b> dBm		Insert Waveform Delete Selected Waveform Delete All Waveforms Edit Repetitions Toggle Markers Name And Store Goto Row
CDMA		RF OFF MOD ON		
I		I/Q		
(1/1)	Segment	9CHF Sequence	64CHFX5+9CHFX8 Waveform Rep# Nk	
	64CHF 9CHF	64CHFX5+9CHFX8	ARB:64CHF 5 ARB:9CHF 8	
		-----		

## Playing the Waveform Sequence

1. Press **Return** twice to return to the top level menu (**ARB Off On** is the first softkey).
2. Press **Select Waveform**. This opens a menu from which you can select waveform segments or waveform sequences to be played.
3. Use the arrow keys or the front-panel knob to highlight the waveform sequence 64CHFX5+9CHFX8. Press **Select Waveform**. This selects the waveform sequence to be played through the signal generator's I/Q section. Press **Return** to return to the main arbitrary waveform generator menu.

FREQUENCY <b>4.000 000 000 00</b> GHz		AMPLITUDE <b>-135.00</b> dBm		Select Waveform (SEQ:64CHF X5+9CHFX8)
T		RF OFF MOD ON		
Select Waveform		64CHFX5+9CHFX8		
(1/1)	Segment	Points	Sequence	Segs
	64CHF ARB	163840	64CHFX5+9CHFX8 SEQ	2
	9CHF ARB	163840		
Goto Row				
Page Up				
Page Down				

4. Press **ARB Off On** until **On** is highlighted. This activates the waveform and plays it into the baseband generator.

To see this signal at the RF output, enter the appropriate frequency and amplitude settings (for example, press **Frequency**, **890.01**, **MHz** and **Amplitude**, **-10.0**, **dBm**, for a carrier at 890.01 MHz at a power level of -10 dBm), activate the modulation (**Mod Off On** set to **On**), and activate the RF output (**RF Off On** set to **On**).

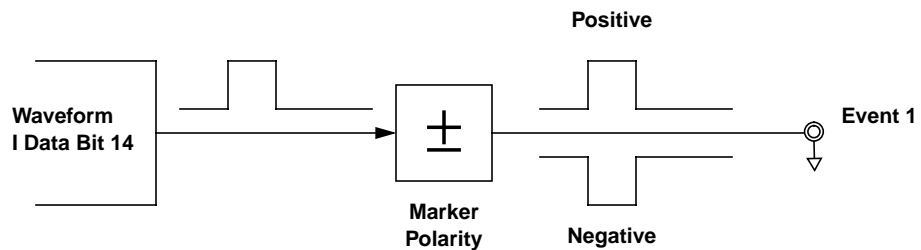
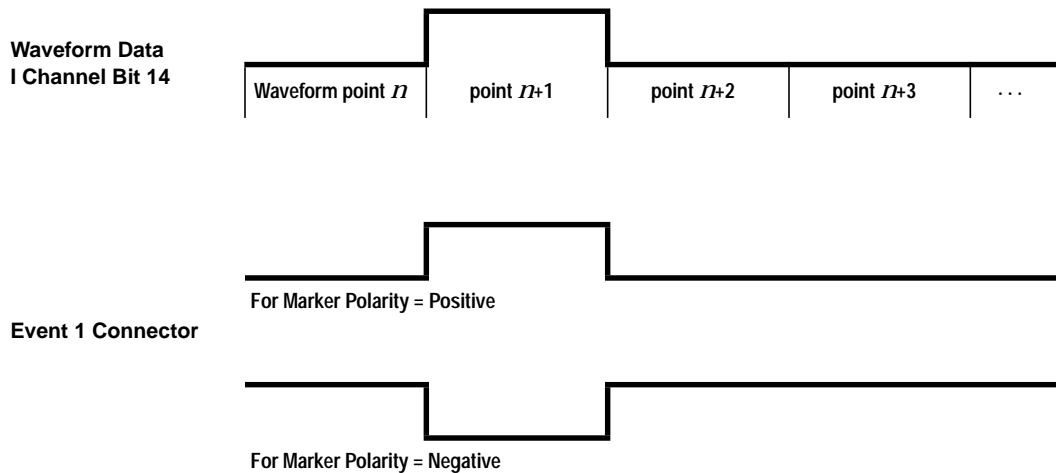
## Using Markers

The signal generator has two markers that you can place on a waveform segment; markers provide auxiliary output signals that are synchronized with a waveform segment. You can construct these output signals as a trigger signal to synchronize another instrument to a given portion of a waveform.

In some situations, it can be useful to use the markers to generate a clock signal. Using a CDMA waveform as a waveform segment (an `AUTOGEN_WAVEFORM_ARB`), for example, the ARB sample clock frequency is a multiple of the chip rate. Using markers and the `# Skipped Points` feature, you can construct a clock at the chip rate easily.

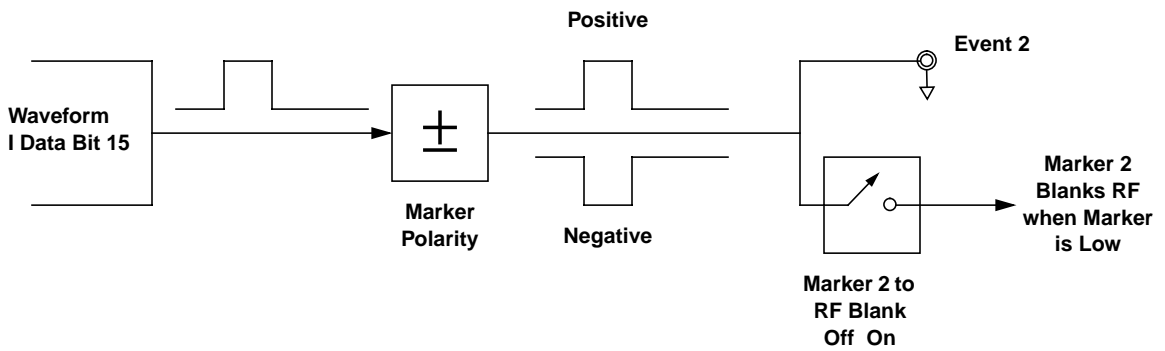
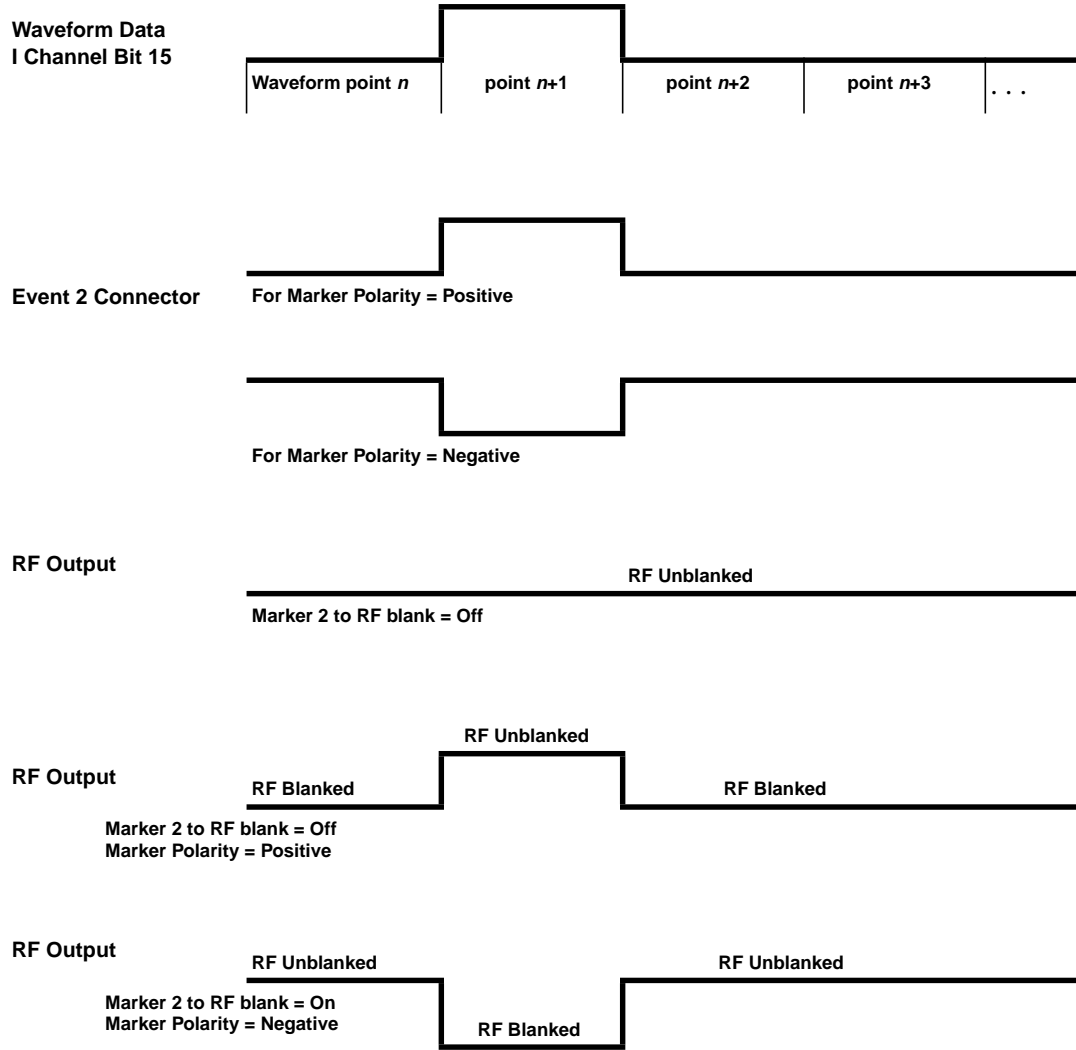
## Placing Markers on a Waveform Segment

### Marker 1 → Event 1





**Marker 2 → Event 2**



## Placing a Marker at the Beginning of the Waveform Segment

You can put a marker at the beginning of a segment to create a trigger output that is synchronous with the start of that waveform segment.

1. Create/select a waveform segment (for details, refer to “[Generating the First Waveform](#)” on page 2-43).
2. Press **Mode**, **ARB Waveform Generator** (if it appears), **Dual ARB**, **Waveform Segments**, **Set Markers**, **Set Marker On First Point**

This sets Marker 1 (selected by default) on the first point in the waveform segment.

### Checking a Marker

Once you set a marker on a waveform segment, you can see the results at the Event 1/2 output (Event 1 for this example).

1. With the desired segment selected, press **Return**, **Return** to display the Dual ARB softkey menu.
2. Press **ARB Off On** to select **On**. The ARB and the I/Q annunciators turn on
3. Connect an oscilloscope to the Event 1 output, and trigger on the Event 1 signal. When a marker is present, a trigger occurs.

## Placing a Marker Across a Range of Points

You can place a marker across a range of points, as well as at a single point.

1. Create/select a waveform segment (for details, refer to “[Generating the First Waveform](#)” on page 2-43).
2. Press **Mode**, **ARB Waveform Generator** (if it appears), **Dual ARB**, **Waveform Segments**, **Set Markers**, **Marker 1 2** (to select marker 2), **Set Marker On Range of Points**
3. Set the first and last points for the marker, then press **Apply To Waveform**.

If you enter a value for either the first marker point or the last marker point that would make the first marker point occur *after* the last, the last marker point is automatically adjusted to match the first marker point.

You can check this marker as described previously (at the Event 2 output for this example).

## Placing Repetitively-Spaced Markers

You can set a marker across a range of points, and designate spaces at a specific interval within that range. This gives you the effect of multiple markers within the range that you specify. You can use this feature to generate a clock signal.

1. Create/select a waveform segment (for details, refer to [“Generating the First Waveform”](#) on page 2-43).
2. Press **Mode**, **ARB Waveform Generator** (if it appears), **Dual ARB**, **Waveform Segments**, **Set Markers**, **Set Marker On Range of Points**
3. Set the first and last points for the marker.
4. To define the spacing that you want between the markers, press **# Skipped Points**, then set the number of points.

For example, a skip of 2, would produce a marker (M) across a given range, with a pattern of two skipped points (w) within that range:



5. Press **Apply To Waveform**.

## Using Marker 2 to Blank the RF Output

Using the *Marker 2 to RF Blank* feature, the range of marker points that you set in this example blanks the RF output. Changing the range changes the blanking interval. When Marker 2 to RF Blank is enabled, the RF output is blanked whenever marker 2 is low (as seen at the Event 2 BNC connector). When Marker 2 is high, the RF output is normal, and its level is controlled by the ALC (when ALC is on).

---

**NOTE** This applies to Marker 2 only. Marker 1 does not blank the RF output.

---

1. Create/select a waveform segment (for details, refer to [“Generating the First Waveform”](#) on page 2-43).
2. Press **Mode**, **ARB Waveform Generator** (if it appears), **Dual ARB**, **ARB Setup**, **Marker Polarity Neg Pos** (to select negative polarity), **Marker 2 To RF Blank Off On** (to turn blanking on).

---

**NOTE** If you leave the marker polarity positive, the RF is blanked *until* the marker goes high (see [“Marker 2 Æ Event 2”](#) on page 2-51).

---

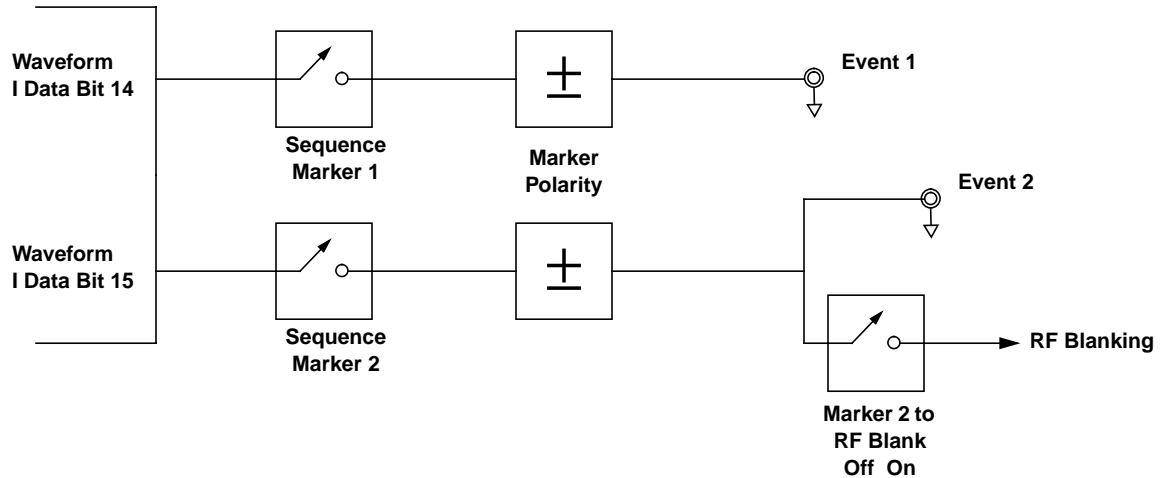
3. Press **Return**, **Waveform Segments**, **Set Markers**, **Marker 1 2** (to select marker 2), **Set Marker On Range of Points**
4. Set the first and last points for the marker, then press **Apply To Waveform**.

You can check this marker as described previously (at the Event 2 output for this example).

## Using Markers in a Waveform Sequence

A waveform sequence comprises waveform segments. When you combine segments to form a sequence, you can enable or disable marker 1 and/or marker 2 on a segment-by-segment basis.

When you select a sequence to output, the markers embedded in any one segment of that sequence are output only if the sequence marker for that segment is enabled (toggled on). This makes it possible to output markers for some segments in a sequence, but not for others.



### Toggling Markers in an Existing Waveform Sequence

In a waveform sequence, you can toggle the markers of each segment independently. When you build a waveform sequence, the markers on each segment are in the last marker toggle state that was used.

1. Press **Mode**, **ARB Waveform Generator** (if it appears), **Dual ARB, Waveform Sequences**.
2. Select the desired waveform sequence.
3. Press **Edit Selected Waveform Sequence**. Note that the entries in the **Mk** column for each segment indicates whether a marker is on. No entry in that column means that both markers are off.

FREQUENCY		AMPLITUDE	
4.000 000 000 00 GHz		-135.00 dBm	
L		RF OFF	MOD ON
		Delete Selected Waveform	
		Delete All Waveforms	
		Edit Repetitions	
		Toggle Markers	
		Name And Store	
		Goto Row	

(1/1)	Segment	AUTOGEN_WAVEFORM Sequence	(1/1)	Waveform Rep#	Seq#	Mk
AUTOGEN_WAVEFORM	SEQ3	ARB:AUTOGEN_WAVEFORM	1			
		ARB:AUTOGEN_WAVEFORM	1	1		
		ARB:AUTOGEN_WAVEFORM	1	2		
		ARB:AUTOGEN_WAVEFORM	1	12		

**Marker Column** (points to the 'Mk' column header)

**This entry show both markers on.** (points to the row where both markers are on)

4. Using the front-panel knob, move the highlight to select the desired segment.
5. Press **Toggle Markers**, then select the marker that you wish to toggle (**Toggle Marker 1** or **Toggle Marker 2**). You can toggle either one of the markers, or both.
6. Use the front-panel arrow keys to move the highlight to the next desired segment, and toggle the markers for that segment. Continue with the remaining segments.
7. When you have all markers set as you wish, press **Return**, where you can name and store the edited waveform sequence.

## Toggling Markers As You Create a Waveform Sequence

You can combine waveform segments to create a waveform sequence, and toggle the markers of each segment independently.

1. Press **Mode**, **ARB Waveform Generator** (if it appears), **Dual ARB**, **Waveform Sequences**, **Build New Waveform Sequence**.
2. Refer to [“Building a Waveform Sequence”](#) on page 2-43 for details on how to build a waveform sequence.
3. To toggle markers:
  - a. Press **Mode**, **ARB Waveform Generator** (if it appears), **Dual ARB**, **Waveform Sequences**.
  - b. Select the desired waveform sequence.
  - c. Press **Edit Selected Waveform Sequence**. Note that the **Mk** entry for each segment indicates whether a marker is on. No entry in that column means that both markers are off.
  - d. Using the front-panel knob, move the highlight to select the desired segment.
  - e. Press **Toggle Markers**, then select the marker that you wish to toggle (**Toggle Marker 1** or **Toggle Marker 2**). You can toggle either one of the markers, or both.
  - f. Use the front-panel arrow keys to move the highlight to the next desired segment, and toggle the markers for that segment. Continue with the remaining segments.
  - g. When you have all markers set as you wish, press **Return**, where you can name and store the edited waveform sequence.

---

## Downloading Waveform Files Into Memory

Follow the guidelines in this section to learn how to download waveform files into the signal generator's ARB memory. (Option UND is required.) For information on system interface, including HP-IB and RS-232, see the programmer's manual.

### Downloading Waveform Files Into ARB Memory

Downloading waveforms into volatile (ARB) memory is much quicker than downloading waveforms into non-volatile (NVARB) memory. If you want to store waveforms in NVARB memory, first follow the instructions to download into volatile ARB memory and then copy or move the waveforms internally into NVARB memory. See the following section titled, [“Transferring Waveforms Between ARB and NVARB Memory”](#)

Use the following SCPI command lines to download a waveform to ARB memory:

```
MMEM:DATA "ARBI:<waveform_name>" , <I_waveform_data>
```

This command downloads the I values for your waveform. The variable `<waveform_name>` denotes the name that will be associated with the downloaded waveform data within the signal generator and therefore must be the same for both I and Q downloads.

```
MMEM:DATA "ARBQ:<waveform_name>" , <Q_waveform_data>
```

This command downloads the Q values for your waveform.

The signal generator will associate the I waveform values and the Q waveform values, and drive the I and Q modulators with the stored waveform in the baseband generator. If only one of the two required commands is executed (I values only or Q values only), the missing data will be set to values corresponding to a 0 V output.

### Sample Command Line

A sample command line:

```
MMEM:DATA "ARBI:<waveform_name>" , #ABC
```

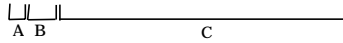
"`<waveform_name>`" the name of the waveform file within the signal generator

- A the number of decimal digits to follow in B.
- B a decimal number specifying the number of data bytes in C.
- C the binary waveform data in 2-byte integers.

## Downloading Waveform Files Into Memory

**Example 1**

```
MMEM:DATA "ARBI:WAVEFORM1", #232<32 bytes of data>
```



WAVEFORM1      the waveform name

2                defines the number of decimal digits to follow in B. This variable is represented by A in the sample command line.

32               denotes how many bytes of data are to follow. This variable is represented by B in the sample command line.

<32 bytes

of data>        the binary waveform data in 2-byte integers. Data order is defined as Most Significant Bit (first) through Least Significant Bit (last). This variable is represented by C in the sample command line.

**Querying the Waveform Data**

Use the following SCPI command line to upload waveform data from the ARB memory to the personal computer:

```
MMEM:DATA? "ARBI:<waveform_name>"
MMEM:DATA? "ARBQ:<waveform_name>"
```

**Waveform Downloading Using HP BASIC for Windows™**

The following program shows you how to use download waveforms using HP BASIC for Windows™.

First, the I waveform data is put into an array of integers called `Iwfm_data` and the Q waveform data is put into an array of integers called `Qwfm_data`. The variable `Nbytes` is set to equal the number of bytes in the I waveform data. This should be twice the number of integers in `Iwfm_data`, since an integer is 2 bytes. Input integers must be between 0 and 16383.

In the Output commands, the USING "#,K" formats the data. The pound symbol (#) suppresses the automatic EOL (End of Line) output. This allows multiple output commands to be concatenated as if they were a single output. The "K" instructs BASIC to output the following numbers or strings in the default format.

```
5 Npoints=20
10 ALLOCATE INTEGER Iwfm_data(1:Npoints),Qwfm_data(1:Npoints)
15 DEG
20 FOR I=1 TO Npoints
25 Iwfm_data(I)=INT(8191*(COS(I*360/Npoints))+8192)
30 Qwfm_data(I)=INT(8191*(COS(I*360/Npoints))+8192)
35 NEXT I
40 Nbytes=2*Npoints
45 Assign @ESG to 719
50 Assign @ESGb to 719; FORMAT MSB FIRST
60 Nbytes$=VAL$(Nbytes)
70 Ndigits$=VAL$(LEN$(Nbytes$))
80 OUTPUT @ESG USING "#,K";"MMEM:DATA " "ARBI:testfile", #"
90 OUTPUT @ESG USING "#,K";Ndigits$
```



```

100 OUTPUT @ESG USING "#,K";Nbytes
110 OUTPUT @ESGb;Iwfm_data(*)
120 OUTPUT @ESG;
130 OUTPUT @ESG USING "#,K";"MMEM:DATA "ARBQ:testfile", #"
140 OUTPUT @ESG USING "#,K";Ndigits$
150 OUTPUT @ESG USING "#,K";Nbytes$
160 OUTPUT @ESGb;Qwfm_data(*)
170 OUTPUT @ESG;
180 Assign @ESG TO *
190 Assign @ESGb TO *
    
```

200 END

**Table 2-1**

5:	Sets the number of points in the waveform.
10:	Defines arrays for I and Q waveform points. Sets them to be integer arrays.
15:	Sets BASIC to use degrees for cosine and sine functions.
20:	Sets up loop to calculate waveform points.
25:	Calculates I waveform points.
30:	Calculates Q waveform points.
35:	End of loop.
40:	Calculates number of bytes in I or Q waveform.
45:	Opens an I/O path to the signal generator using HP-IB. 7 is the address of the HP-IB card in the computer, and 19 is the address of the signal generator. This I/O path is used to send ASCII data to the signal generator.
50:	Opens an I/O path for sending binary data to the signal generator. FORMAT MSB FIRST is needed to send the 2 bytes of each integer to the signal generator in the correct order.
60:	Creates an ASCII string representation of the number of bytes in the waveform.
70:	Finds the number of digits in Nbytes.
80:	Sends the I waveform SCPI download-to-ARBI command and the beginning of the ASCII header for the data. testfile is the waveform name that will be used in the signal generator.
90 to 100:	Sends the rest of the ASCII header.
110:	Sends the binary data. Note that ESGb is the binary I/O path.
120:	Sends an End-of-Line to terminate the transmission.
130 to 170:	Executes same commands for the Q waveform.
180 to 190:	Closes the connections to the signal generator.
200:	End the program.

## Waveform Downloading Using Rocky Mountain BASIC for UNIX

The following program shows you how to download waveforms using RMB for UNIX.

First, the I waveform data is put into an array of integers called `Iwfm_data` and the Q waveform data is put into an array of integers called `Qwfm_data`. The variable `Nbytes` is set to equal the number of bytes in the I waveform data. This should be twice the number of integers in `Iwfm_data`, since an integer is 2 bytes. Input integers must be between 0 and 16383.

In the Output commands, USING "#,K" formats the data. The pound symbol (#) suppresses the automatic EOL (End of Line) output. This allows multiple output commands to be concatenated as if they were a single output. The "K" instructs BASIC to output the following numbers or strings in the default format.

```

5 Npoints=20
10 ALLOCATE INTEGER Iwfm_data(1:Npoint),Qwfm_data(1:Npoints)
15 DEG
20 FOR I=1 TO Npoints
25 Iwfm_data(I)=INT(8191*(COS(I*360/Npoints))+8192)
30 Qwfm_data(I)=INT(8191*(COS(I*360/Npoints))+8192)
35 NEXT I
40 Nbytes=2*Npoints
45 Assign @ESG to 719;FORMAT ON
50 Assign @ESGb to 719; FORMAT OFF
55 Nbytes$=VAL$(Nbytes)
60 Ndigits$=(LEN$(Nbytes$))
65 OUTPUT @ESG USING "#,K";"MMEM:DATA " "ARBI:<name>" ",#"
70 OUTPUT @ESG USING "#,K";Ndigits$
75 OUTPUT @ESG USING "#,K";Nbytes
80 OUTPUT @ESGb;Iwfm_data(*)
85 OUTPUT @ESG;
90 OUTPUT @ESG USING "#,K";"MMEM:DATA " "ARBQ:<name>" ",#"
95 OUTPUT @ESG USING "#,K";Ndigits$
100 OUTPUT @ESG USING "#,K";Nbytes
105 OUTPUT @ESGb;Qwfm_data(*)
110 OUTPUT @ESG;";"
115 Assign @ESGb to *
120 Assign @ESG to *
125 END

```

**Table 2-2**

5:	Sets the number of points in the waveform.
10:	Defines arrays for I and Q waveform points. Sets them to be integer arrays.
15:	Sets BASIC to use degrees for cosine and sine functions.
20:	Sets up loop to calculate waveform points.
25:	Calculates I waveform points.
30:	Calculates Q waveform points.
35:	End of loop.
40:	Calculates number of bytes in I or Q waveform.
45:	Opens an I/O path to the signal generator using HP-IB. 7 is the address of the HP-IB card in the computer, and 19 is the address of the signal generator. This I/O path is used to send ASCII data to the signal generator.
50:	Opens an I/O path for sending binary data to the signal generator.
55:	Creates an ASCII string representation of the number of bytes in the waveform.
60:	Finds the number of digits in Nbytes.
65:	Sends the I waveform SCPI download-to-ARBI command and the beginning of the ASCII header for the data. The variable <name> is the waveform name that will be used in the signal generator.
70 to 75:	Sends the rest of the ASCII header.
80:	Sends the binary data. Note that ESGb is the binary I/O path.
85:	Sends an End-of-Line to terminate the transmission.
90 to 110:	Executes same commands for the Q waveform. The variable <name> that appears in program line 100 must be identical to that in program line 50.
115 to 120:	Closes the connections to the signal generator.
125:	End the program.

## Transferring Waveforms Between ARB and NVARB Memory

Use one of the following procedures to transfer waveforms between ARB and NVARB memory. You can use either remote commands via HP-IB, or the front-panel keys. As mentioned earlier, it is much faster to first download waveforms to ARB memory and then transfer them to NVARB memory.

### Copying Waveforms From ARB to NVARB Memory

To copy waveforms from ARB to NVARB memory, execute the following command lines:

```
MMEM: COPY "ARBI:<waveform_name>", "NVARBI:<waveform_name>"  
MMEM: COPY "ARBQ:<waveform_name>", "NVARBQ:<waveform_name>"
```

Or press **Mode**, **ARB Waveform Generator** (if it appears), **Dual ARB**, **Waveform Segments**, highlight the waveform in ARB memory that you want to copy and press **Store Segment To NVARB Memory**.

### Copying Waveforms From NVARB to ARB Memory

To copy waveforms from NVARB to ARB memory, execute the following command lines:

```
MMEM: COPY "NVARBI:<waveform_name>", "ARBI:<waveform_name>"  
MMEM: COPY "NVARBQ:<waveform_name>", "ARBQ:<waveform_name>"
```

Or press **Mode**, **ARB Waveform Generator** (if it appears), **Dual ARB**, **Waveform Segments**, **Load**, highlight the waveform in NVARB memory that you want to copy and press **Load Segment From NVARB Memory**.

## Selecting a Waveform and Activating the Modulation via HP-IB

The following remote commands are used to select a waveform and activate the modulation.

```
:RADio:ARB:WAVeform "ARBI:"<waveform_name>" "
```

This command selects the waveform called <waveform\_name> in ARB memory as the modulation for the signal generator's RF output.

```
:RADio:ARB:WAVeform "SEQ:"<sequence_name>" "
```

This command selects the user-defined sequence from the signal generator's catalog memory as the modulation at the signal generator's RF output.

```
:RADio:ARB ON
```

This command drives the I and Q modulators with the chosen waveform/sequence in the baseband generator.

---

**NOTE** If you attempt to stop sending information to the signal generator during the execution of a remote command that is sending waveform data, the signal generator will wait indefinitely for further input.

If this happens, you should execute the appropriate device clear command for your programming language over HP-IB.

As an example, in HP BASIC this command is `CLEAR 719` (assuming the signal generator's HP-IB address has been set to 19).

This infinite loop may also happen if an interrupt occurs while trying to read (upload) data from the signal generator. During an interrupted upload, the device clear command can take up to three minutes to execute after the command is initially sent.

---

---

## Viewing Files Stored in the Memory Catalog

The memory catalog can be used to view the existing waveform files, sequence files, CDMA files, and FIR files that have been transferred to the source's mass memory. To review the memory catalog by file type:

1. Switch on the signal generator's line power.
2. If the signal generator is in remote mode, first press the **Local** key to return the signal generator to local control. Press **Utility** (located in the **MENUS** section of the signal generator's front panel).
3. Press **Memory Catalog**.
4. Press **Catalog Type**. If you do not wish to review the FIR catalog, continue with step 5.

To view the files in the FIR catalog, press **FIR**. You can use the appropriate softkeys in this menu to copy, rename, and delete specific files, or to delete all the files within the FIR directory. When you are finished, press **Catalog Type**.

5. To view arbitrary waveform generator-related files, press **ARB Catalog Types**.
  - Press **Seq** to review all of the files in the sequence catalog. Sequence files hold information such as waveform file names, number of repetitions, and playing order.
  - Press **ARB** to review all of the existing arbitrary waveform generator waveform files in volatile ARB memory.
  - Press **NVARB** to review all of the existing arbitrary waveform generator waveform files in NVARB memory.
  - Press **CDMA** to review all of the files in the CDMA catalog.
  - Press **MCDMA** to review all of the files in the multicarrier CDMA catalog.
  - Press **MTONE** to review all of the files in the multitone catalog.

For all arbitrary waveform generator catalog types, you can use the appropriate softkeys to rename or delete specific files, or delete all of the files present in a specific catalog directory. In addition, the Sequence and CDMA directories contain a **Copy File** softkey that allows you to copy and rename a specific file.

You can also view the waveform files in ARB and NVARB memory by pressing **Mode**, **ARB Waveform Generator** (if it appears), **Dual ARB**, **Waveform Segments**.

---

## Creating Additive White Gaussian Noise (AWGN) Waveforms

Using this procedure, you will create an additive white gaussian noise waveform with a bandwidth of 1.25 MHz, a waveform length of 131072 points, and a random noise seed.

The signal generator provides a quick and easy solution to creating additive white gaussian noise waveforms. Waveform bandwidth, length, and noise seed can be adjusted to fit your particular requirements. (Options UND and UN5 are both required.)

1. Preset the signal generator.

Press **Preset** to return the signal generator to normal preset conditions.

2. Open the AWGN menu.

Press the front panel **Mode** key. (If you have multiple options and the **Arb Waveform Generator** softkey is visible, press it next.) Press **AWGN**.

3. Adjust the waveform's bandwidth.

Press **Bandwidth**. Using the numeric keypad, enter 1.25 and press the **MHz** terminator. The noise bandwidth is now set to 1.25 MHz.

4. Adjust the waveform's length.

Press **Waveform Length**, **131072**. The waveform's length is now set to 131072 points.

5. Adjust the waveform's noise seed.

Press **Noise Seed Fixed Random** until **Random** is highlighted. The data generating the noise seed is now set to random.

---

## Using Arbitrary Waveform Generator Triggers

The arbitrary waveform generator includes several different triggering options. For information on the triggering capabilities of the signal generator, see [“Understanding Arbitrary Waveform Generator Triggers”](#) on page 4-6.

---

**NOTE** Arbitrary waveform generator triggers, their associated softkeys and SCPI functionality became available in Option UN5/UND signal generators with serial number prefix US3844 or GB3845. Arbitrary waveform generator triggers are *not* available in Option UN5/UND signal generators with an earlier serial number prefix, unless upgraded.

To upgrade your Option UN5/UND signal generator to include arbitrary waveform generator triggering, contact your nearest HP Sales and Service office. A list of HP Sales and Service offices is provided in the *HP ESG and ESG-D Series Signal Generator User's Guide* at the end of Chapter 3, “Troubleshooting.”

---

In the following procedures, you will learn how to create a time-delayed, externally-triggered custom multicarrier CDMA waveform ([“Creating an Externally-Triggered Custom Multicarrier CDMA Waveform”](#) on page 2-66) and how to use segment advance triggering with waveform sequences ([“Controlling Waveform Sequence Playback Using Segment Advance Triggering”](#) on page 2-72).

### Creating an Externally-Triggered Custom Multicarrier CDMA Waveform

Using this procedure, you will recall a custom multicarrier CDMA state from the signal generator's MCDMA memory catalog and single-trigger the waveform externally with a 100 msec delay.

For this example, recall 5<sub>CARRIER</sub>, the custom 5-carrier CDMA waveform created in the procedure titled, [“Creating Custom Multicarrier CDMA Waveforms”](#) on page 2-14 and stored using the procedure titled, [“Storing a Custom Multicarrier CDMA Waveform”](#) on page 2-23. If you have not created and stored a custom multicarrier CDMA waveform, refer to these previous sections. (Options UND and UN5 are both required.)

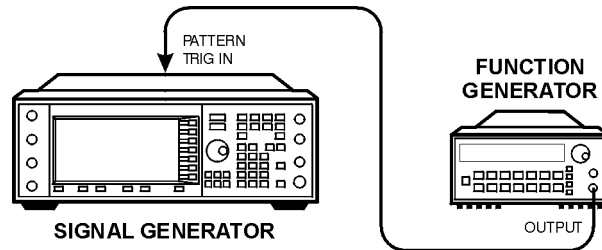
#### Required Equipment

HP 33120A Function Generator



1. Connect the equipment.

Connect the signal generator to the function generator as shown in the following figure.



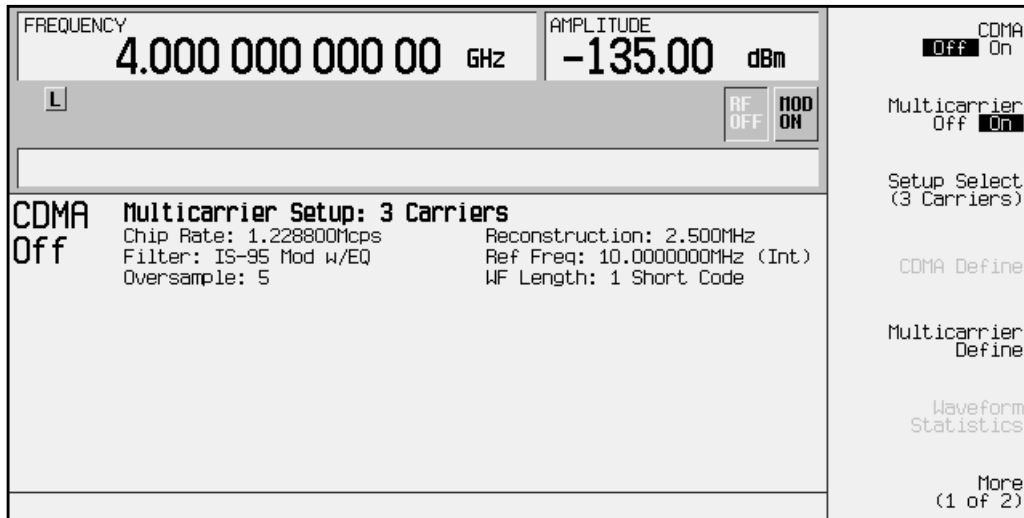
pk719b

2. Preset the signal generator.

Press **Preset** to return the signal generator to normal preset conditions.

3. Activate the multicarrier CDMA mode.

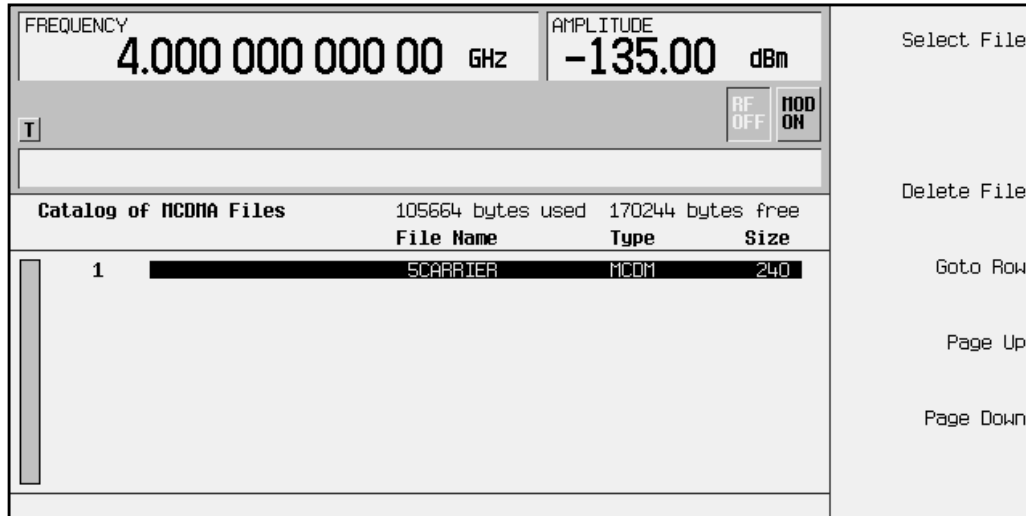
Press the front panel **Mode** key. If you have multiple options and the **Arb Waveform Generator** softkey is visible, press it next. Press **CDMA**. Press **Multicarrier Off On** until **On** is highlighted, as shown in the following figure.



## Using Arbitrary Waveform Generator Triggers

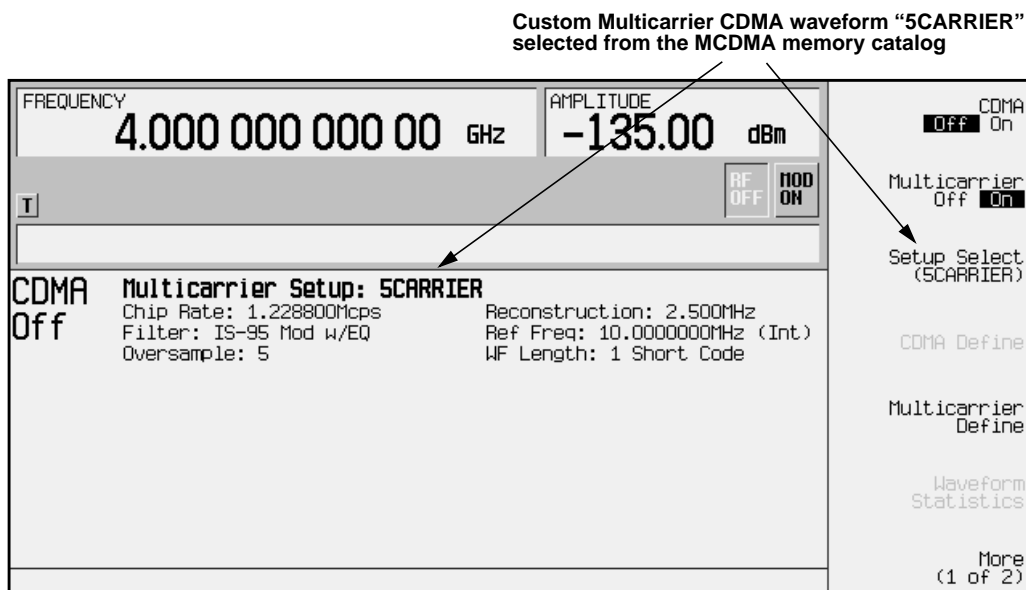
## 4. Open the multicarrier CDMA (MCDMA) memory catalog.

Press **Setup Select**. The default multicarrier CDMA template is set to **3 Carriers**. Press **Custom CDMA Carrier** to open the MCDMA memory catalog, as shown in the following figure.



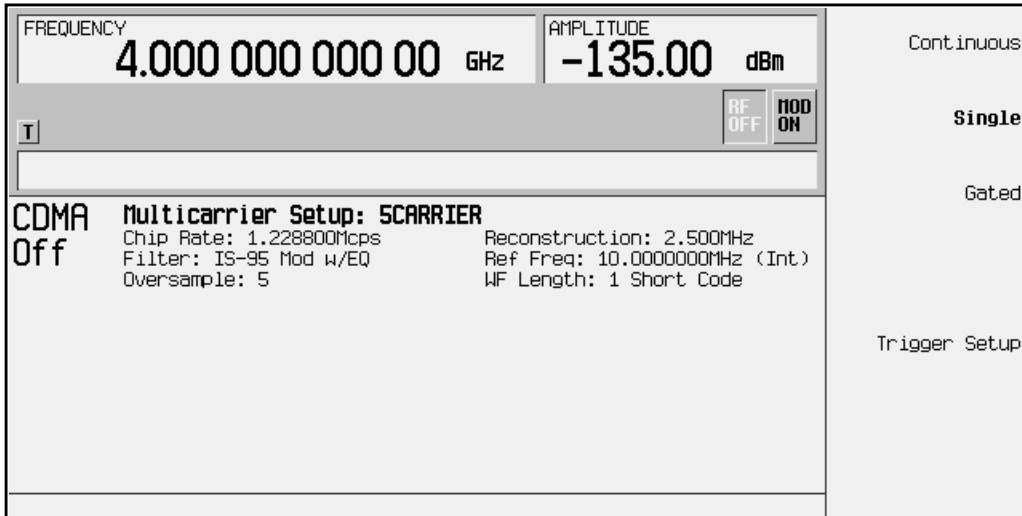
## 5. Select a custom multicarrier CDMA waveform from the MCDMA memory catalog.

Use the front-panel knob or the arrow keys to highlight the file **5CARRIER**, then press **Select File**. The custom multicarrier CDMA waveform **5CARRIER** is selected, as shown in the following figure.



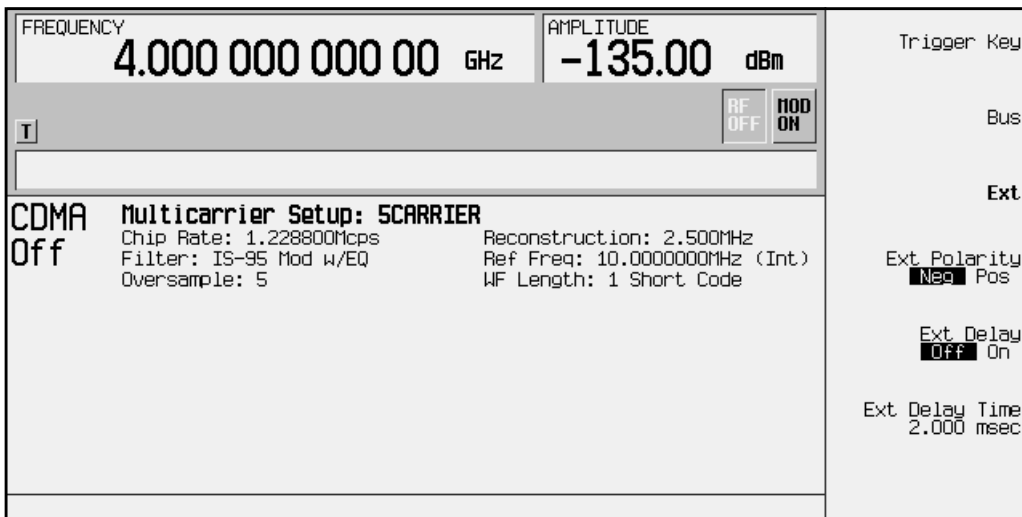
6. Set the trigger to Single.

To set the trigger type to Single, press **More (1 of 2), Trigger, Single**, as shown in the following figure. The waveform will now trigger once when it receives the appropriate signal from the trigger source.



7. Set the trigger source to External.

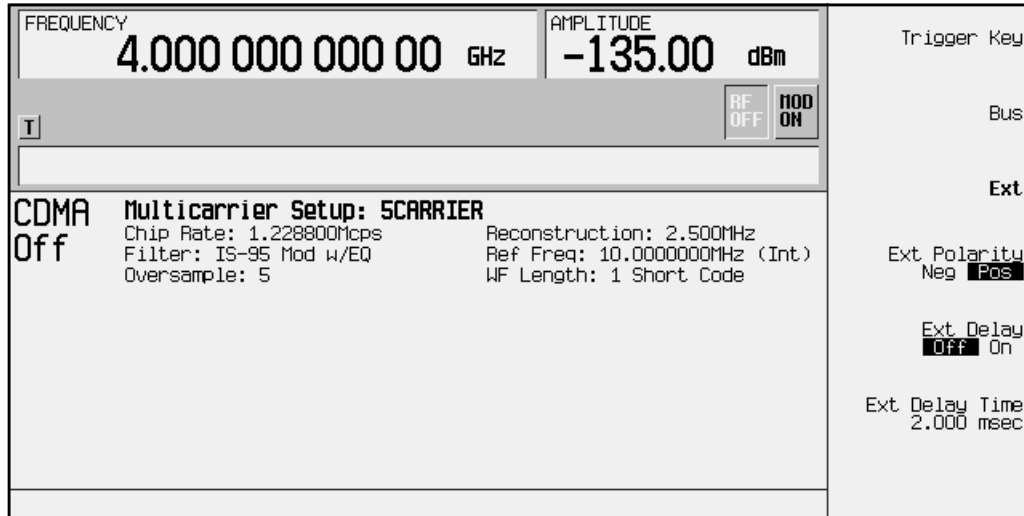
To set the trigger source to External, press **Trigger Setup, Trigger Source, Ext**, as shown in the following figure. The waveform will now trigger when it detects a change in TTL state at the PATTERN TRIG IN rear panel connector.



## Using Arbitrary Waveform Generator Triggers

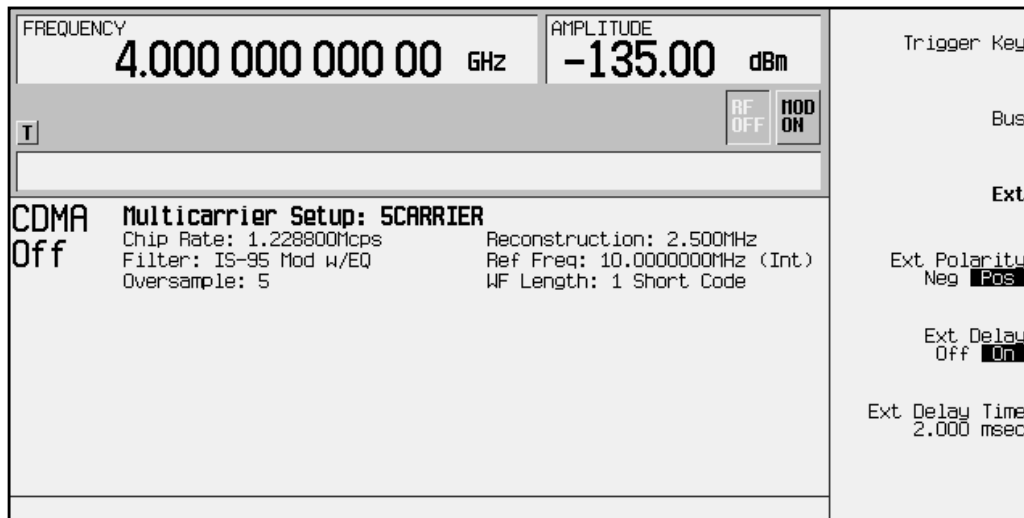
## 8. Set the external polarity to Positive.

To set the external polarity to Positive, press **Ext Polarity Neg Pos** until **Pos** is highlighted, as shown in the following figure. The waveform will now trigger when it detects a change in TTL state from low to high at the PATTERN TRIG IN rear panel connector.



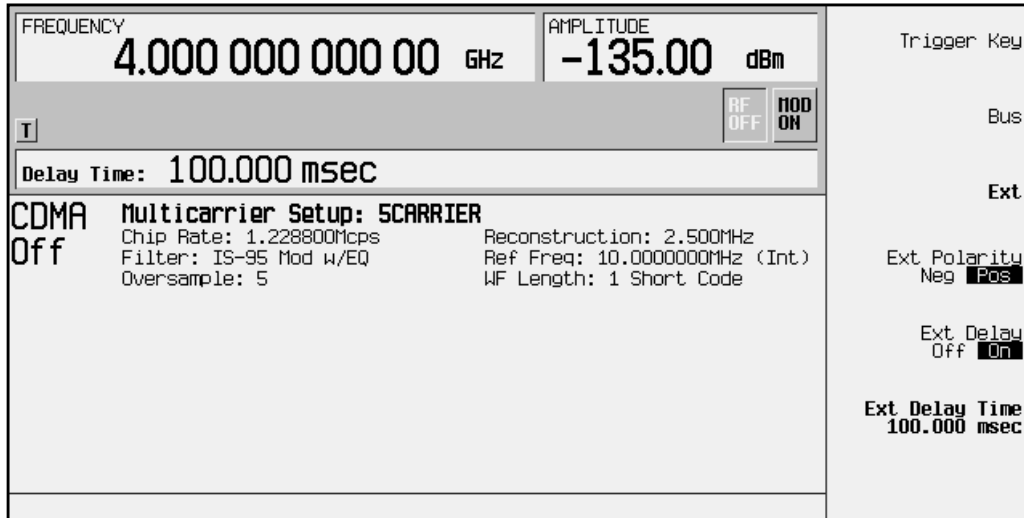
## 9. Activate the external delay.

To activate the external delay, press **Ext Delay Off On** until **On** is highlighted, as shown in the following figure. The waveform will now trigger after the 0defined delay time.



10. Set the external delay time to 100 msec.

To set the external delay time, press **Ext Delay Time**. Using the numeric keypad, enter 100 and terminate your entry with the **msec** softkey, as shown in the following figure. The waveform will now trigger after a 100 msec delay time.



11. Set the function generator to output the triggering stimulus.

Set the function generator to output a 0.1 Hz square wave at an output level of 0 to 5V.

12. Activate the custom multicarrier CDMA waveform.

To activate the recalled custom multicarrier CDMA waveform, press **Mode**, (if you have multiple options, press **Arb Waveform Generator**), **CDMA**, **CDMA Off On** to **On**. The firmware generates the custom multicarrier CDMA waveform in ARB memory. After waveform generation, the custom multicarrier CDMA state is available to be modulated on the RF output.

13. Activate the modulation.

At signal generator preset, **Mod On/Off** is set to **On**. If you did not start this procedure by presetting the signal generator, press **Mod On/Off** to **On**.

---

**NOTE** The RF output amplitude and frequency settings are not saved as part of a custom multicarrier CDMA state file. At signal generator preset (or line power cycle), the RF output frequency is reset to the signal generator's highest specified value and the RF output amplitude is reset to -135 dBm. Before activating the RF output, make adjustments to the RF output frequency and amplitude as required.

---

14. Activate the RF output.

To activate the RF output, press **RF On/Off** to **On**.

## Controlling Waveform Sequence Playback Using Segment Advance Triggering

Using this procedure, you will create and store a 5-tone multitone waveform segment, create and store another 5-tone multitone waveform with modifications, create a sequence containing both waveform segments, and control the sequence playback using segment advance triggering.

### 1. Preset the signal generator.

Press **Preset** to return the signal generator to normal preset conditions.

### 2. Create the first multitone waveform.

Press the front panel **Mode** key. If you have multiple options and the **Arb Waveform Generator** softkey is visible, press it next. Press **Multitone**, **Initialize Table**, **Number of Tones**. Using the numeric keypad, press 5 and terminate your entry with the **Enter** softkey. Modify the frequency spacing to 100 kHz by pressing **Freq Spacing** and using the numeric keypad to enter 100. Terminate your entry with the **kHz** softkey and press **Done**. To generate the multitone waveform in ARB memory, press **Multitone Off On** until **On** is highlighted. You now have a 5-tone multitone waveform, as shown in the following figure.

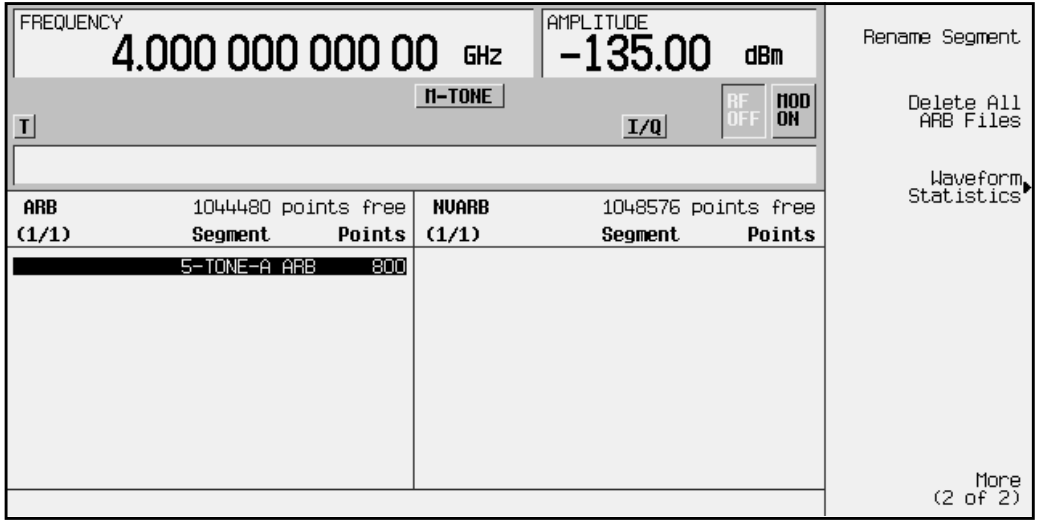
Tone	Freq Offset	Phase	State
1	-200.000 kHz	0	On
2	-100.000 kHz	0	On
3	0.000 kHz	0	On
4	100.000 kHz	0	On
5	200.000 kHz	0	On

**NOTE** At this point, the multitone waveform has the default name assigned to all ARB-generated waveforms: `AUTOGEN_WAVEFORM`. Follow the instructions in the next step to rename the waveform.

### 3. Rename the first multitone waveform in ARB memory.

Press the front panel **Mode** key. If you have multiple options and the **Arb Waveform Generator** softkey is visible, press it next. Press **Dual ARB**, **Waveform Segments**. Highlight the `AUTOGEN_WAVEFORM` segment. Press **More (1 of 2)**, **Rename Segment**, **Editing Keys**, **Clear Text**.

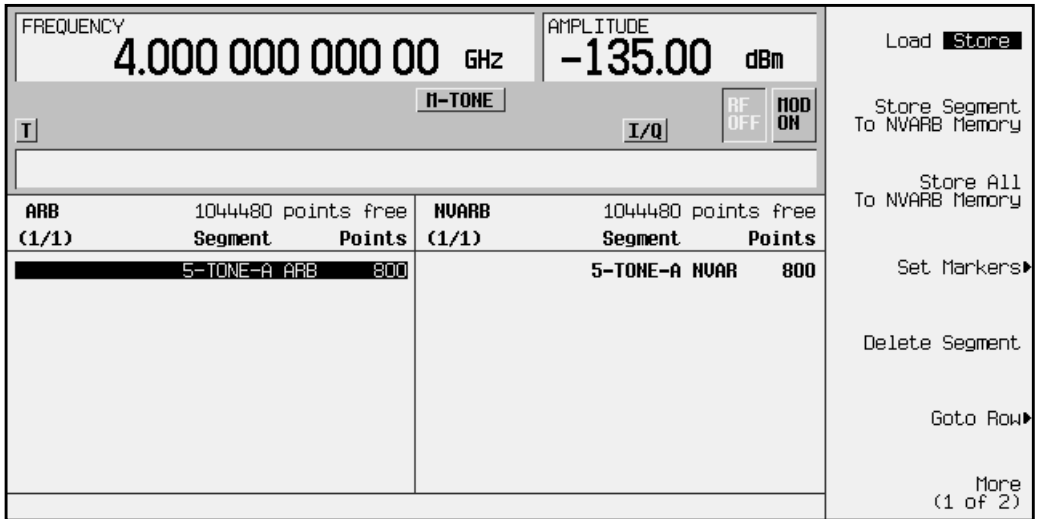
Using the file naming softkeys, name the file 5-TONE-A and terminate your entry with the Enter softkey. You now have the multitone waveform 5-TONE-A in ARB memory, as shown in the following figure.



**NOTE** The following step, 4. Store the 5-TONE-A waveform to NVARB memory, is not necessary, though it is good practice to store waveforms to non-volatile ARB (NVARB) memory to insure that they are not erased if the signal generator’s line power is cycled.

**4. Store the 5-TONE-A waveform to NVARB memory.**

To store the 5-TONE-A waveform to NVARB memory, press **More (2 of 2)**, **Store Segment To NVARB Memory**. The 5-TONE-A waveform has now been copied to NVARB memory, as shown in the following figure.



## Using Arbitrary Waveform Generator Triggers

## 5. Create the second multitone waveform.

Press the front panel **Mode** key. If you have multiple options and the **Arb Waveform Generator** softkey is visible, press it next. Press **Multitone**. Using the arrow keys or the front-panel knob, highlight the number 2 tone and press **Toggle State**. This turns off the number 2 tone. Using the arrow keys or the front-panel knob, highlight the number 4 tone and press **Toggle State**. This turns off the number 4 tone. Press **Apply Multitone**. (Because **Multitone Off On** is still set to **On**, this regenerates the multitone waveform using the changes made to the existing multitone waveform and stores it in ARB memory under the file name `AUTOGEN_WAVEFORM.`) You now have a 5-tone multitone waveform with tone 2 and tone 4 set to **Off**, as shown in the following figure.

The screenshot displays the Multitone Setup screen with the following parameters:

- FREQUENCY:** 4.000 000 000 00 GHz
- AMPLITUDE:** -135.00 dBm
- Multitone Off On:** On
- RF OFF / MOD ON:** MOD ON
- Multitone Setup: default (UNSTORED)**

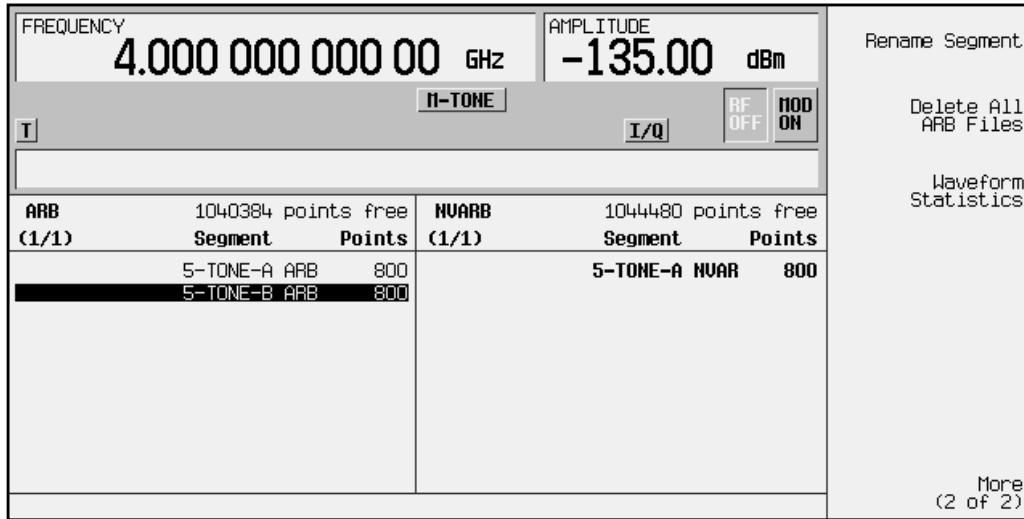
Tone	Freq Offset	Phase	State
1	-200.000 kHz	0	On
2	-100.000 kHz	0	Off
3	0.000 kHz	0	On
4	100.000 kHz	0	Off
5	200.000 kHz	0	On

Additional screen elements include: Initialize Table, Edit Phase, Toggle State, Apply Multitone, Goto Row, and More (1 of 2).



6. Rename the second multitone waveform.

Press the front panel **Mode** key. If you have multiple options and the **Arb Waveform Generator** softkey is visible, press it next. Press **Dual ARB, Waveform Segments**. Using the front-panel knob or the arrow keys, highlight `AUTOGEN_WAVEFORM`, and press **More (1 of 2)**, **Rename Segment, Editing Keys, Clear Text**. Using the file naming softkeys, name the file `5-TONE-B` and terminate your entry with the **Enter** softkey. You now have the modified 5-tone waveform `5-TONE-B` in ARB memory, as shown in the following figure.




---

**NOTE** The following step, 6. *Store the 5-TONE-B waveform to NVARB memory*, is not necessary, though it is good practice to store waveforms to non-volatile ARB (NVARB) memory to insure that they are not erased if the signal generator’s line power is cycled.

---

## Using Arbitrary Waveform Generator Triggers

## 7. Store the 5-TONE-B waveform to NVARB memory.

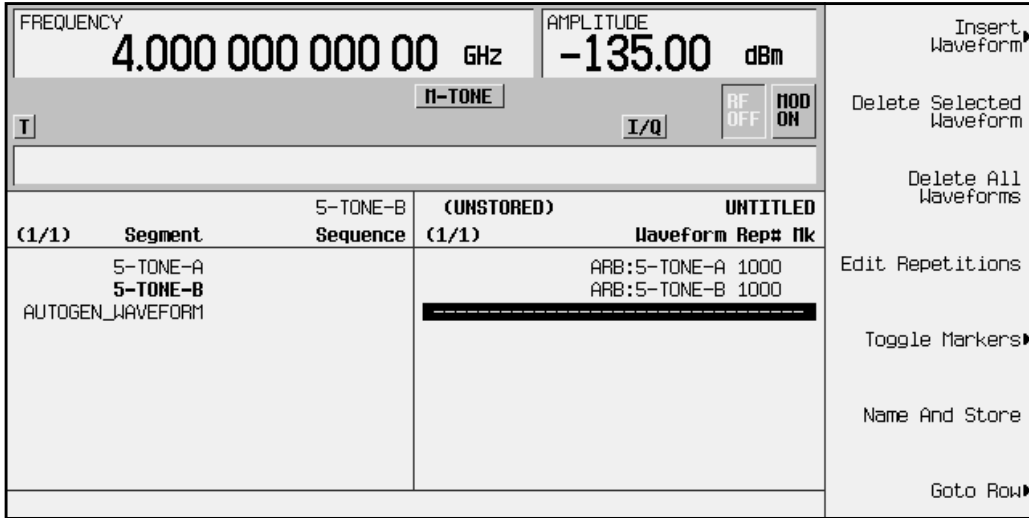
To store the 5-TONE-B waveform to NVARB memory, press **More (2 of 2)**, **Store Segment To NVARB Memory**. The 5-TONE-B waveform has now been copied to NVARB memory, as shown in the following figure.

FREQUENCY <b>4.000 000 000 00</b> GHz		AMPLITUDE <b>-135.00</b> dBm		Load <b>Store</b>	
II-TONE		I/Q		RF OFF <b>MOD ON</b>	
ARB (1/1) 1040384 points free		NVARB (1/1) 1040384 points free		Store Segment To NVARB Memory	
Segment Points		Segment Points		Store All To NVARB Memory	
5-TONE-A ARB 800		5-TONE-A NVAR 800		Set Markers▶	
5-TONE-B ARB 800		5-TONE-B NVAR 800		Delete Segment	
				Goto Row▶	
				More (1 of 2)	

## 8. Create a sequence using the 5-TONE-A and 5-TONE-B waveform segments.

Press the front panel **Mode** key. If you have multiple options and the **Arb Waveform Generator** softkey is visible, press it next. Press **Dual ARB**, **Waveform Sequences**, **Build New Waveform Sequence**, **Insert Waveform**. Use the arrow keys or the front-panel knob to highlight the 5-TONE-A waveform segment. Press **Insert Selected Waveform**. This loads one repetition of the 5-TONE-A waveform segment into the sequencer. Use the arrow keys or the front-panel knob to highlight the 5-TONE-B waveform segment. Press **Insert Selected Waveform**. This loads one repetition of the 5-TONE-B waveform segment into the sequencer. Press **Done Inserting**. One repetition of the 5-TONE-B waveform segment is now programmed to follow the 5-TONE-A waveform segment in the sequence. Highlight the 5-TONE-A waveform segment. Press **Edit Repetitions**. Using the numeric keypad, enter 1000 and press **Enter**. This programs the sequencer to play the 5-TONE-A waveform segment 1000 times before playing the 5-TONE-B waveform segment. Highlight the 5-TONE-B waveform segment. Press **Edit Repetitions**. Using the numeric keypad, enter 1000 and press **Enter**. This programs the sequencer to play the 5-TONE-B waveform

segment 1000 times before playing the 5-TONE-A waveform segment again. You now have a sequence designed to play each waveform segment 1000 times, as shown in the following figure.

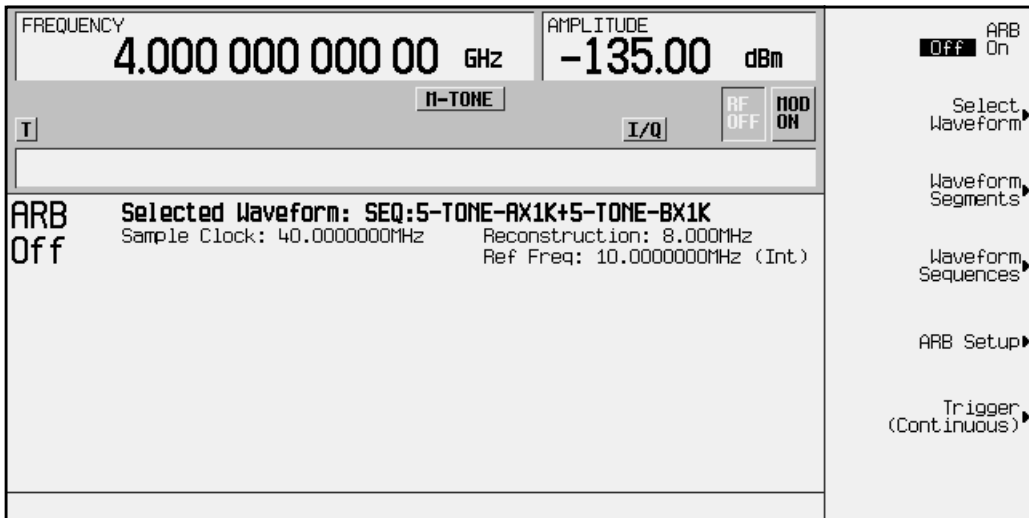


9. Name and store the sequence.

Press **Name and Store**. Use the file naming softkeys and the numeric keypad to name the sequence 5-TONE-AX1K+5-TONE-BX1K. Terminate your entry by pressing **Enter**.

10. Select the sequence 5-TONE-AX1K+5-TONE-BX1K for playback.

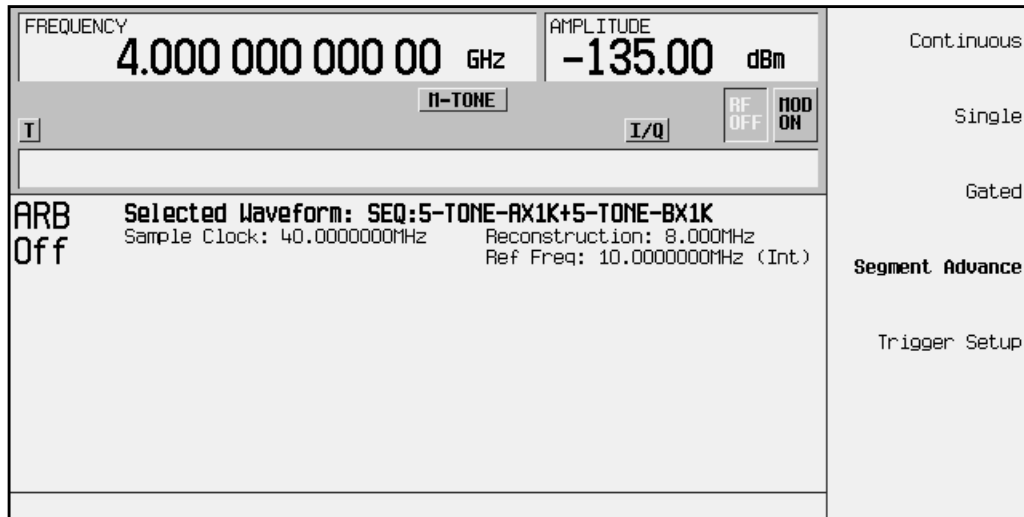
Press the front panel **Mode** key. If you have multiple options and the **Arb Waveform Generator** softkey is visible, press it next. Press **Dual ARB**, **Select Waveform**. Using the front-panel knob or the arrow keys, highlight the sequence 5-TONE-AX1K+5-TONE-BX1K and press **Select Waveform (\*NONE\*)**. The sequence is now ready for playback, as shown in the following figure.



## Using Arbitrary Waveform Generator Triggers

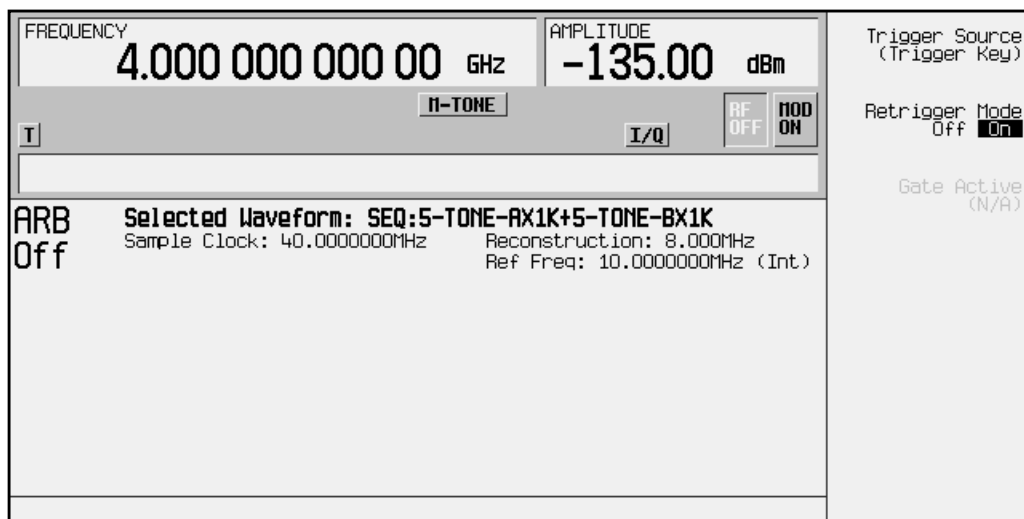
## 11. Set the trigger to Segment Advance.

Press **Trigger**, **Segment Advance**. This will program the sequencer to stop the playback of the current waveform segment and start the playback of the next waveform segment in the sequence when a trigger is received from the trigger source, as shown in the following figure.



## 12. Set the trigger source to Trigger Key.

Press **Trigger Setup**, **Trigger Source**, **Trigger Key**. This will program the sequencer to stop the playback of the current waveform segment and start the playback of the next waveform segment in the sequence when the front panel **Trigger** hardkey is pressed, as shown in the following figure.



## 13. Set the RF output frequency.

Press **Frequency** and enter the your desired RF output frequency.

**14. Set the RF output amplitude.**

Press **Amplitude** and enter the your desired RF output amplitude.

**15. Activate the modulation.**

At signal generator preset, **Mod On/Off** is set to **On**. If you did not start this procedure by presetting the signal generator, press **Mod On/Off** to **On**.

**16. Connect a spectrum analyzer to the signal generator's RF output.**

Connect the signal analyzer's input to the output of the signal generator and adjust the display until you can comfortably observe the complete output of the signal generator's first waveform segment.

**17. Activate the RF output.**

To activate the RF output, press **RF On/Off** to **On**.

**18. Activate the sequence.**

Press the front panel **Mode** key. If you have multiple options and the **Arb Waveform Generator** softkey is visible, press it next. Press **Dual ARB**, then **ARB Off On** until **On** is highlighted. Observe the first waveform (5-TONE-A) in the sequence is now playing.

**19. Advance the sequence to the next waveform segment.**

Press the front panel **Trigger** hardkey. Observe the second waveform segment in the sequence (5-TONE-B) is now playing. Continually pressing the front panel **Trigger** hardkey will cycle through the two waveform segments.

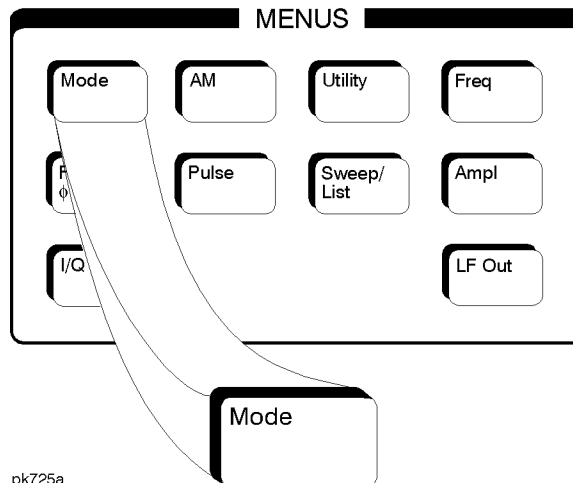
**Using Arbitrary Waveform Generator Triggers**

## 3 Softkey Reference

The following section describes the **Mode** hardkey and the associated softkeys that are used to activate functions specific to the dual arbitrary waveform generator (Option UND).

## Mode Key

Pressing the front-panel **Mode** key accesses a menu of softkeys. Option UN5 provides the softkeys which allow you to access a dual arbitrary waveform generator, a **cdmaOne**<sup>TM</sup> waveform generator, a multitone waveform generator, and an AWGN waveform generator. If you have multiple options and the **Arb Waveform Generator** softkey is visible, press it and then press **CDMA** to access the **cdmaOne**<sup>TM</sup> waveform generator. If you have only Options UN5 and UN5, after pressing the **Mode** hardkey, your first menu is the **Dual ARB**, **CDMA**, **Multitone** and **AWGN** softkeys. This chapter assumes that the **CDMA**, **Dual ARB**, **Multitone**, and **AWGN** softkeys are in the first menu. These softkeys are described in alphabetical order in this chapter (separated into four sections: AWGN, CDMA, Dual ARB, and Multitone). The SCPI commands that duplicate these softkeys remotely are also provided in this section.



pk725a



---

## AWGN (Additive White Gaussian Noise)

Pressing this softkey accesses a menu of softkeys for operating the AWGN waveform generator. Using the softkeys contained within these menus, you will be able to generate additive white gaussian noise waveforms.

### 16384

Press this softkey to set the length of the AWGN waveform to 16384 points.

Softkey Location: Press **Mode**, **AWGN**, **Waveform Length**, **16384**

SCPI Commands:

```
[ :SOURce]:RADio:AWGN:ARB:LENGth 16384  
[ :SOURce]:RADio:AWGN:ARB:LENGth?
```

### 32768

Press this softkey to set the length of the AWGN waveform to 32768 points.

Softkey Location: Press **Mode**, **AWGN**, **Waveform Length**, **32768**

SCPI Commands:

```
[ :SOURce]:RADio:AWGN:ARB:LENGth 32768  
[ :SOURce]:RADio:AWGN:ARB:LENGth?
```

### 65536

Press this softkey to set the length of the AWGN waveform to 65536 points.

Softkey Location: Press **Mode**, **AWGN**, **Waveform Length**, **65536**

SCPI Commands:

```
[ :SOURce]:RADio:AWGN:ARB:LENGth 65536  
[ :SOURce]:RADio:AWGN:ARB:LENGth?
```

## 131072

Press this softkey to set the length of the AWGN waveform to 131072 points.

Softkey Location: Press **Mode**, **AWGN**, **Waveform Length**, **131072**

SCPI Commands:

```
[ :SOURce ]:RADio:AWGN:ARB:LENGth 131072  
[ :SOURce ]:RADio:AWGN:ARB:LENGth?
```

## 262144

Press this softkey to set the length of the AWGN waveform to 262144 points.

Softkey Location: Press **Mode**, **AWGN**, **Waveform Length**, **262144**

SCPI Commands:

```
[ :SOURce ]:RADio:AWGN:ARB:LENGth 262144  
[ :SOURce ]:RADio:AWGN:ARB:LENGth?
```

## 524288

Press this softkey to set the length of the AWGN waveform to 524288 points.

Softkey Location: Press **Mode**, **AWGN**, **Waveform Length**, **524288**

SCPI Commands:

```
[ :SOURce ]:RADio:AWGN:ARB:LENGth 524288  
[ :SOURce ]:RADio:AWGN:ARB:LENGth?
```

## 1048576

Press this softkey to set the length of the AWGN waveform to 1048576 points.

Softkey Location: Press **Mode**, **AWGN**, **Waveform Length**, **1048576**

SCPI Commands:

```
[ :SOURce ]:RADio:AWGN:ARB:LENGth 1048576  
[ :SOURce ]:RADio:AWGN:ARB:LENGth?
```

## AWGN Off On

Press this softkey to toggle the operating state of the AWGN waveform generator.

Status after Normal Preset: Off

Softkey Location: Press **Mode**, **AWGN**, **AWGN Off On**

SCPI Commands:

```
[ :SOURce]:RADio:AWGN:ARB[:STATe] ON|OFF|1|0  
[:SOURce]:RADio:AWGN:ARB[:STATe]?
```

## Bandwidth

Press this softkey to adjust the bandwidth of the AWGN waveform.

Softkey Location: Press **Mode**, **AWGN**, **Bandwidth**

Status after Normal Preset: 1.000000 MHz

SCPI Commands:

```
[ :SOURce]:RADio:AWGN:ARB:BWIDth <value>  
[:SOURce]:RADio:AWGN:ARB:BWIDth?
```

## Noise Seed Fixed Random

Press this softkey to toggle the AWGN waveform noise seed between a fixed value or a randomly generated value. Using a fixed seed will generate the same waveforms each time.

Status after Normal Preset: Fixed

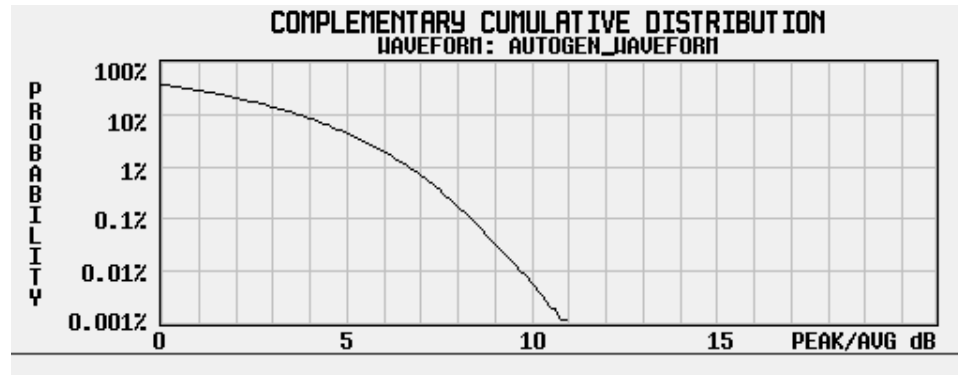
Softkey Location: Press **Mode**, **AWGN**, **Noise Seed Fixed Random**

SCPI Commands:

```
[ :SOURce]:RADio:AWGN:ARB:SEED FIXed|RANdOm  
[:SOURce]:RADio:AWGN:ARB:SEED?
```

## Plot CCDF

Press this softkey to display a plot of the Complementary Cumulative Distribution Function for the active AWGN waveform. The plot displays the probability that the instantaneous envelope power is  $x$  dB above the average power, where  $x$  is the number on the horizontal axis.



Softkey Location: Press **Mode**, **AWGN**, **Waveform Statistics**, **Plot CCDF**

## Waveform Length

Press this softkey to open a menu of waveform length choices; the longer the waveform, the better the statistics (at the expense of memory usage).

Softkey Location: Press **Mode**, **AWGN**, **Waveform Length**

SCPI Commands:

```
[ :SOURce ] :RADio :AWGN :ARB :LENGth <value>  
[ :SOURce ] :RADio :AWGN :ARB :LENGth?
```

## Waveform Statistics

Press this softkey to display the Waveform Statistics Menu. The softkey is active when **AWGN Off On** is set to **On**.

Softkey Location: Press **Mode**, **AWGN**, **Waveform Statistics**

---

## CDMA

Pressing this softkey accesses a menu of softkeys for generating data patterns that are formatted into a structure defined by the **cdmaOne™** protocol, commonly known as IS-95.

signal generators with Options UND and UN5 can provide five different predefined CDMA setups (pilot, 9-channel, 32-channel, 64-channel forward, and reverse) with four different forward channel types (pilot, traffic, paging, and sync) and one reverse channel type (traffic). IS-95 filtering options are also provided, as well as the ability to create, apply and store user-defined FIR filters.

Custom CDMA channel setups include five, independently variable parameters: channel type, Walsh code, power, PN offset, and data (inserted before the Walsh code sequence for forward setups and at the short code sequence for the reverse setup).

Custom multicarrier CDMA channel setups include three, independently variable parameters: carrier type, frequency offset, and power.

This CDMA menu is only available if both Option UND and Option UN5 have been installed. These softkeys are described in this section in alphabetical order.

### 250.0 kHz

Press this softkey to select a reconstruction filter with a cutoff frequency of 250.0 kHz.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Reconstruction Filter**, **250.0 kHz**

SCPI Commands:

```
[ :SOURce]:RADio:ARB:RFILter 250.0 kHz
```

```
[ :SOURce]:RADio:ARB:RFILter?
```

### 2.500 MHz

Press this softkey to select a reconstruction filter with a cutoff frequency of 2.500 MHz.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Reconstruction Filter**, **2.500 MHz**

SCPI Commands:

```
[ :SOURce]:RADio:ARB:RFILter 2.5 MHz
```

```
[ :SOURce]:RADio:ARB:RFILter?
```

## 8.000 MHz

Press this softkey to select a reconstruction filter with a cutoff frequency of 8.000 MHz.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Reconstruction Filter**, **8.000 MHz**

SCPI Commands:

```
[ :SOURce ] :RADio :ARB :RFILter 8.0 MHz
```

```
[ :SOURce ] :RADio :ARB :RFILter ?
```

## 9 Ch Fwd

Press this softkey to select a standard, forward 9 channel CDMA setup.

Using this setup, the signal generator will transmit a 9 channel CDMA signal for forward transmission (base-to-mobile communication direction). Channel 1 is a pilot channel, channel 2 is a paging channel, channels 3 through 8 are traffic channels, and channel 9 is a sync channel. (These channel numbers are *not* equivalent to the Walsh code number.)

To view other channel characteristics, including Walsh code, power, PN offset, data, and total power, press **Mode**, **CDMA**, **Setup Select**, **9 Ch Fwd** (to select the type of CDMA transmission) and then press **CDMA Define**, **Edit Channel Setup** to view the individual channel characteristics. Using the CDMA channel setup table editor, you can customize individual channel types and adjust and display the code domain power of the original 9 channel forward CDMA selection. Once adjusted, the setup select is designated 9 Ch Fwd.

Softkey Location: Press **Mode**, **CDMA**, **Setup Select**, **9 Ch Fwd**

SCPI Commands:

```
[ :SOURce ] :RADio :CDMA :ARB :SETup FWD9
```

```
[ :SOURce ] :RADio :CDMA :ARB :SETup ?
```

## 32 Ch Fwd

Press this softkey to select a standard, forward 32 channel CDMA setup.

Using this setup, the signal generator will transmit a 32 channel CDMA signal for forward transmission (base-to-mobile communication direction). Channel 1 is a pilot channel, channel 2 is a paging channel, channels 3 through 26 and channels 28 through 32 are traffic channels, and channel 27 is a sync channel. (These channel numbers are *not* equivalent to the Walsh code number.)

To view other channel characteristics, including Walsh code, power, PN offset, data, and total power, press **Mode**, **CDMA**, **Setup Select**, **32 Ch Fwd** (to select the type of CDMA transmission) and then press **CDMA Define**, **Edit Channel Setup** to view the individual channel characteristics. Using the CDMA channel setup table editor, you can customize individual channel types and adjust and display the code domain power of the original 32 channel forward CDMA selection. Once adjusted, the setup select is designated 32 Ch Fwd.

**Softkey Location:** Press **Mode**, **CDMA**, **Setup Select**, **32 Ch Fwd**

**SCPI Commands:**

```
[ :SOURCE ]:RADio:CDMA:ARB:SETup FWD32
```

```
[ :SOURCE ]:RADio:CDMA:ARB:SETup?
```

## 64 Ch Fwd

Press this softkey to select a standard, forward 64 channel CDMA setup.

Using this setup, the signal generator will transmit a 64 channel CDMA signal set independently for forward transmission (base-to-mobile communication direction). Channel 1 is a pilot channel, channels 2 through 8 are paging channels, channels 9 through 32 and channels 34 through 64 are traffic channels, and channel 33 is a sync channel. (These channel numbers are *not* equivalent to the Walsh code number.)

To view other channel characteristics, including Walsh code, power, PN offset, data, and total power, press **Mode**, **CDMA**, **Setup Select**, **64 Ch Fwd** (to select the type of CDMA transmission) and then press **CDMA Define**, **Edit Channel Setup** to view the individual channel characteristics. Using the CDMA channel setup table editor, you can customize individual channel types and adjust and display the code domain power of the original 64 channel forward CDMA selection. Once adjusted, the setup select is designated 64 Ch Fwd.

**Softkey Location:** Press **Mode**, **CDMA**, **Setup Select**, **64 Ch Fwd**

**SCPI Commands:**

```
[ :SOURce ] :RADio :CDMA :ARB :SETup FWD64  
[ :SOURce ] :RADio :CDMA :ARB :SETup ?
```

## Adjust Code Domain Power

Press this softkey to access a menu that allows you to adjust the code domain power (the relative power in each of the channels) to IS-97 Levels, Equal Powers (all channels are of equal power and the total power equals 0 dB), Scale to Zero (scale all of the current channel powers so that the total power equals 0 dB while keeping the previous power ratios between the individual channels). After making adjustments, you may view a graphical representation of the code domain power by pressing **Display Code Domain Power**.

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Edit Channel Setup**, **Adjust Code Domain Power**

**SCPI Commands:**

```
[ :SOURce ] :RADio :CDMA :ARB :SETup :CHANnel IS95 | EQUAl | SCALe |  
NONE , PILOt | SYNC | PAGing | TRAFFic , <walsh_value> ,  
<power_value> , <pnofs_value> , RANDom | <data_value>  
{ , PILOt | SYNC | PAGing | TRAFFic , <walsh_value> , <power_value> ,  
<pnofs_value> , RANDom | <data_value> }  
[ :SOURce ] :RADio :CDMA :ARB :SETup :CHANnel ?
```



## Apply Channel Setup

Press this softkey to apply the changes made to the CDMA channel setup using the CDMA channel setup table editor (accessed by pressing the **Edit Channel Setup** softkey). If **CDMA Off On** is set to **On**, then the new channel data is used to generate a new modulation waveform in ARB waveform memory.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Apply Channel Setup**

## Apply Multicarrier

Press this softkey to apply the changes made to the multicarrier CDMA setup using the Multicarrier CDMA Setup table editor (accessed by pressing the **Multicarrier Define** softkey). If **Multicarrier Off On** is **On**, then the new multicarrier data is used to generate a new CDMA waveform in volatile waveform memory when **CDMA Off On** is set to **On**.

Softkey Location: Press **Mode**, **CDMA**, **Multicarrier Define**, **Apply Multicarrier**

## ARB Reference Ext Int

Press this softkey to select either an internal or an external reference for the waveform clock. If you choose external, you must enter the reference frequency (see **Reference Freq** key) and the signal must be applied to the BASEBAND GEN REF IN connector.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **More (1 of 2)**, **ARB Reference Ext Int**

Status after Normal Preset: Int

SCPI Commands:

```
[ :SOURce]:RADio:ARB:CLOCK:REFerence[ :SOURce] INTernal |
EXTernal
```

```
[ :SOURce]:RADio:ARB:CLOCK:REFerence[ :SOURce]?
```

## Bus

Press this softkey to set the trigger source to bus. When the trigger source is set to bus, the signal generator will trigger an event when it receives the appropriate command via HP-IB.

---

### NOTE

---

For trigger availability information, see the **Trigger** softkey definition.

Softkey Location: Press **Mode**, **CDMA**, **More (1 of 2)**, **Trigger**, **Trigger Setup**, **Trigger Source**, **Bus**

SCPI Commands:

```
[ :SOURce]:RADio:CDMA:ARB:TRIGger[ :SOURce] BUS
[ :SOURce]:RADio:CDMA:ARB:TRIGger[ :SOURce]?
```

## CDMA Define

Press this softkey to access a menu for defining CDMA signal parameters such as channel setup, filter adjustments, oversample ratio, chip rate, and reconstruction filter parameters.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**

## CDMA Off On

Press this softkey to enable the CDMA capability. Setting **CDMA Off On** to **On** sets up the internal hardware to generate the currently selected CDMA signal. The **CDMA** and **I/Q** annunciators are turned on in the display. Although the digital modulation is enabled with this softkey, the signal modulates the RF carrier only after you have set **Mod On/Off** to **On**.

Setting **CDMA 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**, **CDMA**, **CDMA Off On**

Status after Normal Preset: **Off**

SCPI Commands:

```
[ :SOURce ] :RADio :CDMA :ARB [ :STATe ] ON | OFF | 1 | 0
```

```
[ :SOURce ] :RADio :CDMA :ARB [ :STATe ] ?
```

## Chip Rate

Press this softkey to set the chip rate to any value from 10 cps to 20 Mcps (using a 2 times oversample rate). 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 **Mcps**, **kcps**, or **cps** terminator softkey.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Chip Rate**

Status after Normal Preset: 1.228800 Mcps

SCPI Commands:

```
[ :SOURce ] :RADio :CDMA :ARB :CRATe <value>
```

```
[ :SOURce ] :RADio :CDMA :ARB :CRATe ?
```

## Continuous

Press this softkey to set the CDMA trigger type to continuous. In continuous trigger mode, the CDMA waveform will repeat itself indefinitely.

---

**NOTE**

---

For trigger availability information, see the **Trigger** softkey definition.

**Softkey Location:** Press **Mode**, **CDMA**, **More (1 of 2)**, **Trigger**, **Continuous**

**SCPI Commands:**

```
[ :SOURce]:RADio:CDMA:ARB:TRIGger:TYPE CONT
[ :SOURce]:RADio:CDMA:ARB:TRIGger:TYPE?
```

## Custom CDMA State

Press this softkey to display the CDMA Setup Select File menu. From this menu, you can choose a custom CDMA setup that has previously been defined and stored in the signal generator's memory. Use the front-panel knob, arrow keys, or the data entry keypad to highlight the desired CDMA state file, then press **Select File** to activate the custom CDMA state.

**Softkey Location:** Press **Mode**, **CDMA**, **Setup Select**, **Custom CDMA State**

**SCPI Commands:**

```
[ :SOURce]:RADio:CDMA:ARB:Setup "<file name>"
[ :SOURce]:RADio:CDMA:ARB:Setup?
```

## Custom CDMA Carrier

With **Multicarrier Off On** set to **On**, press this softkey to display the Multicarrier CDMA (MCDMA) memory catalog. From this catalog listing, you can choose a custom CDMA carrier setup that has previously been defined and stored in the signal generator's memory. Use the front-panel knob, arrow keys, or the numeric keypad to highlight the desired CDMA state file, then press **Select File** to activate the custom CDMA state.

**Softkey Location:** Press **Mode**, **CDMA**, **Setup Select**, **Custom CDMA Carrier**

**SCPI Commands:**

```
[ :SOURce]:RADio:CDMA:ARB:Setup:MCARrier "<file name>"
[ :SOURce]:RADio:CDMA:ARB:Setup:MCARrier?
```

## Define User FIR

Press this softkey to access a table editor for creating and modifying FIR filters. The FIR table editor allows a maximum filter length of 1024 taps with a maximum oversampling ratio of 32. An FIR filter selected for use in CDMA, however, cannot have more than 256 taps so the number of symbols and the oversample ratio should be selected accordingly. Example of using the FIR table editor are provided in the "Using Functions" chapter.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**

SCPI Commands:

```
MEMory:DATA:FIR "<file name>",  
osr,coefficient{,coefficient}  
  
MEMory:DATA:FIR? "<file name>"
```

## Delete All Rows

Press this softkey to delete all rows in any of the table editors. Deletions cannot be recovered.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Edit Channel Setup**, **More (1 of 2)**, **Delete All Rows**

Or press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **More (1 of 2)**, **Delete All Rows**

## Delete File

Press this softkey to delete a file in the catalog listing. Scroll through the catalog of files and when the desired file is highlighted, press the **Delete File**. Be certain that you want to delete the file; you cannot recover the file once you subsequently press **Confirm Delete**. If you do not wish to delete the file, press the **Return** key.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Store Custom CDMA State**, **Delete File**

Or press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **More (1 of 2)**, **Load/Store**, **Delete File**

## Delete Row

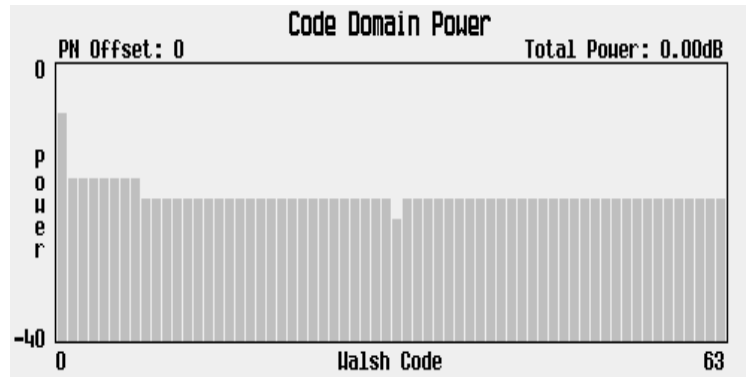
Press this softkey to delete the highlighted row in the table. Deletions cannot be recovered.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Edit Channel Setup**, **Delete Row**

Or press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **Delete Row**

## Display Code Domain Power

Press this softkey to display a graphical representation of the code domain power. (An example of the display is shown here.) Power (in decibels) is represented on the y-axis and Walsh Code is represented on the x-axis.



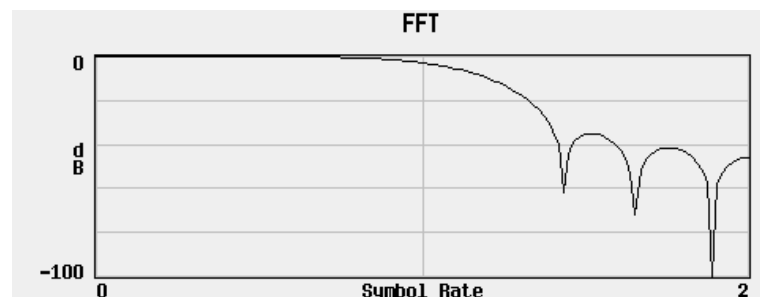
The table represents the code domain power as a graph of the relationship between power in each channel (-40 to 0 dB) versus Walsh code (0 to highest code used in setup). Total code domain power is displayed above the graph.

If there is channel data assigned to more than one PN offset, turning the front-panel knob will display the code-domain power for each PN offset.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Edit Channel Setup**, **Display Code Domain Power**

## Display FFT

Press this softkey to display a graphical representation of the frequency response of the filter loaded into the FIR table editor (calculated using a fast Fourier transform). The following is an example of the frequency response of a Root Nyquist filter with an oversample ratio of 4.

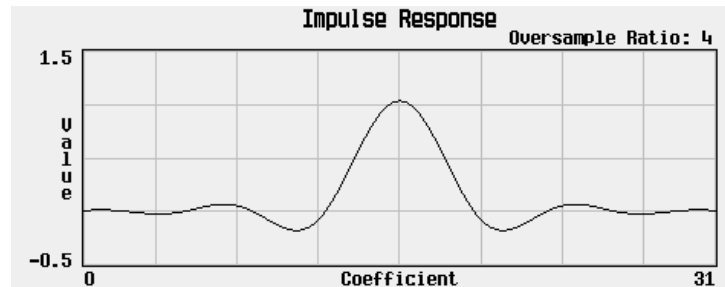


To return to the FIR table editor and the menu keys, press **Return**.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **More (1 of 2)**, **Display FFT**

## Display Impulse Response

Press this softkey to display a graphical representation of impulse response in time of the filter loaded into the FIR table editor. The following is an example of the impulse response of a Root Nyquist filter with an oversample ratio of 4.



To return to the FIR table editor and the menu keys, press Return.

Softkey Location: Press Mode, CDMA, CDMA Define, Filter, Define User FIR, More (1 of 2), Display Impulse Response

## Edit Channel Setup

Press this softkey to access a table editor used to define the channel parameters of the CDMA signal. These parameters include code domain power, and individual channel type, Walsh code, power, PN offset, and data. An example of the display is shown here.

FREQUENCY		AMPLITUDE				
890.010 000 00 MHz		-10.00 dBm				
CDMA		I/Q		RF ON MOD ON		
CDMA Channel Setup						
					Total Power: 0.00dB	
Type	Walsh	Power	PN Offs	Data		
1	Pilot	0	-7.00 dB	0	00000000	Adjust Code Domain Power
2	Paging	1	-16.39 dB	0	RANDOM	
3	Paging	2	-16.39 dB	0	RANDOM	
4	Paging	3	-16.39 dB	0	RANDOM	Display Code Domain Power
5	Paging	4	-16.39 dB	0	RANDOM	
6	Paging	5	-16.39 dB	0	RANDOM	
7	Paging	6	-16.39 dB	0	RANDOM	
8	Paging	7	-16.39 dB	0	RANDOM	Goto Row
9	Traffic	8	-19.39 dB	0	RANDOM	
10	Traffic	9	-19.39 dB	0	RANDOM	More (1 of 2)

Use the front-panel knob or the arrow keys to move the cursor within the table structure and the data input keypad to change values contained in the table.

You can insert one or more pilot, sync, paging or traffic channels by pressing the **Insert Row** softkey. When you have finished setting up new channel types, press the **Return** hardkey to go back to the main CDMA Channel Setup editor window.

You can move quickly through a large table using the keys found beneath the **Goto Row** softkey.

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Edit Channel Setup**

**SCPI Commands:**

```
[ :SOURce]:RADio:CDMA:ARB:SETup:CHANnel IS97|EQUal|SCALE|
NONE,PILot|SYNC|PAGing|TRAFfic,<walsh_value>,
<power_value>,<pnofs_value>,RANDom|<data_value> {,PILot|
SYNC|PAGing|TRAFfic,<walsh_code>,<power_value>,
<pnofs_value>,RANDom|<data_value>}

[:SOURce]:RADio:CDMA:ARB:SETup:CHANnel?
```

## Edit Item

Press this softkey to change the highlighted item in the displayed table.

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Edit Channel Setup**, **Edit Item**

Or press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **Edit Item**

## Equal Powers

Press this softkey to set the channel power levels to a state where all channels are of equal power and the total power equals 0 dBm.

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Edit Channel Setup**, **Adjust Code Domain Power**, **Equal Powers**

**SCPI Commands:**

```
[ :SOURce]:RADio:CDMA:ARB:SETup:CHANnel
EQUal,PILot|SYNC|PAGing|TRAFfic,<walsh_value>,
<power_value>,<pnofs_value>,RANDom|<data_value> {,PILot|
SYNC|PAGing|TRAFfic,<walsh_code>,<power_value>,
<pnofs_value>,RANDom|<data_value>}

[:SOURce]:RADio:CDMA:ARB:SETup:CHANnel?
```

## Ext

Press this softkey to set the trigger source to external triggering. When the trigger source is set to external, the signal generator will trigger an event when it receives the appropriate signal via the PATTERN TRIG IN connector.

---

**NOTE**

---

For trigger availability information, see the **Trigger** softkey definition.

**Softkey Location:** Press **Mode**, **CDMA**, **More (1 of 2)**, **Trigger**, **Trigger Setup**, **Trigger Source**, **Ext**

**SCPI Commands:**

```
[ :SOURce ]:RADio:CDMA:ARB:TRIGger[ :SOURce] EXT  
[ :SOURce ]:RADio:CDMA:ARB:TRIGger[ :SOURce]?
```

## Ext Polarity Neg Pos

Press this softkey to set the external trigger source polarity to either a positive change or a negative change in signal level. Depending on your choice, the signal generator will trigger an event when it receives the appropriate positive or negative change in signal at the PATTERN TRIG IN connector.

---

**NOTE**

---

For trigger availability information, see the **Trigger** softkey definition.

**Status after Normal Preset:** Neg

**Softkey Location:** Press **Mode**, **CDMA**, **More (1 of 2)**, **Trigger**, **Trigger Setup**, **Trigger Source**, **Ext Polarity Neg Pos**

**SCPI Commands:**

```
[ :SOURce ]:RADio:CDMA:ARB:TRIGger[ :SOURce]:EXTernal:SLOPe  
POSitive|NEGative  
[ :SOURce ]:RADio:CDMA:ARB:TRIGger[ :SOURce]:EXTernal:SLOPe?
```



## Ext Delay Off On

Press this softkey to arm (ON) or disarm (OFF) the external trigger delay. To use external trigger delay, press this softkey until **Ext Delay On** is highlighted, and then set the external delay time by pressing the **Ext Delay Time** softkey.

---

### NOTE

---

For trigger availability information, see the **Trigger** softkey definition.

**Softkey Location:** Press **Mode**, **CDMA**, **More (1 of 2)**, **Trigger**, **Trigger Setup**, **Trigger Source**, **Ext Delay Off On**

**Status after Normal Preset:** Off

**SCPI Commands:**

```
[ :SOURce]:RADio:CDMA:ARB:TRIGger[:SOURce]:EXTernal:DElay:
STATE ON|OFF|1|0
```

```
[ :SOURce]:RADio:CDMA:ARB:TRIGger[:SOURce]:EXTernal:DElay:
STATE?
```

## Ext Delay Time

Press this softkey to set the time for the external trigger delay. External trigger delay may be adjusted to trigger a CDMA waveform at a specified length of time after an external trigger signal has been received at the PATTERN TRIG IN connector. 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 2.0 microseconds through 3600 seconds.

To use external trigger delay, press **Ext Delay Off On** until **On** is highlighted, and then set the external delay time by pressing the **Ext Delay Time** softkey.

---

### NOTE

---

For trigger availability information, see the **Trigger** softkey definition.

**Softkey Location:** Press **Mode**, **CDMA**, **More (1 of 2)**, **Trigger**, **Trigger Setup**, **Trigger Source**, **Ext Delay Time**

**Status after Normal Preset:** 2.000 milliseconds

**SCPI Commands:**

```
[ :SOURce]:RADio:CDMA:ARB:TRIGger[:SOURce]:EXTernal:DElay
<value>
```

```
[ :SOURce]:RADio:CDMA:ARB:TRIGger[:SOURce]:EXTernal:DElay?
```

## Filter

Press this softkey to access menus for selecting a filter type, restoring the default filter, and for defining a unique FIR filter. The Filter menu also lets you adjust the filter alpha (when Nyquist or Root Nyquist filters are selected) or bandwidth time product (for Gaussian filters).

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Filter**

## Filter Alpha

Press this softkey to change the FIR filter's alpha parameter in either the Filter menu or the Load Default FIR menus.

In the Filter menu, the **Filter Alpha** softkey changes the alpha parameter of the selected Root Nyquist or Nyquist filter. 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 0.000 through 1.000.

This key only appears *after* choosing a Root Nyquist or Nyquist filter. If a Gaussian filter is in use, you will see **Filter BbT**. If any other filter is in use, you will see a grayed-out softkey: **Filter Factor N/A**.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Filter Alpha**

Status after Normal Preset: 0.500

SCPI Commands:

```
[ :SOURce ]:RADio:CDMA:ARB:FILTer:ALPHa <value>
```

```
[ :SOURce ]:RADio:CDMA:ARB:FILTer:ALPHa?
```

In the Load Default FIR menus, the **Filter Alpha** softkey changes the alpha parameter of the Root Nyquist or Nyquist filter coefficients loaded into the FIR table editor. After entering the alpha value, press **Generate** to modify the filter coefficients in the table editor.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **More (1 of 2)**, **Load Default FIR**, **Root Nyquist (or Nyquist)**, **Filter Alpha**

Status after Normal Preset: 0.350

## Filter BbT

Press this softkey to change the bandwidth-multiplied-by-bit-time (BbT) filter parameter in either the Filter menu or the Load Default FIR menu.

In the Filter menu, the **Filter BbT** softkey changes the BbT parameter of the selected Gaussian filter. 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 0.000 through 1.000.

This key only appears *after* choosing a Gaussian filter. If a Root Nyquist or Nyquist filter is in use, you will see **Filter Alpha**. If any other filter is in use, you will see a grayed-out softkey: **Filter Factor N/A**.

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Select**, **Gaussian**, **Filter BbT**

**Status after Normal Preset:** 0.500

**SCPI Commands:**

```
[ :SOURce]:RADio:CDMA:ARB:FILTer:BBT <value>
```

```
[ :SOURce]:RADio:CDMA:ARB:FILTer:BBT?
```

In the Load Default FIR menu, the **Filter BbT** softkey changes the BbT parameter of the Gaussian filter coefficients loaded into the FIR table editor. After entering the BbT value, press **Generate** to modify the filter coefficients in the table editor.

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **More (1 of 2)**, **Load Default FIR**, **Gaussian**, **Filter BbT**

**Status after Normal Preset:** 0.300

## Filter Factor N/A

This grayed-out softkey is displayed when a filter is in use that doesn't contain an adjustable alpha or BbT parameter (such as the IS-95 filter selections or a user-defined FIR filter). This softkey changes to either **Filter Alpha** or **Filter BbT** if the appropriate Root Nyquist, Nyquist, or Gaussian filter is selected for use.

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Filter Factor N/A**

## Filter Symbols

Press this softkey to define the number of symbols for the filter to be loaded into the FIR table editor. The FIR table editor allows a maximum filter length of 1024 coefficients with a maximum oversample ratio of 32 and a maximum of 32 symbols. An FIR filter selected for use in CDMA, however, cannot have more than 256 coefficients so the number of symbols and the oversample ratio should be selected accordingly. To change the number of symbols, 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 1 through 32.

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **More (1 of 2)**, **Load Default FIR**, **Root Nyquist (or Nyquist, Gaussian, or Rectangle)**, **Filter Symbols**

**Status after Normal Preset:** 8

## Gate Active N/A

This softkey remains grayed-out until the trigger is set to Gated. Once the trigger has been set to Gated, press **Gate Active Low High** to toggle the polarity of the “through” or active state of a gated trigger signal. Gate Active Low will output the signal while the gate is low at the PATTERN TRIG IN connector. Gate Active High has the opposite effect, outputting the signal while the signal level at the PATTERN TRIG IN connector is in a high state.

---

**NOTE**

---

For trigger availability information, see the **Trigger** softkey definition.

**Softkey Location:** Press **Mode**, **CDMA**, **More (1 of 2)**, **Trigger**, **Trigger Setup**, **Gate Active N/A**

**SCPI Commands:**

```
[ :SOURce ] :RADio :CDMA :ARB :TRIGger :TYPE :GATE :ACTive LOW | HIGH  
[ :SOURce ] :RADio :CDMA :ARB :TRIGger :TYPE :GATE :ACTive ?
```

## Gated

Press this softkey to set the CDMA trigger type to Gated. Using a gated trigger, you can set the signal to output when a TTL high or low is present at the PATTERN TRIG IN connector. To set the gate to trigger on either high or low, press **Gated** and then press **Trigger Setup, Gate Active Low High**.

---

### NOTE

---

For trigger availability information, see the **Trigger** softkey definition.

Softkey Location: Press **Mode, CDMA, More (1 of 2), Trigger, Gated**

SCPI Commands:

```
[ :SOURce]:RADio:CDMA:ARB:TRIGger:TYPE GATE
[ :SOURce]:RADio:CDMA:ARB:TRIGger:TYPE?
```

## Gaussian

Press this softkey to select the Gaussian pre-modulation filter in either the **Select (filter)** menu or the **Load Default FIR** menu.

In the **Select (filter)** menu, pressing the **Gaussian** softkey selects this FIR filter for use in your CDMA setup. The default filter bandwidth-multiplied-by-bit time product (BbT) is automatically set to 0.500. You can change the filter BbT to any value between 0.000 and 1.000 by pressing the **Filter BbT** softkey.

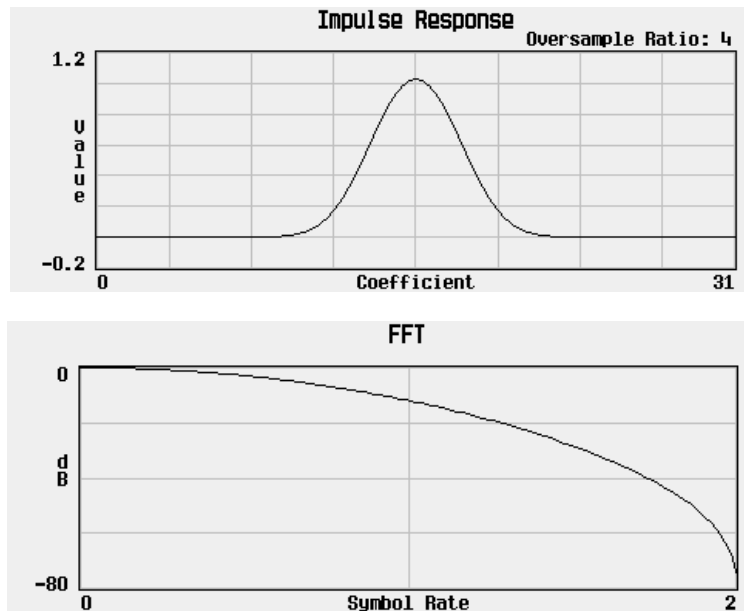
Softkey Location: Press **Mode, CDMA, CDMA Define, Filter, Select, Gaussian**

SCPI Commands:

```
[ :SOURce]:RADio:CDMA:ARB:FILTer GAUSSian
[ :SOURce]:RADio:CDMA:ARB:FILTer?
```

In the **Load Default FIR** menu, pressing the **Gaussian** softkey followed by **Generate** loads the FIR table editor with the coefficient values for the Gaussian filter. The filter BbT and number of filter symbols are defined with the softkeys in this menu. If you change either parameter after loading the filter coefficients, press the **Generate** softkey again to reload the FIR table.

The impulse response and the frequency response of a Gaussian filter with an oversample ratio of 4 are shown in the following graphs.



Softkey Location: Press Mode, CDMA, CDMA Define, Filter, Define User FIR, More (1 of 2), Load Default FIR, Gaussian

## Goto Bottom Row

Press this softkey to go to the bottom row of the current column in the table editor.

Softkey Location: Press Mode, CDMA, CDMA Define, Edit Channel Setup, Goto Row, Goto Bottom Row

Or press Mode, CDMA, CDMA Define, Filter, Define User FIR, Goto Row, Goto Bottom Row

Or press Mode, CDMA, CDMA Define, Filter, Select, Goto Row, Goto Bottom Row

Or press Mode, CDMA, CDMA Define, Filter, Define User FIR, User FIR, Goto Row, Goto Bottom Row

## Goto Middle Row

Press this softkey to go to the middle row of the current column in the table editor.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Edit Channel Setup**, **Goto Row**, **Goto Middle Row**

Or press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Select**, **User FIR**, **Goto Row**, **Goto Middle Row**

Or press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **Goto Row**, **Goto Middle Row**

Or press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **More (1 of 2)**, **Load/Store**, **Goto Row**, **Goto Middle Row**

## Goto Row

Press this softkey to select a row to move to in the current column of the table editor. The front-panel arrow keys and number keypad are used to select the desired row. Pressing **Enter** terminates the selection.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Edit Channel Setup**, **Goto Row**

Or press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **Goto Row**

Or press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **More (1 of 2)**, **Load/Store**, **Goto Row**

Or press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Select**, **User FIR**, **Goto Row**

Or press **Mode**, **CDMA**, **CDMA Define**, **Store Custom CDMA State**, **Goto Row**

## Goto Top Row

Press this softkey to go to the top row of the current column in the table editor.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Edit Channel Setup**, **Goto Row**, **Goto Top Row**

Or press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Select**, **User FIR**, **Goto Row**, **Goto Top Row**

Or press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **Goto Row**, **Goto Top Row**

Or press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **More (1 of 2)**, **Load/Store**, **Goto Row**, **Goto Top Row**

## Insert Row

There are two **Insert Row** softkeys.

In the **Edit Channel Setup** menu, this softkey accesses a menu that allows you to insert a channel type (**Pilot**, **Sync**, **Paging** or **Traffic**) directly above the highlighted row in the table.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Edit Channel Setup**, **Insert Row**

In the **Define User FIR** menu, this softkey inserts a row directly above the highlighted row in the table. The coefficient value in the inserted row is copied from the highlighted row.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **Insert Row**



## IS-95

There are two **IS-95** softkeys.

Press the first **IS-95** softkey to open a menu for selecting an IS-95 baseband filter. The choices include the standard IS-95 filter, as well as a modified version of this filter for improved adjacent channel performance. (This modified filter still meets the IS-95 error function.) These two filters are also provided with an equalizer which provides base station phase equalization for the transmit signal path.

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Select**, **IS-95**

Press the second **IS-95** softkey (located in the IS-95 menu), to select the standard IS-95 baseband filter.

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Select**, **IS-95**, **IS-95**

**Status after Normal Preset:** IS-95 Mod w/EQ

**SCPI Commands:**

```
[ :SOURce]:RADio:CDMA:ARB:FILTer IS95  
[ :SOURce]:RADio:CDMA:ARB:FILTer?
```

## IS-95 Mod

Press this softkey to select a modified version of the standard IS-95 baseband filter. This filter is modified for improved adjacent channel performance. The modification, however, is done in a manner that still meets the IS-95 error function criterion.

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Select**, **IS-95**, **IS-95 Mod**

**SCPI Commands:**

```
[ :SOURce]:RADio:CDMA:ARB:FILTer IS95_MOD  
[ :SOURce]:RADio:CDMA:ARB:FILTer?
```

## IS-95 Mod w/EQ

Press this softkey to select a modified version of the standard IS-95 baseband filter. This filter is modified for improved adjacent channel performance, and includes the equalizer specified by IS-95. The filter modification is done in a manner that still meets the IS-95 error function criterion.

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Select**, **IS-95**, **IS-95 Mod w/EQ**

**SCPI Commands:**

```
[ :SOURce ] :RADio :CDMA :ARB :FILTer IS95_MOD_EQ  
[ :SOURce ] :RADio :CDMA :ARB :FILTer ?
```

## IS-95 w/EQ

Press this softkey to select the standard IS-95 baseband filter with an equalizer provided for phase compensation required by the base station.

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Select**, **IS-95**, **IS-95 w/EQ**

**SCPI Commands:**

```
[ :SOURce ] :RADio :CDMA :ARB :FILTer IS95_EQ  
[ :SOURce ] :RADio :CDMA :ARB :FILTer ?
```

## IS-97 Levels

Press this softkey to set the channel power levels to IS-97 levels.

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Edit Channel Setup**, **Adjust Code Domain Power**, **IS -97 Levels**

**SCPI Commands:**

```
[ :SOURce ] :RADio :CDMA :ARB :SETup :CHANnel  
IS97 ,PILot | SYNC | PAGing | TRAFFic , <walsh_value> ,  
<power_value> , <pnofs_value> , RANDom | <data_value> { , PILot |  
SYNC | PAGing | TRAFFic , <walsh_code> , <power_value> ,  
<pnofs_value> , RANDom | <data_value> }  
[ :SOURce ] :RADio :CDMA :ARB :SETup :CHANnel ?
```

## Load/Store

Press this softkey to access a menu for loading the FIR filter table editor with values from files previously stored in the signal generator memory, and for saving to memory a user-defined filter from the FIR table editor.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **More (1 of 2)**, **Load/Store**

## Load Default FIR

Press this softkey to access a menu for automatically filling the FIR table editor with coefficient values from pre-defined filters such as Root Nyquist, Nyquist, Gaussian and Rectangle. The default filter parameters can also be selected in this menu allowing you to choose the filter alpha or BbT and the number of filter symbols.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**

## Load From Selected File

Press this softkey to fill the FIR table editor with the filter coefficient values stored in the highlighted file. Press the **Confirm Load From File** softkey to confirm the action. The signal generator overwrites any current values in the table. If you have not previously saved the current values to a file, they are lost. If you do not wish to load the file, press the Return key.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **More (1 of 2)**, **Load/Store**, **Load From Selected File**

## Mirror Table

Press this softkey to mirror the FIR table entries such that the table doubles in size, and the values in the top half of the table are duplicated in the bottom half of the table in reverse order.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **Mirror Table**

## Multicarrier Define

Press this softkey to access the Multicarrier CDMA Setup table, a table editor for defining a multicarrier CDMA signal. This softkey is grayed-out until you have enabled the Multicarrier Mode by pressing **Multicarrier Off On** until **On** is highlighted.

At signal generator preset, the default table lists three 9 channel forward carriers. The first carrier is at a frequency offset of  $-1.250000$  MHz, the second carrier has no frequency offset, and the third carrier has a frequency offset of  $+1.250000$  MHz. All three default carriers have a 0.00 dB relative power level.

Using the Multicarrier Setup table, you can build a multicarrier signal using the available CDMA channel types (9-, 32-, and 64- channel forward, Pilot, and Reverse) or a custom CDMA carrier stored in the signal generator's memory.

**Softkey Location:** Press **Mode**, **CDMA**, **Multicarrier Off On**, **Multicarrier Define**

**SCPI Commands:**

```
[ :SOURce ] :RADio :CDMA :ARB :SETup :MCArrier :TABle  
{ FWD9 | FWD32 | FWD64 | PILot | CUSTom, "<file name>" |  
" ", <freq_offset>, <power> }
```

```
[ :SOURce ] :RADio :CDMA :ARB :SETup :MCArrier :TABle?
```

## Multicarrier Off On

Press this softkey to toggle the multicarrier mode off and on. In Multicarrier mode you can select from three different types of CDMA multicarrier signals: a 3 carrier, 4 carrier, or a user-defined custom CDMA multicarrier signal that contains up to 12 carriers.

**Softkey Location:** Press **Mode**, **CDMA**, **Multicarrier Off On**

**Status after Normal Preset:** Off

**SCPI Commands:**

```
[ :SOURce ] :RADio :CDMA :ARB :SETup MCArrier  
[ :SOURce ] :RADio :CDMA :ARB :SETup?
```

## Nyquist

Press this softkey to select the Nyquist (raised cosine) pre-modulation filter in either the Select (filter) menu or the Load Default FIR menu.

In the Select (filter) menu, pressing the Nyquist softkey selects this FIR filter for use in your CDMA setup. The default filter alpha is automatically set to 0.500. You can change the filter alpha to any value between 0 and 1 by pressing the Filter Alpha softkey.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Select**, **Nyquist**

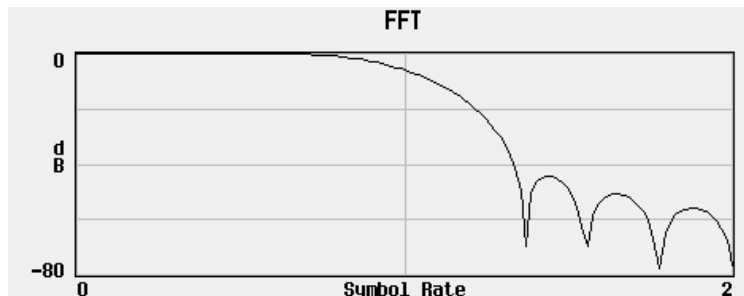
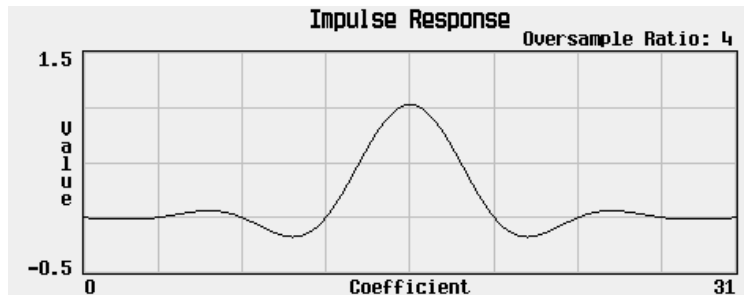
SCPI Commands:

```
[ :SOURce]:RADio:CDMA:ARB:FILTer NYQuist
```

```
[ :SOURce]:RADio:CDMA:ARB:FILTer?
```

In the Load Default FIR menu, pressing the Nyquist softkey followed by **Generate** loads the FIR table editor with the coefficient values for the Nyquist filter. The filter alpha and number of filter symbols are defined with the softkeys in this menu. If you change either parameter after loading the filter coefficients, press the **Generate** softkey again to reload the FIR table.

The impulse response and the frequency response of a Nyquist filter with an oversample ratio of 4 are shown in the following graphs.



Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **More (1 of 2)**, **Load Default FIR**, **Nyquist**

## Optimize FIR For EVM ACP

Press this softkey to optimize the filter for minimized error vector magnitude (select EVM) or to minimized adjacent channel power (select ACP). The EVM selection provides the most ideal passband. The ACP selection improves stopband rejection. This feature only applies to root Nyquist, Nyquist, and Gaussian filters. The softkey is grayed out when any other filter is selected.

Status after Normal Preset: EVM

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Optimize For EVM ACP**

SCPI Command:

```
[ :SOURce ] :RADio :CDMA :ARB :FILTer :CHANnel EVM | ACP  
[ :SOURce ] :RADio :CDMA :ARB :FILTer :CHANnel ?
```

## Oversample Ratio

There are two **Oversample Ratio** softkeys.

In the CDMA Define menu, use the **Oversample Ratio** softkey to set the oversampling ratio (number of filter taps per symbol) for CDMA modulation. Acceptable values range from 2 through 8. Using larger oversample ratios results in more completely filtered images but also uses up more waveform memory.

The upper limit of the oversample ratio is adjusted based on the waveform length and chip rate. The maximum oversample ratio is the smaller of the following three values:

- 40 Mcps/Chip Rate
- 8
- 32/Waveform Length (Note the Waveform Length is the number of CDMA short codes)

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **More (1 of 2)**, **Oversample Ratio**

Status after Normal Preset: 5

SCPI Commands:

```
[ :SOURce ] :RADio :CDMA :ARB :OSAMple <value>  
[ :SOURce ] :RADio :CDMA :ARB :OSAMple ?
```

In the Define User FIR menu, use the **Oversample Ratio** softkey to set the oversampling ratio to be applied to a custom FIR filter design. Acceptable values range from 1 through 32, where the maximum combination of symbols and oversampling ratio is 1024. An FIR filter selected for use in CDMA, however, cannot have more than 256 coefficients so the number of symbols and the oversample ratio should be selected accordingly.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **Oversample Ratio**

Status after Normal Preset: 4

## Page Down

Press this softkey to view the next page of entries.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Edit Channel Setup**, **Goto Row**, **Page Down**

Or press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **Goto Row**, **Page Down**

Or press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **More (1 of 2)**, **Load/Store**, **Page Down**

Or press **Mode**, **CDMA**, **CDMA Define**, **Store Custom CDMA State**, **Page Down**

## Page Up

Press this softkey to view the previous page of entries.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Edit Channel Setup**, **Goto Row**, **Page Up**

Or press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **Goto Row**, **Page Up**

Or press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **More (1 of 2)**, **Load/Store**, **Goto Row**, **Page Up**

Or press **Mode**, **CDMA**, **CDMA Define**, **Store Custom CDMA State**, **Page Up**

## Paging

Press this softkey to insert a paging channel into the CDMA Channel Setup table.

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Edit Channel Setup**, **Insert Row**, **Paging**

**SCPI Commands:**

```
[ :SOURce ] :RADio :CDMA :ARB :SETup :CHANnel  
NONE ,PAGing ,<walsh_value> ,<power_value> ,<pnofs_value> ,  
RANDom |<data_value> { ,PILot |SYNC |PAGing |TRAFFic ,  
<walsh_value> ,<power_value> ,<pnofs_value> ,RANDom |  
<data_value> }  
  
[ :SOURce ] :RADio :CDMA :ARB :SETup :CHANnel ?
```

## Pilot (Setup Select)

In the Setup Select menu, press this softkey to select only a pilot channel for the CDMA setup.

The pilot channel carries pure short code, with no additional information content. It must be present in every station because it is both a demodulation reference for the mobile receivers and for handoff level measurements.

All stations use the same short code and therefore have the same pilot waveform. The pilot waveforms are only distinguished from one another by variations in PN offset.

**Softkey Location:** Press **Mode**, **CDMA**, **Setup Select**, **Pilot**

**SCPI Commands:**

```
[ :SOURce ] :RADio :CDMA :ARB :SETup PILot  
  
[ :SOURce ] :RADio :CDMA :ARB :SETup ?
```

## Pilot (Channel Select)

In the Edit Channel Setup/Insert Row menu, press this softkey to insert a pilot channel into the CDMA Channel Setup table.

The pilot channel carries pure short code, with no additional information content. It must be present in every station because it is both a demodulation reference for the mobile receivers and for handoff level measurements.



All stations use the same short code and therefore have the same pilot waveform. The pilot waveforms are only distinguished from one another by variations in PN offset.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Edit Channel Setup**, **Insert Row**, **Pilot**

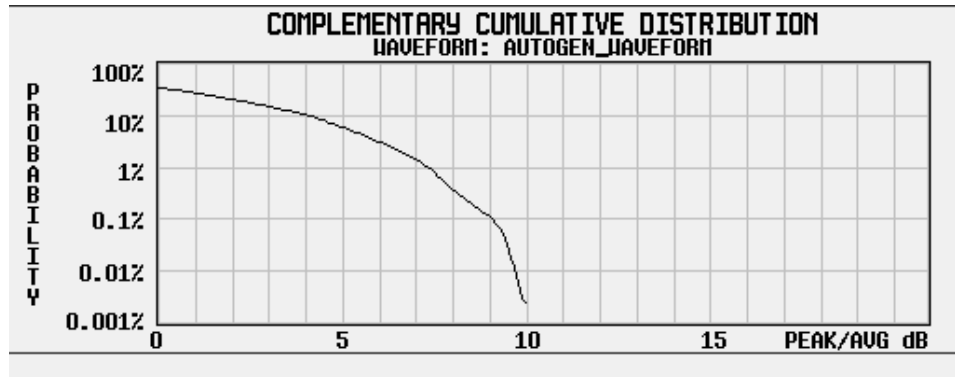
SCPI Commands:

```
[ :SOURce]:RADio:CDMA:ARB:SETup:CHANnel NONE,PILot,
<walsh_value>, <power_value>, <pnofs_value>, RANDom|
<data_value> {,PILot|SYNC|PAGIng|TRAFfic, <walsh_code>,
<power_value>, <pnofs_value>, RANDom|<data_value>}

[:SOURce]:RADio:CDMA:ARB:SETup:CHANnel?
```

## Plot CCDF

After generating a CDMA waveform by pressing **CDMA Off On** until **On** is highlighted, press this softkey to display a plot of the Complementary Cumulative Distribution Function for the generated waveform. The plot displays the probability that the instantaneous envelope power is  $x$  dB above the average power, where  $x$  is the number on the horizontal axis.



Softkey Location: Press **Mode**, **CDMA**, **Waveform Statistics**, **Plot CCDF**

## Random

Press this softkey to enter random data as the CDMA channel data type.

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Edit Channel Setup**, **Edit Item**, **Random**

**Status after Normal Preset:** Random

**SCPI Commands:**

```
[ :SOURce ]:RADio:CDMA:ARB:SETup:CHANnel NONE,PILot,  
<walsh_value>,<power_value>,<pnofs_value>,RANDOM|  
<data_value> {,PILot|SYNC|PAGing|TRAFfic,<walsh_code>,  
<power_value>,<pnofs_value>,RANDOM}
```

```
[ :SOURce ]:RADio:CDMA:ARB:SETup:CHANnel?
```

## Reconstruction Filter

Press this softkey to display a menu for selecting a reconstruction filter. You may choose a filter with a cutoff frequency of 250.0 kHz, 2.500 MHz, 8.000 MHz or no filter (Through).

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Reconstruction Filter**

**Status after Normal Preset:** 2.500 MHz

**SCPI Commands:**

```
[ :SOURce ]:RADio:ARB:RFILter <value>|THROUGH
```

```
[ :SOURce ]:RADio:ARB:RFILter?
```

## Rectangle

Press this softkey to select a rectangle pre-modulation filter in either the Select (filter) menu or the Load Default FIR menu.

In the Select (filter) menu, pressing the **Rectangle** softkey selects this FIR filter for use in your CDMA setup.

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Select**, **More (1 of 2)**, **Rectangle**

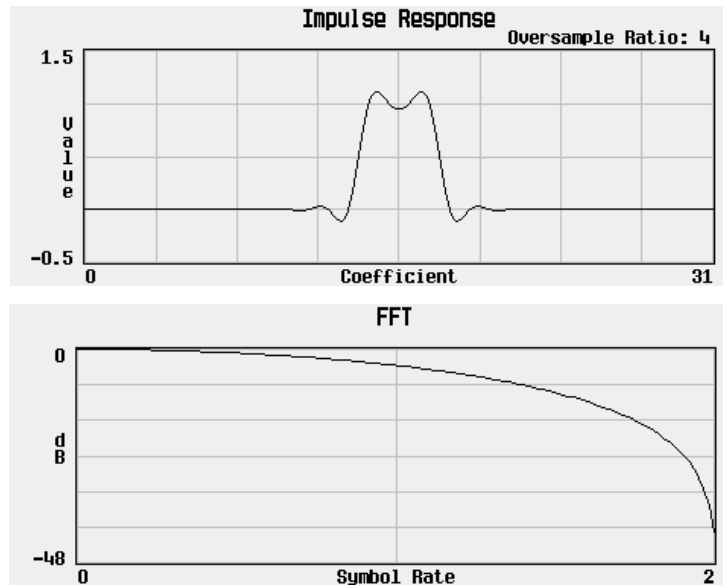
**SCPI Commands:**

```
[ :SOURce ]:RADio:CDMA:ARB:FILTer RECTangle
```

```
[ :SOURce ]:RADio:CDMA:ARB:FILTer?
```

In the Load Default FIR menu, pressing the **Rectangle** softkey followed by **Generate** loads the FIR table editor with the coefficient values for a rectangle filter.

The impulse response and the frequency response of a rectangle filter with an oversample ratio of 4 are shown in the following graphs.



Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **More (1 of 2)**, **Load Default FIR**, **Rectangle**

## Reference Frequency

Press this softkey to set the reference frequency of the external clock. It is only accessible when you are using an external ARB reference applied to the BASEBAND GEN REF IN connector. Acceptable values range from 250.0000 kHz to 20.0000000 MHz.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **More (1 of 2)**, **Reference Freq**

Status after Normal Preset: 10.0000000 MHz

SCPI Commands:

```
[ :SOURce ]:RADio:ARB:CLOCK:REFerence:EXTernal
:FREQuency <value>
```

```
[ :SOURce ]:RADio:ARB:CLOCK:REFerence:EXTernal:FREQuency?
```

## Restore Default Filter

Press this softkey to replace the current FIR filter with the default filter (IS-95 Mod w/EQ).

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Restore Default Filter**

**SCPI Commands:**

```
[ :SOURce ]:RADio:CDMA:ARB:FILTer IS95_MOD_EQ
```

```
[ :SOURce ]:RADio:CDMA:ARB:FILTer?
```

## Retrigger Mode Off On

Press this softkey to toggle the operating state of the CDMA retrigger mode. With **Retrigger Mode Off On** set to **On**, if a trigger occurs while a waveform is playing, the waveform will retrigger at the end and play one more time. The retriggers do not accumulate. If several triggers are received during a waveform, it will only be replayed once. When **Retrigger Mode Off On** is set to **Off**, if a trigger occurs while a waveform is playing, it is ignored.

---

**NOTE**

---

For trigger availability information, see the **Trigger** softkey definition.

**Softkey Location:** Press **Mode**, **CDMA**, **More (1 of 2)**, **Trigger**, **Trigger Setup**, **Retrigger Mode Off On**

**Status after Normal Preset:** Off

**SCPI Commands:**

```
[ :SOURce ]:RADio:CDMA:ARB:RETRigger ON|OFF|1|0
```

```
[ :SOURce ]:RADio:CDMA:ARB:RETRigger?
```

## Reverse

Press this softkey to select a reverse traffic channel for the CDMA setup.

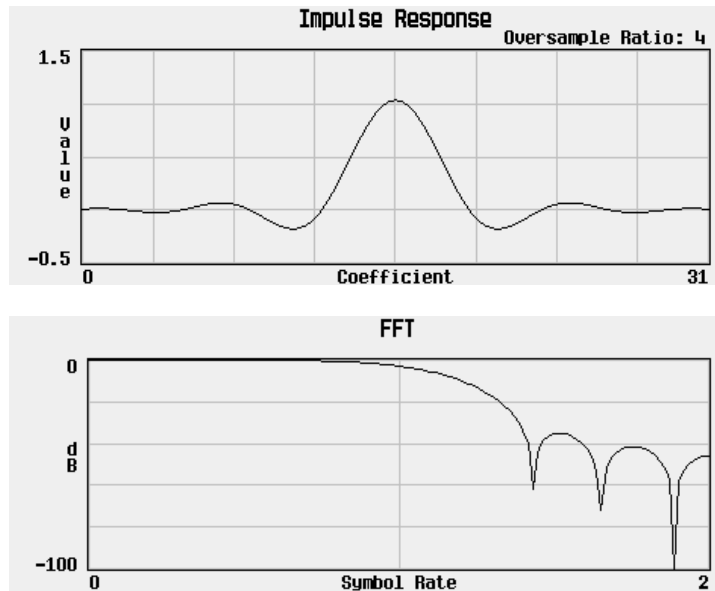
Softkey Location: Press **Mode**, **CDMA**, **Setup Select**, **Reverse**

SCPI Commands:

```
[ :SOURce ] :RADio :CDMA :ARB :SETup REVerse
[ :SOURce ] :RADio :CDMA :ARB :SETup ?
```

In the Load Default FIR menu, pressing the **Root Nyquist** softkey followed by **Generate** loads the FIR table editor with the coefficient values for the Root Nyquist filter. The filter alpha and number of filter symbols are defined with the softkeys in this menu. If you change either parameter after loading the filter coefficients, press the **Generate** softkey again to reload the FIR table.

The impulse response and the frequency response of a Root Nyquist filter with an oversample ratio of 4 are shown in the following graphs.



Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **More (1 of 2)**, **Load Default FIR**, **Root Nyquist**

## Root Nyquist

Press this softkey to select the Root Nyquist (root raised cosine) pre-modulation filter in either the Select (filter) menu or the Load Default FIR menu.

In the Select (filter) menu, pressing the **Root Nyquist** softkey selects this FIR filter for use in your CDMA setup. The default filter alpha is automatically set to 0.500. You can change the filter alpha to any value between 0 and 1 by pressing the **Filter Alpha** softkey.

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Select**, **Root Nyquist**

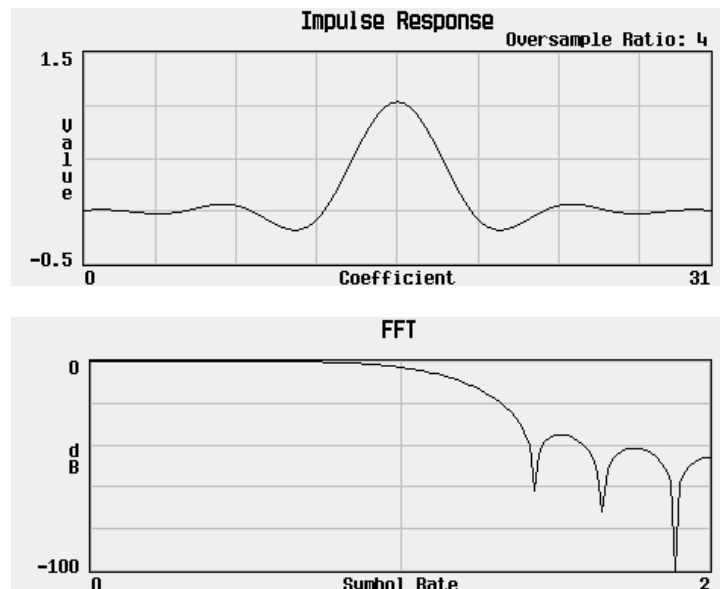
**SCPI Commands:**

```
[ :SOURce]:RADio:CDMA:ARB:FILTer RNYquist
```

```
[ :SOURce]:RADio:CDMA:ARB:FILTer?
```

In the Load Default FIR menu, pressing the **Root Nyquist** softkey followed by **Generate** loads the FIR table editor with the coefficient values for the Root Nyquist filter. The filter alpha and number of filter symbols are defined with the softkeys in this menu. If you change either parameter after loading the filter coefficients, press the **Generate** softkey again to reload the FIR table.

The impulse response and the frequency response of a Root Nyquist filter with an oversample ratio of 4 are shown in the following graphs.



**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Define User FIR**, **More (1 of 2)**, **Load Default FIR**, **Root Nyquist**

## Scale To 0dB

Press this softkey to scale all of the current channel powers in a manner that the total power equals 0 dB while keeping the previous power ratios between the individual channels.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Edit Channel Setup**, **Adjust Code Domain Power**, **Scale To 0dB**

SCPI Commands:

```
[ :SOURce]:RADio:CDMA:ARB:SETup:CHANnel SCALE,PILot|
SYNC|PAGing|TRAFfic,<walsh_value>,<power_value>,
<pnofs_value>,RANDom|<data_value> {,PILot|SYNC|PAGing
|TRAFfic,<walsh_code>,<power_value>,<pnofs_value>,RANDom|
<data_value>}
```

```
[ :SOURce]:RADio:CDMA:ARB:SETup:CHANnel?
```

## Select

Press this softkey to access a menu for selecting the pre-modulation filter type. The pre-defined choices are Root Nyquist, Nyquist, Gaussian, and several IS-95 baseband filters. The standard IS-95 filter is available as well as a modified version of this filter which meets the IS-95 error function for improved adjacent channel performance. These two filters are also provided with an equalizer for phase compensation required by the base station. In addition to the pre-defined filters, you can access the catalog of files stored in the signal generator memory. You can select any filter that you have either created externally and downloaded into memory, or that you have created internally in the Define User FIR menu and then subsequently stored.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Select**

Status after Normal Preset: Root Nyquist

SCPI Commands:

```
[ :SOURce]:RADio:CDMA:ARB:FILter RNYQuist|NYQuist|GAUSSian|
IS95|IS95_EQ|IS95_MOD|IS95_MOD_EQ|"<file name>"
```

```
[ :SOURce]:RADio:CDMA:ARB:FILter?
```

## Select File

There are three **Select File** softkeys.

In the User FIR menu, use the **Select File** softkey to choose a custom filter for your pre-modulation filter from the catalog of user-defined FIR filters. Scroll through the catalog of files and when the desired filter is highlighted, press the **Select File** softkey.

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Select**, **User FIR**, **Select File**

**SCPI Commands:**

```
[ :SOURce ]:RADio:CDMA:ARB:FILter "<file name>"
```

```
[ :SOURce ]:RADio:CDMA:ARB:FILter?
```

In the Custom CDMA State menu, use the **Select File** softkey to choose a customized CDMA instrument state from the catalog of CDMA files. (You can create these files using the **Store Custom CDMA State** softkey in the Setup Select menu.) Scroll through the catalog of files and when the desired CDMA state is highlighted, press the **Select File** softkey.

**Softkey Location:** Press **Mode**, **CDMA**, **Setup Select**, **Custom CDMA State**, **Select File**

In the Custom CDMA Carrier State menu, use the **Select File** softkey to choose a customized CDMA instrument state from the catalog of MCDMA files. (You can create these files using the **Store Custom Multicarrier** softkey in the Setup Select menu.) Scroll through the catalog of files and when the desired CDMA state is highlighted, press the **Select File** softkey.

**Softkey Location:** Press **Mode**, **CDMA**, **Setup Select**, **Custom CDMA Carrier**, **Select File**



## Setup Select

Press this softkey to access a menu for defining the type of CDMA *or* Multicarrier CDMA channelization required for your application. To access the Multicarrier CDMA setups, **Multicarrier Off On** must be set to **On**.

The *CDMA* choices include:

- Pilot - a single pilot channel.
- 9 Channel Forward - a CDMA setup consisting of 9 channels (including pilot, paging, sync, and 6 traffic channels) at IS-97-defined power levels.
- 32 Channel Forward - a CDMA setup consisting of 32 channels (including pilot, paging, sync, and 29 traffic channels) at IS-97-defined power levels.
- 64 Channel Forward - a CDMA setup consisting of 64 channels (including pilot, 7 paging, sync, and 55 traffic channels) at IS-97-defined power levels.
- Reverse - a single traffic channel.
- Custom CDMA State - a user-defined CDMA state file previously stored in the signal generator's non-volatile memory.

The *Multicarrier CDMA* choices include:

- 3 Carriers - Three 9 channel forward carriers at power levels of 0.00 dB. The first carrier has a frequency offset of  $-1.25$  MHz, the second carrier has no frequency offset, and the third carrier has a frequency offset of  $+1.25$  MHz.
- 4 Carriers - Four 9 channel forward carriers at power levels of 0.00 dB. The first carrier has a frequency offset of  $-1.875$  MHz, the second carrier has a frequency offset of  $-625$  kHz, the third carrier has a frequency offset of  $+625$  kHz, and the fourth carrier has a frequency offset of  $+1.875$  MHz.
- Custom CDMA Carrier - a custom multicarrier CDMA setup defined by the user and stored in the signal generator's MCDMA memory catalog.

Softkey Location: Press **Mode**, **CDMA**, **Setup Select**

Status after Normal Preset: 9 Ch Fwd

SCPI Commands:

```
[ :SOURce]:RADio:CDMA:ARB:SETup:CHANnel
FWD9|FWD32|FWD64|PILot|REVerse|"<file name>"
```

```
[ :SOURce]:RADio:CDMA:ARB:SETup:CHANnel?
```

```
[ :SOURce ] :RADio :CDMA :ARB :SETup :MCArrier CAR3 | CAR4  
| "<file name>"  
  
[ :SOURce ] :RADio :CDMA :ARB :SETup :MCArrier ?
```

## Single

Press this softkey to set the CDMA trigger type to single. After receiving a trigger, the CDMA signal will be output once.

---

**NOTE**

---

For trigger availability information, see the **Trigger** softkey definition.

Softkey Location: Press **Mode**, **CDMA**, **More (1 of 2)**, **Trigger**, **Single**

SCPI Commands:

```
[ :SOURce ] :RADio :CDMA :ARB :TRIGger :TYPE SINGLE  
[ :SOURce ] :RADio :CDMA :ARB :TRIGger :TYPE ?
```

## Store Custom CDMA State

Press this softkey to access a menu that allows you to store the current custom CDMA state into the file you enter. Afterward, you can recall this custom state from the signal generator's memory by pressing **Mode**, **CDMA**, **Setup Select**, **Custom CDMA State** and selecting the appropriate file.

Along with the contents of the CDMA channel table editor (channel types, Walsh code, power levels, PN offset, and data), this softkey stores the following signal generator state information to the memory catalog:

- FIR filter
- FIR filter file name
- FIR filter alpha
- FIR filter BbT
- FIR filter channel (EVM or ACP)
- chip rate
- waveform length
- oversample ratio
- ARB reconstruction filter
- ARB reference clock source (internal or external)
- ARB reference clock frequency

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Store Custom CDMA State**

SCPI Commands:

```
[ :SOURce ] :RADio :CDMA :ARB :SETup :STORe "<file name>"
```

## Store Custom Multicarrier

Press this softkey to access a menu that allows you to store the current changes to the default multicarrier setup into the file you enter.

Afterward, you can recall these custom multicarrier settings from the signal generator's memory by pressing **Mode, CDMA, Setup Select, Custom CDMA Carrier** and selecting the appropriate file.

This softkey stores the following instrument state information to the memory catalog:

- type of carriers
- frequency offset for each carrier
- power level for each carrier
- the number of different carriers

**Softkey Location:** Press **Mode, CDMA, Multicarrier Define, Store Custom Multicarrier**

**SCPI Commands:**

```
[ :SOURce ]:RADio:CDMA:ARB:SETup:MCARrier:STORE  
"<file name>"
```

## Store To File

There are three **Store to File** softkeys.

In the Load/Store menu for defining custom FIR filters, use the **Store to File** softkey to save a custom filter, created in the FIR table editor, to a file in the signal generator's non-volatile memory. When you press the **Store to File** softkey, a menu is displayed for creating a file name. The file name can consist of up to 23 alpha-numeric and special characters. After creating the file name, press the **Enter** terminator softkey and the file is stored. Once stored, this file becomes a part of the catalog of FIR files and can be re-loaded into the FIR table editor for further modifications, or can be applied to a custom CDMA modulation state.

**Softkey Location:** Press **Mode, CDMA, CDMA Define, Filter, Define User FIR, More (1 of 2), Load/Store, Store to File**

In the Store Custom CDMA State menu, use the **Store to File** softkey to save the current CDMA instrument state to a file in the signal generator's non-volatile memory. Create a file name and store the file as described in the previous paragraph. Once stored, this file becomes a part of the catalog of CDMA states and can be re-loaded using the **Select File** softkey in the Custom CDMA State menu.

**Softkey Location:** Press **Mode, CDMA, CDMA Define, Store Custom CDMA State, Store To File**

In the Store Custom Multicarrier menu, use the **Store to File** softkey to save the current Multicarrier CDMA Setup to a file in the signal generator's non-volatile memory. Create a file name and store the file as described in the first paragraph. Once stored, this file becomes a part of the catalog of MCDMA states and can be re-loaded using the **Select File** softkey in the Custom CDMA Carrier menu.

**Softkey Location:** Press **Mode**, **CDMA**, **Multicarrier Define**, **Store Custom Multicarrier**, **Store To File**

## Sync

Press this softkey to insert a synchronization channel into the CDMA Channel Setup table.

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Edit Channel Setup**, **Insert Row**, **Sync**

**SCPI Commands:**

```
[ :SOURce ]:RADio:CDMA:ARB:SETup:CHANnel NONE,SYNC,  
<walsh_value>,<power_value>,<pnofs_value>,RANDOM|  
<data_value> {,PILOt|SYNC|PAGIng|TRAFFic,<walsh_code>,  
<power_value>,<pnofs_value>,RANDOM|<data_value>}
```

```
[ :SOURce ]:RADio:CDMA:ARB:SETup:CHANnel?
```

## Through

Press this softkey to bypass all reconstruction filtering. This is useful for using external reconstruction filters at frequencies different than those supplied internally.

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Reconstruction Filter**, **Through**

**SCPI Commands:**

```
[ :SOURce ]:RADio:ARB:RFILter THROUGH
```

```
[ :SOURce ]:RADio:ARB:RFILter?
```

## Traffic

Press this softkey to insert a traffic channel into the CDMA Channel Setup table.

**Softkey Location:** Press **Mode**, **CDMA**, **CDMA Define**, **Edit Channel Setup**, **Insert Row**, **Traffic**

**SCPI Commands:**

```
[ :SOURce]:RADio:CDMA:ARB:SETup:CHANnel NONE,TRAFFic,
<walsh_value>, <power_value>, <pnofs_value>, RANDom|
<data_value> { ,PILOt|SYNC|PAGIng|TRAFFic, <walsh_code>,
<power_value>, <pnofs_value>, RANDom| <data_value> }
```

```
[ :SOURce]:RADio:CDMA:ARB:SETup:CHANnel?
```

## Trigger

Press this softkey to display the CDMA trigger menu. This menu offers three different types of CDMA triggering: continuous, single and gated. The menu also contains a **Trigger Setup** key that allows you to adjust the trigger source, the retrigger mode and the gate active polarity.

---

### NOTE

CDMA triggers, their associated softkeys and SCPI functionality became available in Option UN5/UND signal generators with serial number prefix US3844 or GB3845. CDMA Triggers are *not* available in Option UN5/UND signal generators with an earlier serial number prefix, unless upgraded.

To upgrade your Option UN5/UND signal generator to include CDMA triggering, contact your nearest HP Sales and Service office. A list of HP Sales and Service offices is provided in the *HP ESG and ESG-D Series Signal Generator User's Guide* at the end of Chapter 3, "Troubleshooting."

---

**Softkey Location:** Press **Mode**, **CDMA**, **More (1 of 2)**, **Trigger**

**Status after Normal Preset:** Continuous

**SCPI Commands:**

```
[ :SOURce]:RADio:CDMA:ARB:TRIGger:TYPE CONT|SINGLE|GATE
[ :SOURce]:RADio:CDMA:ARB:TRIGger:TYPE?
```

## Trigger Key

Press this softkey to set the trigger source to the signal generator's front-panel **Trigger** hardkey. When the trigger source is set to **Trigger Key**, the signal generator will trigger an event when the **Trigger** hardkey is pressed.

---

**NOTE**

---

For trigger availability information, see the **Trigger** softkey definition.

Softkey Location: Press **Mode**, **CDMA**, **More (1 of 2)**, **Trigger**, **Trigger Setup**, **Trigger Source**, **Trigger Key**

SCPI Commands:

```
[ :SOURCE ] :RADio:CDMA:ARB:TRIGger [ :SOURCE ] KEY  
[ :SOURCE ] :RADio:CDMA:ARB:TRIGger [ :SOURCE ] ?
```

## Trigger Setup

Press this softkey to display the CDMA trigger setup menu. This menu allows you to adjust the trigger source, the retrigger mode and the gate active polarity.

---

**NOTE**

---

For trigger availability information, see the **Trigger** softkey definition.

Softkey Location: Press **Mode**, **CDMA**, **More (1 of 2)**, **Trigger**, **Trigger Setup**

## Trigger Source

Press this softkey to display the CDMA trigger source menu. This menu allows you to select the trigger source. The choices are the front panel **Trigger** key, a trigger command sent over the HP-IB bus, or an external trigger applied to the PATTERN TRIG IN connector.

---

**NOTE**

---

For trigger availability information, see the **Trigger** softkey definition.

Softkey Location: Press **Mode**, **CDMA**, **More (1 of 2)**, **Trigger**, **Trigger Source**

Status after Normal Preset: Ext

SCPI Commands:

```
[ :SOURCE ] :RADio:CDMA:ARB:TRIGger [ :SOURCE ] KEY | EXT | BUS  
[ :SOURCE ] :RADio:CDMA:ARB:TRIGger [ :SOURCE ] ?
```

## User FIR

Press this softkey to display the catalog of FIR filter files stored in the signal generator's memory. You can select a custom filter from this catalog for your pre-modulation filter. Scroll through the listed files and when your selection is highlighted, press the **Select File** softkey. Notice that `User File` is shown in the `Data` field of the display as well as in the second line of the **Select** softkey.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **Filter**, **Select**, **User FIR**

## Waveform Length

Press this softkey to adjust the waveform length (in short codes). Acceptable values range from 1 to 16 short codes. The upper limit is adjusted based on the oversample ratio to fit the signal within the available memory.

Softkey Location: Press **Mode**, **CDMA**, **CDMA Define**, **More (1 of 2)**, **Waveform Length**

Status after Normal Preset: 1

SCPI Commands:

```
[ :SOURCE]:RADio:CDMA:ARB:WLENgth <value>  
[ :SOURCE]:RADio:CDMA:ARB:WLENgth?
```

## Waveform Statistics

Press this softkey to display the Waveform Statistics Menu. When the softkey is active, statistics are available for the selected waveform.

Softkey Location: Press **Mode**, **CDMA**, **Waveform Sequences**, **More (1 of 2)**, **Waveform Statistics**

---

## Dual ARB

Pressing this softkey accesses a menu of softkeys for generating data patterns using the dual arbitrary waveform generator. Within these menus, you will be able to select and/or modify the waveform, waveform segments, waveform sequences, as well as the waveform generator's sample clock rate, internal/external reference (and with an external reference, the reference frequency) and reconstruction filter. These softkeys are described in this section in alphabetical order.

### # Skipped Points

Press this softkey to set the number of points to skip in the range that you are defining. The first point in a range always has a marker set; the skipped points are after that marker. This enables you to set repetitively spaced markers. For example, a skip of 2 produces two points between each marker across the defined range. You can use either the front-panel knob or the numeric keys to set the value.

**Softkey Location:** Press **Mode**, **Dual ARB**, **Waveform Segments**, **Set Markers**, **Set Marker On Range of Points**, **# Skipped Points**

Or press **Mode**, **Dual ARB**, **Select Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker On Range of Points**, **# Skipped Points**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Build New Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker On Range of Points**, **# Skipped Points**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Edit Selected Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker On Range of Points**, **# Skipped Points**

**Default Value:** 0

**SCPI Command:**

```
[ :SOURce ]:RADio:ARB:MARKer[:SET] "<file name>",  
<mkr(1|2)>, <first_point>, <last_point>, <skip_count>
```



## 250.0 kHz

Press this softkey to select a reconstruction filter with a cutoff frequency of 250 kHz.

Softkey Location: Press **Mode**, **Dual ARB**, **ARB Setup**, **Reconstruction Filter**, **250.0 kHz**

SCPI Commands:

```
[ :SOURce]:RADio:ARB:RFILter 250.0 kHz
```

```
[ :SOURce]:RADio:ARB:RFILter?
```

## 2.500 MHz

Press this softkey to select a reconstruction filter with a cutoff frequency of 2.500 MHz.

Softkey Location: Press **Mode**, **Dual ARB**, **ARB Setup**, **Reconstruction Filter**, **2.500 MHz**

SCPI Commands:

```
[ :SOURce]:RADio:ARB:RFILter 2.5 MHz
```

```
[ :SOURce]:RADio:ARB:RFILter?
```

## 8.000 MHz

Press this softkey to select a reconstruction filter with a cutoff frequency of 8.000 MHz.

Softkey Location: Press **Mode**, **Dual ARB**, **ARB Setup**, **Reconstruction Filter**, **8.000 MHz**

SCPI Commands:

```
[ :SOURce]:RADio:ARB:RFILter 8.0 MHz
```

```
[ :SOURce]:RADio:ARB:RFILter?
```

## Apply to Waveform

This is the terminator softkey that you use to either create or delete markers over a range of points.

### Creating Markers

Press this softkey to apply the defined set of markers to the selected waveform.

**Softkey Location:** Press **Mode**, **Dual ARB**, **Waveform Segments**, **Set Markers**, **Set Marker On Range of Points**, **Apply to Waveform**

**SCPI Command:**

```
[ :SOURce ]:RADio:ARB:MARKer:[SET] "<file name>",  
<mkr(1|2)>, <first_point>, <last_point>, <skip_count>
```

### Deleting Markers

Press this softkey to delete all markers from the selected waveform that are within the defined range.

**Softkey Location:** Press **Mode**, **Dual ARB**, **Waveform Segments**, **Set Markers**, **Set Marker Off Range of Points**, **Apply to Waveform**

Or press **Mode**, **Dual ARB**, **Select Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker On Range of Points**, **Apply to Waveform**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Build New Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker On Range of Points**, **Apply to Waveform**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Edit Selected Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker On Range of Points**, **Apply to Waveform**

**SCPI Command:**

```
[ :SOURce ]:RADio:ARB:MARKer:CLEar "<file name>",  
<mkr(1|2)>, <first_point>, <last_point>
```

## ARB Off On

Press this softkey to toggle the operating state of the dual arbitrary waveform generator between on and off.

**Softkey Location:** Press **Mode**, **Dual ARB**, **ARB Off On**

**Status after Normal Preset:** Off

**SCPI Commands:**

```
[ :SOURce ]:RADio:ARB[ :STATe ] ON|OFF|1|0  
  
[ :SOURce ]:RADio:ARB[ :STATe ]?
```

## ARB Reference Ext Int

Press this softkey to select either an internal or an external reference for the waveform clock. If external, you must enter the reference frequency (see **Reference Freq** key) and the signal must be applied to the BASEBAND GEN REF IN connector.

Softkey Location: Press **Mode**, **Dual ARB**, **ARB Setup**, **ARB Reference Ext Int**

Status after Normal Preset: Int

SCPI Commands:

```
[ :SOURce ]:RADio:ARB:CLOCK:REFerence[ :SOURce ]  
INTernal | EXTernal
```

```
[ :SOURce ]:RADio:ARB:CLOCK:REFerence[ :SOURce ]?
```

## ARB Sample Clock

Press this softkey to adjust the sample clock rate. Allowable values range from 1.0 Hz to 40 MHz. After entering the desired clock rate, terminate the entry with **GHz**, **MHz**, **kHz**, or **Hz**.

Softkey Location: Press **Mode**, **Dual ARB**, **ARB Setup**, **ARB Sample Clock**

Status after Normal Preset: 6.1440000 MHz

SCPI Commands:

```
[ :SOURce ]:RADio:ARB:CLOCK:SRATe <value>
```

```
[ :SOURce ]:RADio:ARB:CLOCK:SRATe?
```

## ARB Setup

Press this softkey to access a menu for adjusting the ARB reference between internal and external (and the reference frequency for external ARB references), the frequency of the ARB sample clock, and the type of reconstruction filter.

Softkey Location: Press **Mode**, **Dual ARB**, **ARB Setup**

## Build New Waveform Sequence

Press this softkey to access a menu for creating a new waveform sequence file.

**Softkey Location:** Press **Mode**, **Dual ARB**, **Waveform Sequences**, **Build New Waveform Sequence**

**SCPI Commands:**

```
[ :SOURce ]:RADio:ARB:SEQuence "<file  
name>" , <waveform> , <reps> { , <waveform> , <reps> }  
  
[ :SOURce ]:RADio:ARB:SEQuence? "<file name>"
```

## Bus

Press this softkey to set the trigger source to bus. When the trigger source is set to bus, the signal generator will trigger an event when it receives the appropriate command via HP-IB.

---

**NOTE**

---

For trigger availability information, see the **Trigger** softkey definition.

**Softkey Location:** Press **Mode**, **Dual ARB**, **Trigger**, **Trigger Setup**, **Trigger Source**, **Bus**

**SCPI Commands:**

```
[ :SOURce ]:RADio:ARB:TRIGger [ :SOURce ] BUS  
[ :SOURce ]:RADio:ARB:TRIGger [ :SOURce ]?
```

## Continuous

Press this softkey to set the dual ARB trigger type to continuous. In continuous trigger mode, the selected waveform will repeat itself indefinitely.

---

**NOTE**

---

For trigger availability information, see the **Trigger** softkey definition.

**Softkey Location:** Press **Mode**, **Dual ARB**, **Trigger**, **Continuous**

**SCPI Commands:**

```
[ :SOURce ]:RADio:ARB:TRIGger:TYPE CONT  
[ :SOURce ]:RADio:ARB:TRIGger:TYPE?
```

## Delete All ARB Files

Press this softkey to delete all files from the volatile ARB memory. Deletions cannot be recovered.

Softkey Location: Press **Mode**, **Dual ARB**, **Waveform Sequences**, **More (1 of 2)**, **Delete All ARB Files**

SCPI Commands:

```
:MMEMemory:DElete:ARB
```

## Delete All NVARB Files

Press this softkey to delete all files from the nonvolatile NVARB memory. Deletions cannot be recovered.

Softkey Location: Press **Mode**, **Dual ARB**, **Waveform Sequences**, **Load**, **More (1 of 2)**, **Delete All NVARB Files**

SCPI Commands:

```
:MMEMemory:DElete:NVARb
```

## Delete Segment

Press this softkey to delete the selected waveform segment in the displayed catalog. Note that confirmation is required, by pressing **Confirm Delete**, before the segment will be deleted. Deletions cannot be recovered. If you want to cancel confirmation, press the **Return** hardkey.

Softkey Location: Press **Mode**, **Dual ARB**, **Waveform Segments**, **Delete Segment**

## Delete Selected Waveform

Press this softkey to delete the highlighted waveform. Deletions cannot be recovered.

Softkey Location: Press **Mode**, **Dual ARB**, **Waveform Sequences**, **Build New Waveform Sequence**, **Delete Selected Waveform**

Or press **Mode**, **Dual ARB**, **Waveform Sequences**, **Edit Selected Waveform Sequence**, **Delete Selected Waveforms**

## Delete Waveform Sequence

Press this softkey to delete the highlighted waveform sequence from the displayed catalog. Deletions cannot be recovered. Note that confirmation is required, by pressing **Confirm Delete**, before the sequence will be deleted. Deletions cannot be recovered.

Softkey Location: Press **Mode**, **Dual ARB**, **Waveform Sequences**, **Delete Waveform Sequence**

## Done Inserting

Press this softkey to end the insertion mode and return to the edit menu.

Softkey Location: Press **Mode**, **Dual ARB**, **Waveform Sequences**, **Build New Waveform Sequence**, **Insert Waveform**, **Done Inserting**

Or press **Mode**, **Dual ARB**, **Waveform Sequences**, **Edit Selected Waveform Sequence**, **Insert Waveform**, **Done Inserting**

## Edit Repetitions

Press this softkey to edit the amount of repetitions of the highlighted sequence. Use the front-panel arrow keys, knob, or numeric keypad to enter the number of repetitions.

Softkey Location: Press **Mode**, **Dual ARB**, **Waveform Sequences**, **Build New Waveform Sequence**, **Edit Repetitions**

Or press **Mode**, **Dual ARB**, **Waveform Sequences**, **Edit Selected Waveform Sequence**, **Edit Repetitions**

## Edit Selected Waveform Sequence

Press this softkey to access a menu for editing the selected waveform sequence.

Softkey Location: Press **Mode**, **Dual ARB**, **Waveform Sequences**, **Edit Selected Waveform Sequence**

## Enter

This is a terminator softkey that notifies the signal generator when you have completed a desired action. If you use the front-panel knob or keypad to enter a value, the signal generator completes the action only after you press **Enter**.

## Ext

Press this softkey to set the trigger source to external triggering. When the trigger source is set to external, the signal generator will trigger an event when it receives the appropriate signal via the PATTERN TRIGGER IN connector.

---

**NOTE**

---

For trigger availability information, see the **Trigger** softkey definition.

**Softkey Location:** Press **Mode**, **Dual ARB**, **Trigger**, **Trigger Setup**, **Trigger Source**, **Ext**

**SCPI Commands:**

```
[ :SOURCE]:RADio:ARB:TRIGger[:SOURCE] EXT
```

```
[ :SOURCE]:RADio:ARB:TRIGger[:SOURCE]?
```

## Ext Polarity Neg Pos

Press this softkey to set the external trigger source polarity to either a positive change or a negative change in signal level.

---

**NOTE**

---

For trigger availability information, see the **Trigger** softkey definition.

**Softkey Location:** Press **Mode**, **Dual ARB**, **Trigger**, **Trigger Setup**, **Trigger Source**, **Ext Polarity Neg Pos**

**Status after Normal Preset:** Neg

**SCPI Commands:**

```
[ :SOURCE]:RADio:ARB:TRIGger[:SOURCE]:EXTernal:SLOPe  
POSitive|NEGative
```

```
[ :SOURCE]:RADio:ARB:TRIGger[:SOURCE]:EXTernal:SLOPe?
```

## Ext Delay Off On

Press this softkey to arm or disarm the external trigger delay. To use external trigger delay, press this softkey until **Ext Delay On** is highlighted, and then set the external delay time by pressing the **Ext Delay Time** softkey.

---

**NOTE**

---

For trigger availability information, see the **Trigger** softkey definition.

**Softkey Location:** Press **Mode**, **Dual ARB**, **Trigger**, **Trigger Setup**, **Trigger Source**, **Ext Delay Off On**

**Status after Normal Preset:** Off

**SCPI Commands:**

```
[ :SOURce ] :RADio :ARB :TRIGger [ :SOURce ] :EXTernal :DELay :STATe  
ON | OFF | 1 | 0
```

```
[ :SOURce ] :RADio :ARB :TRIGger [ :SOURce ] :EXTernal :DELay :STATe?
```

## Ext Delay Time

Press this softkey to set the time for the external trigger delay. 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 2.000 microseconds through 3600 seconds.

---

**NOTE**

---

For trigger availability information, see the **Trigger** softkey definition.

To use external trigger delay, press this softkey until **Ext Delay On** is highlighted, and then set the external delay time by pressing the **Ext Delay Time** softkey.

**Softkey Location:** Press **Mode**, **Dual ARB**, **Trigger**, **Trigger Setup**, **Trigger Source**, **Ext Delay Time**

**Status after Normal Preset:** 2.000 milliseconds

**SCPI Commands:**

```
[ :SOURce ] :RADio :ARB :TRIGger [ :SOURce ] :EXTernal :DELay  
<value>
```

```
[ :SOURce ] :RADio :ARB :TRIGger [ :SOURce ] :EXTernal :DELay?
```



## First Mkr Point

This softkey defines the *first* marker point when you define a range of points over which to either create or delete a marker. You can use either the front-panel knob or the numeric keys to set this value, which must be  $\geq 1$ , and  $\leq$  the total number of waveform points in the selected waveform.

Default Value: 1

### Creating Markers

Softkey Location: Press **Mode**, **Dual ARB**, **Waveform Segments**, **Set Markers**, **Set Marker On Range of Points**, **First Mkr Point**

Or press **Mode**, **Dual ARB**, **Select Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker On Range of Points**, **First Mkr Point**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Build New Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker On Range of Points**, **First Mkr Point**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Edit Selected Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker On Range of Points**, **First Mkr Point**

SCPI Command:

```
[ :SOURce]:RADio:ARB:MARKer:[SET] "<file name>",  
<mkr(1|2)>, <first_point>, <last_point>, <skip_count>
```

### Deleting Markers

Softkey Location: Press **Mode**, **Dual ARB**, **Waveform Segments**, **Set Markers**, **Set Marker Off Range of Points**, **First Mkr Point**

Or press **Mode**, **Dual ARB**, **Select Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker Off Range of Points**, **First Mkr Point**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Build New Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker Off Range of Points**, **First Mkr Point**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Edit Selected Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker Off Range of Points**, **First Mkr Point**

SCPI Command:

```
[ :SOURce]:RADio:ARB:MARKer:CLEar "<file name>",  
<mkr(1|2)>, <first_point>, <last_point>
```

## Gated

Press this softkey to set the dual ARB trigger type to gated. Using a gated trigger, you can set the signal to output when a TTL high or low is present at the PATTERN TRIG IN connector. To set the gate to trigger on either high or low, press **Gated** and then press **Trigger Setup, Gate Active Low High**.

---

**NOTE**

---

For trigger availability information, see the **Trigger** softkey definition.

Softkey Location: Press **Mode, Dual ARB, Trigger, Gated**

SCPI Commands:

```
[ :SOURce ]:RADio:ARB:TRIGger:TYPE GATE  
[ :SOURce ]:RADio:ARB:TRIGger:TYPE?
```

## Gate Active N/A

This softkey remains grayed-out until the trigger is set to gated. Once the trigger has been set to gated, press **Gate Active Low High** to toggle the polarity of the “through” or active state of a gated trigger signal. Gate active low will output the signal while the gate is low at the PATTERN TRIG IN connector. Gate active high has the opposite effect, outputting the signal while the signal level at the PATTERN TRIG IN connector is in a high state.

---

**NOTE**

---

For trigger availability information, see the **Trigger** softkey definition.

Softkey Location: Press **Mode, Dual ARB, Trigger, Trigger Setup, Gate Active N/A**

SCPI Commands:

```
[ :SOURce ]:RADio:ARB:TRIGger:TYPE:GATE:ACTive LOW|HIGH  
[ :SOURce ]:RADio:ARB:TRIGger:TYPE:GATE:ACTive?
```

## Goto Bottom Row

Press this softkey to move the selection bar to the bottom row in the current table or list of items.

**Goto Bottom Row** is located in table editor menus and in catalogs of files.

## Goto Middle Row

Press this softkey to move the selection bar to the middle row in the current table or list of items.

**Goto Middle Row** is located in table editor menus and in catalogs of files.

## Goto Row

Press this softkey to display softkeys that enable you to select a row or page in a table or list of items.

**Goto Row** is located in table editor menus and in catalogs of files.

## Goto Top Row

Press this softkey to move the selection bar to the top row in the current table or list of items.

**Goto Top Row** is located in table editor menus and in catalogs of files.

## Insert Waveform

Press this softkey to open a menu and table editor which allows you to insert a waveform to the current row of the table editor.

**Softkey Location:** Press **Mode, Dual ARB, Waveform Sequences, Build New Waveform Sequence, Insert Waveform**

Or press **Mode, Dual ARB, Waveform Sequences, Edit Selected Waveform Sequence, Insert Waveform**

## Insert Selected Waveform

Press this softkey to insert the highlighted waveform into the sequence you are building.

**Softkey Location:** Press **Mode, Dual ARB, Waveform Sequences, Build New Waveform Sequence, Insert Waveform, Insert Selected Waveform**

Or press **Mode, Dual ARB, Waveform Sequences, Edit Selected Waveform Sequence, Insert Waveform, Insert Selected Waveform**

## Insert Waveform Sequence Contents

Press this softkey to insert the contents of the highlighted sequence into the sequence you are building.

**Softkey Location:** Press **Mode, Dual ARB, Waveform Sequences, Build New Waveform Sequence, Insert Waveform, Insert Waveform Sequence Contents**

Or press **Mode, Dual ARB, Waveform Sequences, Edit Selected Waveform Sequence, Insert Waveform, Insert Waveform Sequence Contents**

## Last Mkr Point

This softkey defines the *last* marker point when you define a range of points over which to either create or delete a marker. You can use either the front-panel knob or the numeric keys to set this value, which must be  $\geq 1$ , and  $\leq$  the total number of waveform points in the selected waveform.

If you enter a value for either the first marker point or the last marker point that would make the first marker point occur *after* the last, the last marker point is automatically adjusted to match the first marker point.

Default Value: Last marker point in selected waveform segment.

### Creating Markers

Softkey Location: Press **Mode**, **Dual ARB**, **Waveform Segments**, **Set Markers**, **Set Marker On Range of Points**, **Last Mkr Point**

Or press **Mode**, **Dual ARB**, **Select Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker On Range of Points**, **Last Mkr Point**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Build New Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker On Range of Points**, **Last Mkr Point**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Edit Selected Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker On Range of Points**, **Last Mkr Point**

SCPI Command:

```
[ :SOURce ]:RADio:ARB:MARKer:[SET] "<file name>",  
<mkr(1|2)>, <first_point>, <last_point>, <skip_count>
```

### Deleting Markers

Softkey Location: Press **Mode**, **Dual ARB**, **Waveform Segments**, **Set Markers**, **Set Marker Off Range of Points**, **Last Mkr Point**

SCPI Command:

Or press **Mode**, **Dual ARB**, **Select Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker Off Range of Points**, **Last Mkr Point**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Build New Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker Off Range of Points**, **Last Mkr Point**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Edit Selected Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker Off Range of Points**, **Last Mkr Point**

```
[ :SOURce ]:RADio:ARB:MARKer:CLEar "<file name>",  
<mkr(1|2)>, <first_point>, <last_point>
```

## Load Store

Press this softkey to toggle between the two displayed catalog windows to allow you to either load or store waveform segments.

Softkey Location: Press **Mode**, **Dual ARB**, **Select Waveform**, **Waveform Segments**, **Load Store**

## Name And Store

Press this softkey to store and rename (if necessary) the highlighted sequence.

Softkey Location: Press **Mode**, **Dual ARB**, **Waveform Sequences**, **Build New Waveform Sequence**, **Name and Store**

Or press **Mode**, **Dual ARB**, **Waveform Sequences**, **Edit Selected Waveform Sequence**, **Name And Store**

## Marker 1 2

Press this softkey to select the marker that you want to be active for setting or clearing.

Softkey Location: Press **Mode**, **Dual ARB**, **Waveform Segments**, **Set Markers**, **Set Marker 1 2**

Or press **Mode**, **Dual ARB**, **Select Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker 1 2**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Build New Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker 1 2**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Edit Selected Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker 1 2**

Default Value: Marker 1

SCPI Command:

```
[ :SOURce]:RADio:ARB:MARKer:[SET] "<file name>",  
<mkr(1|2)>, <first_point>, <last_point>, <skip_count>
```

## Marker Polarity Neg Pos

Press this softkey to set the polarity of *both* markers to active positive or active negative.

Softkey Location: Press **Mode**, **Dual ARB**, **Arb Setup**, **Marker Polarity Neg Pos**

Default Value: Positive

SCPI Command:

```
[ :SOURce ] :RADio :ARB :MARKer :POLarity NEG | POS  
[ :SOURce ] :RADio :ARB :MARKer :POLarity ?
```

## Mkr 2 To RF Blank Off On

Press this softkey to enable or disable RF blanking when marker 2 is low.

Softkey Location: Press **Mode**, **Dual ARB**, **Arb Setup**, **Mkr 2 To Blank Off On**

Default Value: Off

SCPI Command:

```
[ :SOURce ] :RADio :ARB :MARKer :RFBLank ON | OFF | 1 | 0  
[ :SOURce ] :RADio :ARB :MARKer :RFBLank ?
```

## Page Down

Press this softkey to view the next page of listings in a table editor or catalog of files.

**Page Down** is located in table editor menus and in catalogs of files.

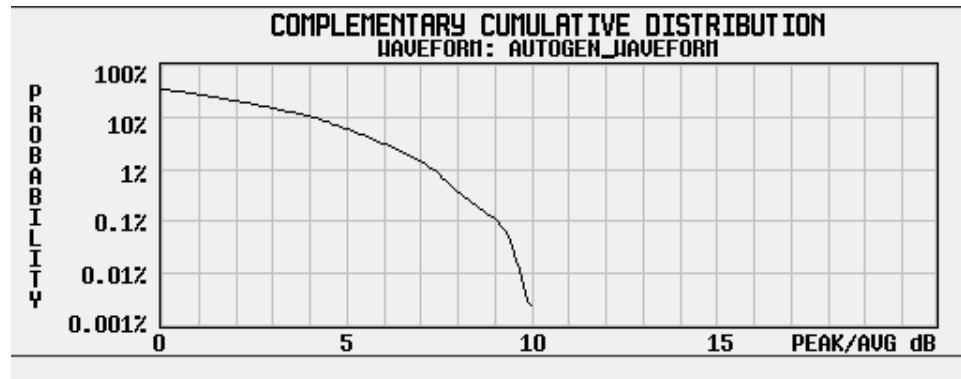
## Page Up

Press this softkey to view the previous page of listings in a table editor or catalog of files.

**Page Down** is located in table editor menus and in catalogs of files.

## Plot CCDF

Press this softkey to display a plot of the Complementary Cumulative Distribution Function for the selected waveform. The plot displays the probability that the instantaneous envelope power is  $x$  dB above the average power, where  $x$  is the number on the horizontal axis.



Softkey Location: Press **Mode**, **Dual ARB**, **Select Waveform**, **Waveform Segments**, **More (1 of 2)**, **Waveform Statistics**, **Plot CCDF**

## Reconstruction Filter

Press this softkey to display a menu for selecting a reconstruction filter. You may choose a filter with a cutoff frequency of 250.0 kHz, 2.500 MHz, 8.000 MHz or Through (no filter).

Softkey Location: Press **Mode**, **Dual ARB**, **ARB Setup**, **Reconstruction Filter**

Status after Normal Preset: 2.500 MHz

SCPI Commands:

```
[ :SOURCE ]:RADio:ARB:RFILter <value>|Through
[ :SOURCE ]:RADio:ARB:RFILter?
```

## Reference Freq

Press this softkey to set the reference frequency of the external clock. This softkey is only accessible when you are using an external ARB reference connected to the BASEBAND GEN REF IN connector. Acceptable values range from 250.000 kHz to 20.000000 MHz.

Softkey Location: Press **Mode**, **Dual ARB**, **ARB Setup**, **Reference Freq**

Status after Normal Preset: 10.0000000 MHz

SCPI Commands:

```
[ :SOURce ] : RADio : ARB : CLOck : REFerence : EXTernal  
: FREQuency <value>
```

```
[ :SOURce ] : RADio : ARB : CLOck : REFerence : EXTernal  
: FREQuency?
```

## Rename Segment

Press this softkey to rename the selected waveform segment in the displayed catalog.

Softkey Location: Press **Mode**, **Dual ARB**, **Waveform Segments**, **More (1 of 2)**, **Rename Segment**

SCPI Commands:

```
: MMEMoRY : MOVE <src_file> , <dest_file>
```

## Retrigger Mode Off On

Press this softkey to toggle the operating state of the CDMA retrigger mode. With **Retrigger Mode Off On** set to **On**, if a trigger occurs while a waveform is playing, the waveform will retrigger at the end and play one more time. The retriggers do not accumulate. If several triggers are received during a waveform, it will only be replayed once. When **Retrigger Mode Off On** is set to **Off**, if a trigger occurs while a waveform is playing, it is ignored.

---

### NOTE

---

For trigger availability information, see the **Trigger** softkey definition.

Softkey Location: Press **Mode**, **Dual ARB**, **Trigger**, **Trigger Setup**, **Retrigger Mode Off On**

Status after Normal Preset: Off

SCPI Commands:

```
[ :SOURce ] : RADio : ARB : RETRigger ON | OFF | 1 | 0  
[ :SOURce ] : RADio : ARB : RETRigger?
```



## Segment Advance

Press this softkey to set the dual ARB trigger type to segment advance. After receiving a trigger while operating with a waveform sequence, the sequencer will play the next segment in the sequence.

---

### NOTE

---

For trigger availability information, see the **Trigger** softkey definition.

**Softkey Location:** Press **Mode**, **Dual ARB**, **Trigger**, **Segment Advance**

**SCPI Commands:**

```
[ :SOURce]:RADio:ARB:TRIGger:TYPE SADVance
[ :SOURce]:RADio:ARB:TRIGger:TYPE?
```

## Select Waveform

Press this softkey to display a list of files that can be selected for the Dual ARB to play.

**Softkey Location:** Press **Mode**, **Dual ARB**, **Select Waveform**

**SCPI Commands:**

```
[ :SOURce]:RADio:ARB:WAVEform "<file name>"
[ :SOURce]:RADio:ARB:WAVEform?
```

## Select Waveform (ARBI: *or* SEQ:)

Press this softkey to select the type of signal for the dual arbitrary waveform generator to generate. Choose between the waveform segment (**ARBI:**) or sequence file (**SEQ:**). Note that the name of the segment (**ARBI:**) or sequence (**SEQ:**) will follow after **ARBI:** or **SEQ:** in the softkey name.

**Softkey Location:** Press **Mode**, **Dual ARB**, **Select Waveform**, **Select Waveform (ARBI:/SEQ:)**

**SCPI Commands:**

```
[ :SOURce]:RADio:ARB:WAVEform "ARBI|SEQ:"
[ :SOURce]:RADio:ARB:WAVEform?
```

## Set Markers

Press this softkey to display a menu that enables you to set waveform markers. This softkey is not available unless a waveform segment is selected. See [“Waveform Segments”](#) on page 3-74.

Softkey Location: Press **Mode**, **Dual ARB**, **Waveform Segments**, **Set Markers**

Or press **Mode**, **Dual ARB**, **Select Waveform**, **Waveform Segments**, **Set Markers**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Build New Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Edit Selected Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**

SCPI Command:

```
[ :SOURce ]:RADio:ARB:MARKer:[SET] "<file name>",  
<mkr(1|2)>, <first_point>, <last_point>, <skip_count>
```

## Set Marker Off All Points

Press this softkey to clear the active marker (1 or 2) from all waveform points.

Softkey Location: Press **Mode**, **Dual ARB**, **Waveform Segments**, **Set Markers**, **Set Marker Off All Points**

Or press **Mode**, **Dual ARB**, **Select Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker Off All Point**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Build New Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker Off All Point**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Edit Selected Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker Off All Point**

SCPI Command:

```
[ :SOURce ]:RADio:ARB:MARKer:CLEar:All "<file name>",  
<mkr(1|2)>
```

## Set Marker Off Range of Points

Press this softkey to display a menu where you can clear the active marker from a range of points on the selected waveform.

**Softkey Location:** Press **Mode**, **Dual ARB**, **Waveform Segments**, **Set Markers**, **Set Marker Off Range of Points**

Or press **Mode**, **Dual ARB**, **Select Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker Off Range of Points**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Build New Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker Off Range of Points**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Edit Selected Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker Off Range of Points**

**SCPI Command:**

```
[ :SOURce]:RADio:ARB:MARKer:CLEar "<file name>",  
<mkr(1|2)>, <first_point>, <last_point>
```

## Set Marker On First Point

Press this softkey to turn on the active marker on the first point of the selected waveform.

**Softkey Location:** Press **Mode**, **Dual ARB**, **Waveform Segments**, **Set Markers**, **Set Marker On First Point**

Or press **Mode**, **Dual ARB**, **Select Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker On First Point**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Build New Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker On First Point**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Edit Selected Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker On First Point**

**SCPI Command:**

```
[ :SOURce]:RADio:ARB:MARKer:[SET] "<file name>",  
<mkr(1|2)>, <first_point>, <last_point>, <skip_count>
```

## Set Marker On Range of Points

Press this softkey to display a menu where you can set the active marker over a range of points on the selected waveform.

Softkey Location: Press **Mode**, **Dual ARB**, **Waveform Segments**, **Set Markers**, **Set Marker On Range of Points**

Or press **Mode**, **Dual ARB**, **Select Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker On Range of Points**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Build New Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker On Range of Points**

Or press **Mode**, **Dual ARB**, **Waveform Sequence**, **Edit Selected Waveform Sequence**, **Insert Waveform**, **Waveform Segments**, **Set Markers**, **Set Marker On Range of Points**

SCPI Command:

```
[ :SOURce ]:RADio:ARB:MARKer:[SET] "<file name>",  
<mkr(1|2)>, <first_point>, <last_point>, <skip_count>
```

## Show Waveform Sequence Contents

Press this softkey to display the contents of the selected waveform sequence in a table format. The content information displayed is a list of the waveforms and corresponding repetitions for that sequence. Note that this softkey is only present when a sequence is highlighted.

Softkey Location: Press **Mode**, **Dual ARB**, **Select Waveform**, **Show Waveform Sequence Contents**

Or press **Mode**, **Dual ARB**, **Waveform Sequences**, **Build New Waveform Sequence**, **Insert Waveform**, **Show Waveform Sequence Contents**

Or press **Mode**, **Dual ARB**, **Waveform Sequences**, **Edit Selected Waveform Sequence**, **Insert Waveform**, **Show Waveform Sequence Contents**

## Single

Press this softkey to set the dual ARB trigger type to single. After receiving a trigger, the waveform will be output once.

Softkey Location: Press **Mode**, **Dual ARB**, **Trigger**, **Single**

SCPI Commands:

```
[ :SOURce ]:RADio:ARB:TRIGger:TYPE SINGLE  
[ :SOURce ]:RADio:ARB:TRIGger:TYPE?
```

## Store All

Press this softkey to move all of the files from or currently stored in (volatile) ARB memory to (non-volatile) NVARB memory for later recall and use.

Softkey Location: Press **Mode**, **Dual ARB**, **Select Waveform**, **Waveform Segments**, **Store All**

## Store Segment

Press this softkey to store the selected file from (volatile) ARB memory to (non-volatile) NVARB memory for later recall and use.

Softkey Location: Press **Mode**, **Dual ARB**, **Select Waveform**, **Waveform Segments**, **Store Segment**

## Through

Press this softkey to bypass all reconstruction filtering. This is useful for using external reconstruction filters at frequencies different than those supplied internally.

Softkey Location: Press **Mode**, **Dual ARB**, **ARB Setup**, **Reconstruction Filter**, **Through**

SCPI Commands:

```
[ :SOURce]:RADio:ARB:RFILter THROugh
[ :SOURce]:RADio:ARB:RFILter?
```

## Toggle Marker 1

Press this softkey to enable/disable marker1 for the selected segment of a waveform sequence.

Softkey Location: Press **Mode**, **Dual ARB**, **Waveform Sequence**, **Build New Waveform Sequence**, **Toggle Markers**, **Toggle Marker 1**

Default Value: Off

SCPI Commands:

```
[ :SOURce]:RADio:ARB:SEQuence
"<file name>", <waveform>, <reps>, <mkr1(1|0)>, <mkr2(1|0)>
{, <waveform>, <reps>, <mkr1(1|0)>, <mkr2(1|0)>}
[ :SOURce]:RADio:ARB:SEQuence? "<file name>"
```

## Toggle Marker 2

Press this softkey to enable/disable marker 2 for the selected segment of a waveform sequence.

Default Value: Off

Softkey Location: Press Mode, Dual ARB, Waveform Sequence, Build New Waveform Sequence, Toggle Markers, Toggle Marker 2

SCPI Commands:

```
[ :SOURce ]:RADio:ARB:SEQuence "<file name>", <waveform>, <reps>, <mkr1(1|0)>, <mkr2(1|0)> {, <waveform>, <reps>, <mkr1(1|0)>, <mkr2(1|0)> }
```

```
[ :SOURce ]:RADio:ARB:SEQuence? "<file name>"
```

## Toggle Markers

Press this softkey to display a menu where you can toggle markers 1 and 2 to enable or disable markers for selected segments of a sequence.

Softkey Location: Press Mode, Dual ARB, Waveform Sequence, Build New Waveform Sequence, Toggle Markers

SCPI Commands:

```
[ :SOURce ]:RADio:ARB:MARKer:[SET] "<file name>", <mkr(1|2)>, <first_point>, <last_point>, <skip_count>
```

```
[ :SOURce ]:RADio:ARB:MARKer:CLEar:All "<file name>", <mkr(1|2)>
```

## Trigger

Press this softkey to display the dual arbitrary waveform generator trigger menu. This menu offers four different types of triggering: continuous, single, gated, and when a waveform sequence is active, segment advance. The menu also contains a **Trigger Setup** key that allows you to adjust the trigger source, the retrigger mode and the gate active polarity.

---

### NOTE

Dual ARB triggers, their associated softkeys and SCPI functionality became available in Option UN5/UND signal generators with serial number prefix US3844 or GB3845. Dual ARB triggers are *not* available in Option UN5/UND signal generators with an earlier serial number prefix, unless upgraded.

To upgrade your Option UN5/UND signal generator to include Dual ARB triggering, contact your nearest HP Sales and Service office. A list of HP Sales and Service offices is provided in the *HP ESG and ESG-D Series Signal Generator User's Guide* at the end of Chapter 3, "Troubleshooting."

**Softkey Location:** Press **Mode**, **Dual ARB**, **Trigger**

**Status after Normal Preset:** Continuous

**SCPI Commands:**

```
[ :SOURce]:RADio:ARB:TRIGger:TYPE CONTinuous|SINGLE|GATE|
SADVance
[ :SOURce]:RADio:ARB:TRIGger:TYPE?
```

## Trigger Key

Press this softkey to set the trigger source to the signal generator's front-panel **Trigger** hardkey. When the trigger source is set to **Trigger Key**, the signal generator will trigger an event when the **Trigger** hardkey is pressed.

---

### NOTE

For trigger availability information, see the **Trigger** softkey definition.

**Softkey Location:** Press **Mode**, **Dual ARB**, **Trigger**, **Trigger Setup**, **Trigger Source**, **Trigger Key**

**SCPI Commands:**

```
[ :SOURce]:RADio:ARB:TRIGger[:SOURce] KEY
[ :SOURce]:RADio:ARB:TRIGger[:SOURce]?
```

## Trigger Setup

Press this softkey to display the dual ARB trigger setup menu. This menu allows you to adjust the trigger source, the retrigger mode and the gate active polarity.

---

**NOTE** For trigger availability information, see the **Trigger** softkey definition.

---

Softkey Location: Press **Mode**, **Dual ARB**, **Trigger**, **Trigger Setup**

## Trigger Source

Press this softkey to display the dual ARB trigger source menu. This menu allows you to adjust the trigger source between the front panel **Trigger** key, a trigger command sent over the HP-IB bus, or an external trigger applied to the PATTERN TRIG IN connector.

---

**NOTE** For trigger availability information, see the **Trigger** softkey definition.

---

Softkey Location: Press **Mode**, **Dual ARB**, **Trigger**, **Trigger Source**

SCPI Commands:

```
[ :SOURce ]:RADio:ARB:TRIGger[ :SOURce ] KEY|EXT|BUS  
[ :SOURce ]:RADio:ARB:TRIGger[ :SOURce ]?
```

## Waveform Segments

Press this softkey to open a menu and table editor where you can store and load waveform segments to or from the non-volatile waveform memory (NVARB).

Until a waveform is selected, two of the softkeys in this menu are gray:

- [Set Markers](#) Select
- Waveform Statistics

Softkey Location: Press **Mode**, **Dual ARB**, **Waveform Segments**

Or press **Mode**, **Dual ARB**, **Select Waveform**, **Waveform Segments**

## Waveform Sequences

Press this softkey to open a menu and table editor where you can build waveform sequences, edit existing sequences, and/or delete sequences.

Softkey Location: Press **Mode**, **Dual ARB**, **Waveform Sequences**



## Waveform Statistics

Press this softkey to display the Waveform Statistics Menu. When the softkey is active, statistics are available for the selected waveform.

Softkey Location: Press **Mode**, **Dual ARB**, **Waveform Sequences**, **More (1 of 2)**, **Waveform Statistics**

---

## Multitone

Pressing this softkey accesses a menu of softkeys that enables you to create multitone signals using the multitone waveform generator. Within these menus, you will be able to create, select, and/or modify the waveform. These softkeys are described in this section in alphabetical order. See also “[Creating a Multitone Waveform](#)” on page 2-39.

### Apply Multitone

In the multitone table editor, press this softkey to apply to the signal any changes you have made in the phase or state parameters.

Softkey Location: Press **Mode**, **Multitone**, **Apply Multitone**

SCPI Commands:

```
[ :SOURce ] :RADio :MTONE :ARB [ :STATe ] ON
```

### Delete File

Press this softkey to delete the highlighted file from the displayed catalog. You will be prompted for confirmation.

**Delete File** is located in catalogs of files.

### Done

In the multitone setup table, press this softkey to accept the entered number of tones and frequency spacing, and return to the multitone menu. This also sets the phase column to all zeros, and the state column to all on.

Softkey Location: Press **Mode**, **Multitone**, **Initialize Table**, **Done**

### Edit Phase

Use this softkey and the front-panel knob or number keys to set the phase of the selected tone in the multitone table editor. Tone phase is relative to the other tones.

Softkey Location: Press **Mode**, **Multitone**, **Edit Phase**

Default Value: 0                      Range: 0 though 359

SCPI Commands:

```
[ :SOURce ] :RADio :MTONE :ARB :SETup :TABLE  
freq_spacing,num_tones,phase0,state0,phase1,state1,...
```

```
[ :SOURce ] :RADio :MTONE :ARB :SETup :TABLE?
```

## Enter

This is a terminator softkey that notifies the signal generator when you have completed a desired action. If you use the front-panel knob or keypad to enter a value, the signal generator completes the action only after you press **Enter**.

## Freq Spacing

Use this softkey and the front-panel knob or number keys to set the spacing between tones in the multitone table editor. This is done as part of initializing the table editor. See [“Creating a Multitone Waveform”](#) on page 2-39 for details.

Softkey Location: Press **Mode**, **Multitone**, **Initialize Table**, **Freq Spacing**

Default Value: 10.000 kHz                      Range: 100 Hz though 5 MHz

SCPI Commands:

```
[ :SOURce ]:RADio:MTONe:ARB:SETup:TABLE  
freq_spacing,num_tones,phase0,state0,phase1,state1,...
```

```
[ :SOURce ]:RADio:MTONe:ARB:SETup:TABLE?
```

## Goto Bottom Row

Press this softkey to move the selection bar to the bottom row in the current table or list of items.

**Goto Bottom Row** is located in table editor menus and in catalogs of files.

## Goto Middle Row

Press this softkey to move the selection bar to the middle row in the current table or list of items.

**Goto Middle Row** is located in table editor menus and in catalogs of files.

## Goto Row

Press this softkey to display softkeys that enable you to select a row or page in a table or list of items.

**Goto Row** is located in table editor menus and in catalogs of files.

## Goto Top Row

Press this softkey to move the selection bar to the top row in the current table or list of items.

**Goto Top Row** is located in table editor menus and in catalogs of files.

## Initialize Table

Press this softkey to display a menu that enables you to set the initial values for the multitone table editor. This is also the menu you use to change the frequency spacing and the number of tones.

Softkey Location: Press **Mode**, **Multitone**, **Initialize Table**

## Load/Store

Press this softkey to access a menu for loading the multitone table editor with values from files previously stored in the signal generator memory, and for saving to memory a user-defined signal from the multitone table editor.

Softkey Location: Press **Mode**, **Multitone**, **More (1 of 2)**, **Load/Store**

## Load From Selected File

Press this softkey to replace the current information in a table editor with the information stored in the highlighted file.

**Load From Selected File** is located in catalogs of files.

```
[ :SOURce ] : RADio : MTONE : ARB : SETup "<file name>"  
[ :SOURce ] : RADio : MTONE : ARB : SETup?
```

## MTONE

Press this softkey to display the multitone waveform files stored in the signal generator.

Softkey Location: Press **Utility**, **Memory Catalog**, **Catalog Type**, **ARB Catalog Types**, **More (1 of 2)**, **MTONE**

SCPI Command:

```
:MEMory : CATalog : MTONE?
```

## Multitone Off On

Press this softkey to toggle the operating state of the multitone generator between on and off.

Softkey Location: Press **Mode**, **Multitone**, **Multitone Off On**

Default Value: Off

SCPI Command:

```
[ :SOURce ] :RADio :MTONE :ARB [ :STATe ] ON | OFF | 1 | 0
[ :SOURce ] :RADio :MTONE :ARB [ :STATe ] ?
```

## Number of Tones

Use this softkey and the front-panel knob or number keys to set the number of tones in the multitone table editor. This is done as part of initializing the table editor. See [“Creating a Multitone Waveform”](#) on page 2-39 for details.

Softkey Location: Press **Mode**, **Multitone**, **Initialize Table**, **Number of Tones**

Default Value: 8                      Range: 2 though 64

SCPI Command:

```
[ :SOURce ] :RADio :MTONE :ARB :SETup :TABLE
freq_spacing, num_tones, phase0, state0, phase1, state1, ...
```

```
[ :SOURce ] :RADio :MTONE :ARB :SETup :TABLE ?
```

## Page Down

Press this softkey to view the next page of listings in a table editor or catalog of files.

**Page Down** is located in table editor menus and in catalogs of files.

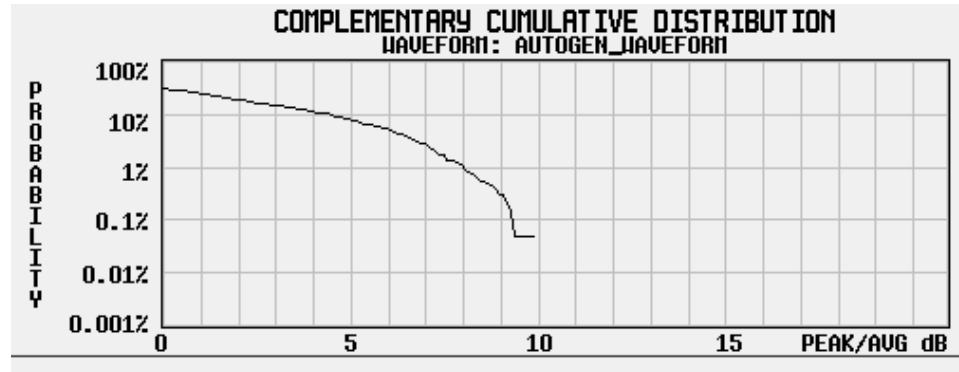
## Page Up

Press this softkey to view the previous page of listings in a table editor or catalog of files.

**Page Down** is located in table editor menus and in catalogs of files.

## Plot CCDF

Press this softkey to display a plot of the Complementary Cumulative Distribution Function for the selected waveform. The plot displays the probability that the instantaneous envelope power is  $x$  dB above the average power, where  $x$  is the number on the horizontal axis.



Softkey Location: Press Mode, Multitone, Waveform Segments, More (1 of 2), Waveform Statistics, Plot CCDF

## Store To File

Press this softkey to display a menu where you can store the current table editor information for later use.

Store To File is located in catalogs of files.

```
[ :SOURce ] :RADio :MTONE :ARB :SETup :STORE "<file name>"
```

## Toggle State

In the multitone table editor, press this softkey to turn the selected tone or and off. This determines whether or not a tone is generated.

Softkey Location: Press Mode, Multitone, Toggle State

Default Value: On

SCPI Command:

```
[ :SOURce ] :RADio :MTONE :ARB :SETup :TABLE  
freq_spacing,num_tones,phase0,state0,phase1,state1,...
```

```
[ :SOURce ] :RADio :MTONE :ARB :SETup :TABLE?
```

## Waveform Statistics

Press this softkey to display the Waveform Statistics Menu. When the softkey is active, statistics are available for the selected waveform.

Softkey Location: Press **Mode**, **Multitone**, **More (1 of 2)**, **Waveform Statistics**





# 4 Operation

This section contains detailed information that will help you learn how to operate the dual arbitrary waveform generator section of your signal generator.

---

## Managing Volatile and Non-Volatile ARB Memory

Follow the guidelines in this section to learn how to manage the signal generator's volatile and non-volatile ARB memory. (Option UND is required.)

### Understanding Arbitrary Waveform Memory Types

There are two types of arbitrary waveform generator memory: volatile, referred to as ARB memory, and non-volatile, referred to as NVARB memory.

Waveform data stored in ARB memory is volatile. The data in ARB memory is destroyed whenever the signal generator's line power is cycled. In ARB memory, waveform data may be downloaded, sequenced, and played back through the signal generator's I/Q baseband generator section.

Information stored in NVARB memory is non-volatile. Waveforms stored in NVARB memory must first be moved to ARB memory in order to be sequenced and played. Waveform data stored in NVARB memory is not at risk when the signal generator's line power is cycled.

While waveforms may be directly downloaded to either ARB or NVARB memory, it may be faster, if memory space permits, to first download the waveform data to ARB memory and then store it in NVARB memory. Downloads into ARB memory are significantly faster than downloads into NVARB memory. For additional information, see the section titled [“Downloading Waveform Files Into Memory”](#) on page 2-57.

### Arbitrary Waveform Memory and CDMA Format Relationships

Other arbitrary waveform generator formats, such as CDMA and Wideband CDMA, use the same memory space as the waveform files downloaded for use by the dual arbitrary waveform generator. These formats all use the same file, `AUTOGEN_WAVEFORM`. You may increase memory space for waveform files by turning off the formats that are not being used and deleting the file `AUTOGEN_WAVEFORM`.

## Understanding Volatile ARB Waveform Memory

Volatile waveform memory space is allocated in 4096-point (8192 byte) segments. Accordingly, regardless of how small the waveform is, it will always occupy at least 4096 points (8192 bytes) of volatile ARB memory. If a waveform file is too large to fit into a 4096-point memory segment, then additional memory space is allocated in multiples of 4096 points. For instance, if a waveform consists of 4100 points, it will be allocated to a 8192-point memory segment.

When played back through the sequencer, smaller waveforms will only play back the number of points occupied by their waveform data, not the full 4096 points. See the following table.

**Table 4-1 Waveform Size Versus Memory Catalog File Size**

Waveform	Number of Points	Memory Space (in points)
wfm1	32	4096
wfm2	128	4096
wfm3	4096	4096
wfm4	4098	8192
TOTAL POINTS	8354	20480

It is important to remember that, if there are lots of small waveform files stored in volatile ARB memory, the total memory usage may be much more than the sum of the points that make up the actual waveform data. There will not be as much memory available as perhaps expected, based on the combined sum of the individual waveform data files.

---

## Waveform Composition

Dual ARB waveforms are composed of two sets of data: I and Q. The I data drives the I port of the I/Q modulator and the Q data drives the Q port. These two sets of data give rise to the name *dual* arbitrary waveform generator.

I and Q data are arrays of 2-byte integers. The actual waveform shape is enclosed in the least-significant 14 bits of both the I and Q data. The other four bits (two for I and two for Q) are used for event markers and internal sequencing.

**Table 4-2 I and Q Bit Delegation**

Bit Number	I	Q
0 through 13	waveform data	waveform data
14	EVENT 2	reserved
15	EVENT 1	reserved

A 1 in bit position 14 or 15 of the I data will cause a TTL high to appear at the associated EVENT BNC connector on the signal generator's rear panel.

The waveform data (bits 0 through 13) is in unsigned, offset format:

- 0 gives negative full-scale output
- 8192 gives 0V output
- 16383 gives positive full-scale output

## Event Markers and Sequencing

As mentioned earlier, markers can be made available at the EVENT 1 and EVENT 2 connectors on the signal generator's rear panel. Waveform segments played individually will pass these markers to the associated output connector. However, when a segment is played as part of a sequence, the sequencer masks certain EVENT 1 markers. EVENT 2 markers are always played.

The sequencer will play the EVENT 1 marker for the first segment listed in a sequence. Subsequent waveform segments will have their EVENT 1 markers disabled. This means during a sequence playback where the first waveform segment has multiple repetitions, the markers for each segment repetition will be played until the sequencer moves on to the next listed waveform segment.

With Option UN5 CDMA turned on (Option UN5 requires Option UND hardware), an even second output is generated at the EVENT 1 connector. A marker is output every two seconds indicating the beginning of every 75th short code sequence for use in synchronizing CDMA analysis instruments.

For additional information on marker functionality, see [“Using Markers”](#) on page 2-50.

## Waveform Limitations

There are several parameters that your waveform files must meet in order to work correctly:

1. Each I and Q waveform must have at least 16 points (a point equals an integer).
2. Each I and Q waveform must have an even number of points.
3. Each I and Q waveform should be the same length. (Different length I and Q waveforms are allowed. The shorter waveform will give a 0V output from its end up to the length of the longer waveform.)
4. When overwriting a waveform in memory, you must rewrite both the I and Q waveforms.

---

## Understanding Arbitrary Waveform Generator Triggers

The Arbitrary Waveform Generator includes several different triggering options. For information on setting up triggering schemes, see [“Using Arbitrary Waveform Generator Triggers”](#) on page 2-66.

---

**NOTE** Arbitrary waveform generator triggers, their associated softkeys and SCPI functionality became available in Option UN5/UND signal generators with serial number prefix US3844 or GB3845. Arbitrary waveform generator triggers are *not* available in Option UN5/UND signal generators with an earlier serial number prefix, unless upgraded.

To upgrade your Option UN5/UND signal generator to include arbitrary waveform generator triggering, contact your nearest HP Sales and Service office. A list of HP Sales and Service offices is provided in the *HP ESG and ESG-D Series Signal Generator User's Guide* at the end of Chapter 3, “Troubleshooting.”

---

### Trigger Types

There are four different trigger types available with Option UND: continuous, single, gated and segment advance. These trigger types can be accessed by pressing the appropriate softkey or sending the appropriate SCPI command via HP-IB.

#### Continuous Triggering

This is the default trigger setting for the signal generator. When continuous triggering is selected, once the waveform has been generated and activated, it will repeat continuously until the mode is turned off.

#### Single Triggering

When single triggering is selected, once the waveform has been generated and activated, it will play once and then wait for another signal from the selected trigger source before playing again.

#### Gated Triggering

When gated triggering is selected, the waveform is set to output when a TTL high or low is present at the PATTERN TRIG IN connector on the signal generator's rear panel. Gated triggering includes one additional function: gate active low/high.

- Gate Active

Once the trigger has been set to gated, use gate active to toggle the polarity of the “through” or active state of a gated trigger signal. Gate active low will output the signal while the gate is in a TTL low state at the PATTERN TRIG IN connector. Gate active high has the opposite effect, outputting the signal while the signal level at the PATTERN TRIG IN connector is in a TTL high state.

### Segment Advance Triggering

Segment advance is used while operating with a sequence of waveform segments. In segment advance mode, a given sequence is played continuously. When a trigger is received, the next segment in the sequence is played continuously.

## Trigger Sources

There are three different trigger sources available with Option UND: the front panel Trigger key, the HP-IB interface, and external triggering.

### The Trigger Key

With the trigger source set to trigger key, the waveform will trigger when the front panel Trigger hardkey is pressed.

### The HP-IB Interface Bus

With the trigger source set to bus, the waveform will trigger when the signal generator receives the appropriate remote command (for example, \*TRG in HP BASIC) over the HP-IB interface bus.

### External Triggering

With the trigger source set to external, the waveform will trigger when the signal generator receives a TTL signal at the PATTERN TRIG IN rear panel connector. External triggering includes several additional functions: external polarity (positive or negative), external delay, and external delay time.

- External Polarity

The polarity of the external triggering signal can be set to either a positive change or a negative change in signal level.

- External Delay

A delay in the time an external trigger stimulus is received at the PATTERN TRIG IN connector to the time at which the waveform playback is started.

- External Delay Time

The amount of delay in the time an external trigger stimulus is received at the PATTERN TRIG IN connector and the time the waveform is actually output, variable from 2.0 microseconds to 3600 seconds.

## Retrigger Mode

Using Retrigger Mode (Retrigger Mode Off On set to On), if a trigger occurs while a waveform is playing, the waveform will retrigger when it reaches the end. When using Retrigger Mode, triggers do not accumulate; if multiple triggers are sent to the signal generator as a waveform is playing only one trigger is kept until the end of the current waveform playback. With Retrigger Mode set to off, if a trigger occurs while a waveform is playing, it is ignored.

**Understanding Arbitrary Waveform Generator Triggers**



# 5 Remote Programming

This chapter contains a brief overview of the Standard Commands for Programmable Instruments (SCPI) programming language (including a command syntax description) and a listing of all of the CDMA and Dual ARB subsystem SCPI commands in alphabetical order. The descriptions include syntax requirements, ranges, restrictions, query responses, and status after a \*RST.

---

## Getting Started with SCPI

This section includes some basic reference material for the Standard Commands for Programmable Instruments language (SCPI). For more detailed information, see the programming guide.

### Understanding Common Terms

The following terms are used throughout the remainder of this chapter.

Controller	A controller is any computer used to communicate with a SCPI instrument. A controller can be a personal computer, a minicomputer, or a plug-in card in a card cage. Some intelligent instruments can also function as controllers.
Instrument	An instrument is any device that implements SCPI. Most instruments are electronic measurement or stimulus devices, but this is not a requirement. Similarly, most instruments use an HP-IB or RS-232 interface for communication. The same concepts apply regardless of the instrument function or the type of interface used.
Program Message	A program message is a combination of one or more properly formatted SCPI commands. Program messages always go from a controller to an instrument. Program messages tell the instrument how to make measurements and output signals.
Response Message	A response message is a collection of data in specific SCPI formats. Response messages always go from an instrument to a controller or listening instrument. Response messages tell the controller about the internal state of the instrument and about measured values.
Command	A command is an instruction in SCPI. You combine commands to form messages that control instruments. In general, a command consists of mnemonics (keywords), parameters, and punctuation.
Query	A query is a special type of command. Queries instruct the instrument to make response data available to the controller. Query mnemonics always end with a question mark.

## Standard Notation

This section uses several forms of notation that have specific meaning:

### Command

**Mnemonics** Many commands have both a long and a short form and you must use either one or the other (SCPI does not accept a combination of the two). Consider the `FREQuency` command, for example. The short form is `FREQ` and the long form is `FREQUENCY`. This notation type is a shorthand to document both the long and short form of commands. SCPI is not case sensitive, so `fREquEnCy` is just as valid as `FREQUENCY`, but `FREQ` and `FREQUENCY` are the only valid forms of the `FREQuency` command.

### Angle

#### Brackets

Angle brackets indicate that the word or words enclosed represent something other than themselves. For example, `<new line>` represents the ASCII character with the decimal value 10. Similarly, `<END>` means that EOI is asserted on the HP-IB interface. Words in angle brackets have much more rigidly defined meaning than words shown in ordinary text. For example, this section uses the word “message” to talk about messages generally. But the bracketed words `<program message>` indicate a precisely defined element of SCPI. If you need them, you can find the exact definitions of words such as `<program message>` in a syntax diagram.

## More About Commands

### Query and Event Commands

You can query any value that you can set. For example, the presence of the signal generator `FREQuency:OFFSet` command implies that a `FREQuency:OFFSet?` also exists. If you see a command ending with a question mark, it is a query-only command. Some commands are events and cannot be queried. An event has no corresponding setting if it causes something to happen inside the instrument at a particular instant.

### Implied Commands

Implied commands appear in square brackets. If you send a subcommand immediately preceding an implied command, but do not send the implied command, the instrument assumes you intend to use the implied command and behaves just as if you had sent it. Notice that this means that the instrument expects you to include any parameters required by the implied command. The following example illustrates equivalent ways to program the signal generator using explicit and implied commands.

An example signal generator command, `FREQuency[:CW]`, with and without the implied command:

<code>FREQuency:CW 500 MHz</code>	using explicit commands
<code>FREQuency 500 MHz</code>	using implied commands

## Optional Parameters

Optional parameter names are enclosed in square brackets. If you do not send a value for an optional parameter, the instrument chooses a default value. The instrument's command dictionary documents the values used for optional parameters.

## Command Syntax

Following the heading for each programming command entry is a syntax statement showing the proper syntax for the command. An example syntax statement is shown here:

```
POWer[:LEVel] MAXimum|MIN
```

Syntax statements read from left to right. In this example, the `[:LEVel]` portion of the statement immediately follows the `POWer` portion of the statement with no separating space. A separating space is legal only between the command and its argument. In this example, the portion following the `[:LEVel]` portion of the statement is the argument. Additional conventions used in the syntax statements are defined as follows:

- Italics are used to symbolize a program code parameter or query response.
- ::= means “is defined as.”
- | (vertical bar) indicates a choice of one element from a list. For example, `<A> | <B>` indicates `<A>` or `<B>` but not both.
- {} (braces or curly brackets) indicate that the enclosed items may be included zero or more times.
- [] (square brackets) indicate that the enclosed items are optional.
- Upper-case lettering indicates that the upper-case portion of the command is the minimum required for the command. For example, in the command `FREQuency`, `FREQ` is the minimum requirement.
- Lower-case lettering indicates that the lower-case portion of the command is optional; it can either be included with the upper-case portion of the command or omitted. For example, in the command `FREQuency`, either `FREQ`, or `FREQUENCY` is correct.
- ? after a subsystem command indicates that the command is a query.

---

## CDMA Subsystem SCPI Command Reference (Options UND and UN5 Required)

The CDMA subsystem SCPI commands are used to set the controls and the parameters associated with cdmaOne™ communications standard via a remote controller. These commands are only for signal generators with both Options UND and UN5.

### ARB Reference Internal External

```
[ :SOURce ] :RADio :ARB :CLOCK :REFerence [ :SOURce ] INTernal | EXTernal
[ :SOURce ] :RADio :ARB :CLOCK :REFerence [ :SOURce ] ?
```

This command selects either an internal or external reference for the waveform clock. If external is selected, the external frequency *must* be entered (see the Reference Frequency command) and the signal must be applied to the BASEBAND GEN REF IN connector.

At \*RST, this value is set to Internal.

### CDMA State

```
[ :SOURce ] :RADio :CDMA :ARB [ :STATe ] ON | OFF | 1 | 0
[ :SOURce ] :RADio :CDMA :ARB [ :STATe ] ?
```

This command enables or disables the CDMA capability. The choices are ON (1) or OFF (0). Executing the command [ :SOURce ] :RADio :CDMA :ARB [ :STATe ] ON sets up the internal hardware to generate the currently selected CDMA signal selection. The CDMA and I/Q annunciators are turned on in the display. Although the digital modulation is enabled with this softkey, the enabled modulation is not present on RF carrier until you have activated the modulation by executing the command :OUTPut :MODulation [ :STATe ] ON.

Executing the command [ :SOURce ] :RADio :CDMA :ARB [ :STATe ] ON activates the I/Q state and sets the I/Q source to internal. You can override these selections in the I/Q menu.

At \*RST, this value is set to Off.

## Channel Setup

```
[ :SOURce]:RADio:CDMA:ARB:SETup:CHANnel IS97|EQUal|SCALE|NONE,PILot|SYNC|
PAGing|TRAFFic,<walsh_code>,<power_value>,<pnofs_value>,RANDom|<data_value>
{,PILot|SYNC|PAGing|TRAFFic,<walsh_code>,<power_value>,<pnofs_value>,RANDom|
<data_value>}
```

```
[ :SOURce]:RADio:CDMA:ARB:SETup:CHANnel?
```

This command defines the channel parameters of the CDMA signal. These parameters include:

- IS97|EQUal|SCALE|NONE - code domain power settings
  - IS97 - sets the channel power levels to IS-97-defined power levels.
  - EQUal - sets the channel power levels so that all channels are of equal power and the total power equals 0 dBm.
  - SCALE - scales all of the current channel powers so that the total power equals 0 dB while keeping the previous power ratios between the individual channels.
  - NONE - default power settings
- PILOT|SYNC|PAGING|TRAFFIC - channel type
  - PILOT - a pilot channel
  - SYNC - a sync channel
  - PAGING - a paging channel
  - TRAFFIC - a traffic channel
- <walsh\_code> - the walsh code assigned to the channel (0, 63)
- <power\_value> - the channel power in dB (-40 to 0 dB)
- <pnofs\_value> - the PN offset value (0, 511)
- RANDom|<data\_value> - the transmitted data
  - RANDom - random data
  - <data\_value> - user-defined data (0 to 255)

At \*RST, this value is set to Off.

**Channel Setup Program Example:**

```

5    INTEGER Pn
10   ASSIGN @Esg TO 719
15   !   Start the Channel Process
20   !   With the Is97 selection the powers of the channels will
25   !   automatically be adjusted to IS97 Levels once the channel
30   !   setup is complete
35   OUTPUT @Esg USING "K,#";"SOURCE:RADIO:CDMA:ARB:SETUP:CHAN IS97,"
40   !
45   !   Set the PN Offset to 12
50   Pn=12
55   !
60   !   Pilot
65   OUTPUT @Esg USING "K,#";"PILOT,0,-3,"&VAL$(Pn)&","000000,"
70   !
75   !   PAGING ON CHANNEL 1
80   OUTPUT @Esg USING "K,#";"PAGING,1,-3,"&VAL$(Pn)&","RANDOM,"
85   !
90   !   SYNC ON CHANNEL 32
95   OUTPUT @Esg USING "K,#";"SYNC,32,-3,"&VAL$(Pn)&","RANDOM,"
100  !
105  !   Set up Traffic Channels on walsh 8 to 40
110  FOR N=8 TO 40
115    OUTPUT @Esg USING "K,#";"TRAFFIC,"&VAL$(N)&","-5,"&VAL$(Pn)&"RANDOM,"
120  NEXT N
125  !
130  !   TERMINATE CHANNEL STRUCTURE
135  OUTPUT 719;" "
140  !
145  END

```

**Chip Rate**

```

[SOURCE]:RADIO:CDMA:ARB:CRATE <value>
[SOURCE]:RADIO:CDMA:ARB:CRATE?

```

This command sets the chip rate. Choices for the variable <value> range from 10 cps to 40 Mcps. The maximum chip rate is 20 Mcps using a 2 times oversample rate.

At \*RST, this value is set to 1.2288000 Mcps.

## Custom CDMA State, Store

```
[ :SOURce]:RADio:CDMA:ARB:SETup:STORE "<file name>"
```

This command stores the current custom CDMA state into a designated file name. Afterward, you can recall this custom state from the signal generator's memory by executing the command `[ :SOURce]:RADio:CDMA:ARB:SETup: "<file name>"` with the appropriate file name in place of the variable.

Along with the contents of the CDMA channel table editor (channel types, Walsh code, power levels, PN offset, and data), this softkey stores the following instrument state information to the memory catalog:

- FIR filter
- FIR filter file name
- FIR filter alpha
- FIR filter BbT
- FIR filter channel (EVM or ACP)
- chip rate
- waveform length
- oversample ratio
- ARB reconstruction filter
- ARB reference clock source (internal or external)
- ARB reference clock frequency

## Custom Multicarrier, Store

```
[ :SOURce]:RADio:CDMA:ARB:SETup:MCARrier:STORE "<file name>"
```

This command allows you to store the current changes to the default multicarrier setup into the file you enter. Afterward, you can recall these custom multicarrier settings from the signal generator's memory by executing the command

```
[ :SOURce]:RADio:CDMA:ARB:SETup:MCARrier "<file name>".
```

This command stores the following instrument state information to the memory catalog:

- type of carriers
- frequency offset for each carrier
- power level for each carrier
- the number of different carriers



## External Delay State

```
[ :SOURce ] :RADio :CDMA :ARB :TRIGger [ :SOURce ] :EXTernal :DELay :STATe ON | OFF | 1 | 0
```

```
[ :SOURce ] :RADio :CDMA :ARB :TRIGger [ :SOURce ] :EXTernal :DELay :STATe?
```

This command sets the operating state for the external trigger delay. The choices are On or Off.

At \*RST, this value is set to Off.

## External Delay Time

```
[ :SOURce ] :RADio :CDMA :ARB :TRIGger [ :SOURce ] :EXTernal :DELay <value>
```

```
[ :SOURce ] :RADio :CDMA :ARB :TRIGger [ :SOURce ] :EXTernal :DELay?
```

This command sets the time for the external trigger delay. The range of values allowed for the variable <value> is 2.000 microseconds through 3600 seconds.

At \*RST, this value is set to 2.000 msec.

## External Polarity

```
[ :SOURce ] :RADio :CDMA :ARB :TRIGger [ :SOURce ] :EXTernal :SLOPe POSitive | NEGative
```

```
[ :SOURce ] :RADio :CDMA :ARB :TRIGger [ :SOURce ] :EXTernal :DELay :STATe?
```

This command sets the polarity of the external trigger. The choices are Positive or Negative.

At \*RST, this value is set to Negative.

## Filter Alpha, Nyquist, or Root Nyquist

```
[ :SOURce ] :RADio :CDMA :ARB :FILTer :ALPHa <value>
```

```
[ :SOURce ] :RADio :CDMA :ARB :FILTer :ALPHa?
```

This command changes the Nyquist or root Nyquist filter's alpha value. The acceptable range for the variable <value> is 0.000 through 1.000.

This command is effective only *after* choosing a Root Nyquist or Nyquist filter. It does not have an effect on other types of filters.

At \*RST, this value is set to 0.500.

## Filter BbT, Gaussian

```
[ :SOURce]:RADio:CDMA:ARB:FILTer:BBT <value>
[:SOURce]:RADio:CDMA:ARB:FILTer:BBT?
```

This command changes the bandwidth-multiplied-by-bit-time (BbT) filter parameter. The acceptable range for the variable <value> is 0.000 through 1.000.

This command is effective only *after* choosing a Gaussian filter. It does not have an effect on other types of filters.

At \*RST, this value is set to 0.500.

## Filter Selection

```
[ :SOURce]:RADio:CDMA:ARB:FILTer RNYQuist|NYQuist|GAUSSian|RECTangle|IS95|
IS95_EQ|IS95_MOD|IS95_MOD_EQ|"<file name>"
[:SOURce]:RADio:CDMA:ARB:FILTer?
```

This command selects the pre-modulation filter type. The choices are:

- RNYQuist - Root Nyquist filter
- NYQuist - Nyquist filter
- GAUSSian - Gaussian filter
- RECTangle - Rectangle filter
- IS95 - Standard IS-95 filter
- IS95\_MOD - a modified version of an IS-95 filter which meets the IS-95 error function for improved adjacent channel performance.
- IS95\_EQ - a modified version of an IS-95 filter with an equalizer which provides base station phase equalization for the transmit signal path.
- IS95\_MOD\_EQ - a modified version of an IS-95 filter which meets the IS-95 error function for improved adjacent channel performance with an equalizer which provides base station phase equalization for the transmit signal path.
- "<file name>" - any filter file that you have either created externally and downloaded into memory, or that you have created internally in the Define User FIR menu and then subsequently stored.

At \*RST, this value is set to IS-95 Modified with Equalization.

## Filter Optimization

```
[ :SOURCE ] :RADio:CDMA:ARB:FILTer:CHANnel EVM|ACP
[ :SOURCE ] :RADio:CDMA:ARB:FILTer:CHANnel?
```

This command is used to optimize the filter for minimized error vector magnitude (select EVM) or to minimized adjacent channel power (select ACP). The EVM selection provides the most ideal passband. The ACP selection improves stopband rejection. This feature only applies to root Nyquist, Nyquist, and Gaussian filters. The softkey is grayed out when any other filter is selected.

At \*RST, this value is set to EVM.

## Gate Active

```
[ :SOURCE ] :RADio:CDMA:ARB:TRIGger:TYPE:GATE:ACTive LOW|HIGH
[ :SOURCE ] :RADio:CDMA:ARB:TRIGger:TYPE:GATE:ACTive?
```

This command toggles the polarity of the “through” or active state of a gated trigger signal. The choices are low or high. Gate active low will output the signal while the gate is low at the PATTERN TRIG IN connector. Gate active high has the opposite effect, outputting the signal while the signal level at the PATTERN TRIG IN connector is in a high state.

At \*RST, this value is set to N/A.

## Multicarrier Define

```
[ :SOURCE ] :RADio:CDMA:ARB:SETup:MCARrier:TABLE
{FWD9|FWD32|FWD64|PILot|CUSTom,"<file name>"|",<freq_offset>,<power>}
[ :SOURCE ] :RADio:CDMA:ARB:SETup:MCARrier:TABLE?
```

This command defines the multicarrier CDMA waveform. The choices are:

- FWD9 - a 9 channel forward carrier
- FWD32 - a 32 channel forward carrier
- FWD64 - a 64 channel forward carrier
- CUSTom - a custom multicarrier CDMA waveform stored in the signal generator's memory, or created by modifying the 3-carrier or 4-carrier template.
- "<file name>" - a custom multicarrier CDMA waveform stored in the signal generator's memory. This value is entered only for a custom carrier.
- "" - A null string, entered for any non-custom carrier.
- <freq\_offset> - the frequency offset
- <power> - the power level

## Multicarrier Setup Select

```
[ :SOURce]:RADio:CDMA:ARB:SETup:MCARrier CAR3|CAR4|"<file name>"  
[ :SOURce]:RADio:CDMA:ARB:SETup:MCARrier?
```

This command defines the type of multicarrier CDMA setup required for your application. The choices include:

- **CAR3** - three 9 channel forward carriers with a power level of 0.00 dB, the first with a -1.25 MHz frequency offset, the second with no frequency offset, and the third with +1.25 MHz frequency offset.
- **CAR4** - four 9 channel forward carriers with a power level of 0.00 dB, the first with a -1.875 MHz frequency offset, the second with a -625 kHz frequency offset, the third with +625 kHz frequency offset, and the fourth with a +1.875 MHz frequency offset.
- "**<file name>**" - a user-defined multicarrier CDMA state file previously stored in the signal generator's non-volatile memory.

At \*RST, this value is set to 3 Carriers.

## Oversample Ratio

```
[ :SOURce]:RADio:CDMA:ARB:OSAMple <value>  
[ :SOURce]:RADio:CDMA:ARB:OSAMple?
```

This command sets the oversampling ratio (number of filter taps per symbol) for CDMA modulation. The acceptable range for the variable **<value>** is 2 through 8. Using larger oversample ratios results in more completely filtered images but also uses up more waveform memory.

The upper limit of the oversample ratio is adjusted based on the waveform length and chip rate. The maximum oversample ratio is the smaller of the following three values:

- 40 Mcps/Chip Rate
- 8
- 32/Waveform Length (Note the Waveform Length is the number of CDMA short codes)

At \*RST, this value is set to 0.500.

## Reconstruction Filter

```
[ :SOURce]:RADio:ARB:RFILter <value>|THRough  
[ :SOURce]:RADio:ARB:RFILter?
```

This command is used to modify the reconstruction filter. You may choose a filter with a cutoff frequency of 250.0 kHz, 2.500 MHz, 8.000 MHz or no filter (**THRough**). Acceptable values for the variable **<value>** are 250.0 kHz, 2.500 MHz, or 8.000 MHz.

At \*RST, this value is set to 2.500 MHz.

## Reference Frequency

```
[ :SOURce ] :RADio :ARB :CLOCK :REFerence :EXTernal :FREQuency <value>
[ :SOURce ] :RADio :ARB :CLOCK :REFerence :EXTernal :FREQuency?
```

This command sets the reference frequency of the external clock. It is only effective when you are using an external ARB reference applied to the BASEBAND GEN REF IN connector. The acceptable range for the variable <value> is 250.0000 kHz to 20.0000000 MHz.

At \*RST, this value is set to 10.0000000 MHz.

## Retrigger Mode State

```
[ :SOURce ] :RADio :ARB :RETRIGger ON | OFF | 1 | 0
[ :SOURce ] :RADio :ARB :RETRIGger?
```

This command sets the operating state of the retrigger mode. The choices are On or Off.

At \*RST, this value is set to On.

## Setup Select

```
[ :SOURce ] :RADio :CDMA :ARB :SETup FWD9 | FWD32 | FWD64 | PILot | REVerse | MCARrier |
"<file name>"
[ :SOURce ] :RADio :CDMA :ARB :SETup?
```

This command defines the type of CDMA channelization required for your application. The choices include:

- **PILot** - a single pilot channel.
- **FWD9** - a CDMA setup consisting of 9 channels (including pilot, paging, sync, and 6 traffic channels) at IS-97-defined power levels.
- **FWD32** - a CDMA setup consisting of 32 channels (including pilot, paging, sync, and 29 traffic channels) at IS-97-defined power levels.
- **FWD64** - a CDMA setup consisting of 64 channels (including pilot, 7 paging, sync, and 55 traffic channels) at IS-97-defined power levels.
- **REVerse** - a single traffic channel.
- **MCARrier** - the default multicarrier mode, a 3 carrier setup. This selection activates Multicarrier mode and deactivates any other mode that was previously on.
- **"<file name>"** - a user-defined CDMA state file previously stored in the signal generator's non-volatile memory.

At \*RST, this value is set to 9 Ch Fwd.

## Trigger Source

```
[ :SOURce]:RADio:CDMA:ARB:TRIGger[:SOURce] KEY|EXT|BUS
```

```
[ :SOURce]:RADio:CDMA:ARB:TRIGger[:SOURce]?
```

This command sets the trigger source. The choices include the front panel **Trigger** key, a trigger command sent over the HP-IB bus, or an external trigger applied to the PATTERN TRIG IN connector.

At \*RST, this value is set to Ext.

## Trigger Type

```
[ :SOURce]:RADio:CDMA:ARB:TRIGger:TYPE CONTinuous|SINGle|GATE|SADVance
```

```
[ :SOURce]:RADio:CDMA:ARB:TRIGger:TYPE?
```

This command sets the trigger type. The choices are continuous, single, gated, and when a waveform sequence is active, segment advance.

At \*RST, this value is set to Continuous.

## User FIR Definition

```
MEMory:DATA:FIR "<file name>",<osr>,<coefficient>{,<coefficient>}
```

```
MEMory:DATA:FIR? "<file name>"
```

This command is used to define User FIR filters. A maximum filter length of 1024 taps is allowed with a maximum oversampling ratio of 32. An FIR filter selected for use in CDMA, however, cannot have more than 256 taps so the number of symbols and the oversample ratio should be selected accordingly. Examples of using the FIR table editor are provided in [Chapter 2, "Using Functions."](#)

## Waveform Length

```
[ :SOURce]:RADio:CDMA:ARB:WLENgth <value>
```

```
[ :SOURce]:RADio:CDMA:ARB:WLENgth?
```

This command adjusts the waveform length (in short codes). The acceptable range for the variable <value> is 1 to 32 short codes. The upper limit is adjusted based on the oversample ratio to fit the signal within the available memory. The maximum waveform length is 32/oversample ratio.

At \*RST, this value is set to 1.

---

## Dual ARB Subsystem SCPI Command Reference (Option UND Only)

The Dual ARB subsystem SCPI commands are used to set the controls and the parameters associated with the dual arbitrary waveform generator via a remote controller. These commands are for signal generators with Option UND only.

### ARB State

```
[ :SOURce]:RADio:ARB[:STATe] ON|OFF|1|0
[:SOURce]:RADio:ARB[:STATe]?
```

This command enables or disables the dual arb waveform generator capability. The choices are ON (1) or OFF (0). Executing the command `[ :SOURce]:RADio:ARB[:STATe] ON` turns on the dual arbitrary generator.

At \*RST, this value is set to Off.

### ARB Reference Internal External

```
[ :SOURce]:RADio:ARB:CLOCK:REFeRence[:SOURce] INTernal|EXTernal
[:SOURce]:RADio:ARB:CLOCK:REFeRence[:SOURce]?
```

This command selects either an internal or external reference for the waveform clock. If external is selected, the external frequency *must* be entered (see the Reference Frequency command) and the signal must be applied to the BASEBAND GEN REF IN connector.

At \*RST, this value is set to Internal.

### Create Waveform Sequence

```
[ :SOURce]:RADio:ARB:SEQuence "<file name>",<waveform>,<reps>,<mkr1(1|0)>,<mkr2(1|0)>{,<waveform>,<reps>,<mkr1(1|0)>,<mkr2(1|0)>}
[:SOURce]:RADio:ARB:SEQuence? "<file name>"
```

This command is used to create a waveform sequence. You may either recall a sequence from catalog memory using the command `[ :SOURce]:RADio:ARB:SEQuence "<file name>"`, or you may create a new sequence by using the command `[ :SOURce]:RADio:ARB:SEQuence <waveform>,<reps>{,<waveform>,<reps>}`. For the variable `<waveform>`, use the appropriate waveform file name. For the variable `<reps>`, input the number of times you would like the waveform to repeat.

## External Delay State

```
[ :SOURce]:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay:STATe ON|OFF|1|0
```

```
[ :SOURce]:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay:STATe?
```

This command sets the operating state for the external trigger delay. The choices are on or off.

At \*RST, this value is set to Off.

## External Delay Time

```
[ :SOURce]:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay <value>
```

```
[ :SOURce]:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay?
```

This command sets the time for the external trigger delay. The range of values allowed for the variable <value> is 2.000 microseconds through 3600 seconds.

At \*RST, this value is set to 2.000 msec.

## External Polarity

```
[ :SOURce]:RADio:ARB:TRIGger[:SOURce]:EXTernal:SLOPe POSitive|NEGative
```

```
[ :SOURce]:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay:STATe?
```

This command sets the polarity of the external trigger. The choices are positive or negative.

At \*RST, this value is set to Negative.

## Gate Active

```
[ :SOURce]:RADio:ARB:TRIGger:TYPE:GATE:ACTive LOW|HIGH
```

```
[ :SOURce]:RADio:ARB:TRIGger:TYPE:GATE:ACTive?
```

This command toggles the polarity of the “through” or active state of a gated trigger signal. The choices are low or high. Gate active low will output the signal while the gate is low at the PATTERN TRIG IN connector. Gate Active High has the opposite effect, outputting the signal while the signal level at the PATTERN TRIG IN connector is in a high state.

At \*RST, this value is set to N/A.



## Markers

### Defining a Marker Over a Range of Points

```
[ :SOURce]:RADio:ARB:MARKer:[SET] "file name", <mkr(1|2)>, <first_Point>, <last_point>, <skip_count>
```

This command defines a marker over a range of points on a waveform segment. The choices include:

"file name" - the name of the waveform segment file to which you want to add a marker

<mkr(1)> - selects marker 1

<mkr(2)> - selects marker 2

<first\_Point> - defines the first point in the range over which the marker will be placed. This number must be greater than or equal to 1, and less than or equal to the total number of waveform points.

<last\_point> - Defines the last point in the range over which the marker will be placed. This value must be greater than or equal to 1, and less than or equal to the total number of waveform points.

If you enter a value for either the first marker point or the last marker point that would make the first marker point occur *after* the last, the last marker point is automatically adjusted to match the first marker point.

<skip\_count> - creates a repeating pattern of markers. Defining a skip count causes the marker to appear on the first point in the defined range, disappear over the number of points defined as the skip count, then reappear for one point. The pattern repeats until the end of the defined range. This enables you to set repetitively spaced markers. For example, a skip of 2 produces two points between each marker across the defined range.

### Clearing Markers

```
[ :SOURce]:RADio:ARB:MARKer:CLEar "file name", <mkr(1|2)>, <first_Point>, <last_point>
```

```
[ :SOURce]:RADio:ARB:MARKer:CLEar:ALL "file name", <mkr(1|2)>
```

These commands clear markers from a waveform segment. The choices include:

"file name" - the name of the waveform segment file from which you want to clear markers

<mkr(1)> - designates marker 1 as the marker to be deleted.

<mkr(2)> - designates marker 2 as the marker to be deleted.

<first\_Point> - defines the first point in a range of points. This number must be greater than or equal to 1, and less than or equal to the total number of waveform points.

<last\_point> - defines the last point in a range of points. This value must be greater than or equal to 1, and less than or equal to the total number of waveform points.

If you enter a value for either the first marker point or the last marker point that would make the first marker point occur *after* the last, the last marker point is automatically adjusted to match the first marker point.

### Setting Marker Polarity

```
[ :SOURce]:RADio:ARB:MARKer:POLarity NEG|POS
[ :SOURce]:RADio:ARB:MARKer:POLarity?
```

These commands set the marker polarity as active positive or negative. The choice is:

NEG - sets the marker polarity as active negative.

POS - sets the marker polarity as active positive.

### Setting Marker 2 to Blank the RF Output

```
[ :SOURce]:RADio:ARB:MARKer:RFBLank ON|OFF|1|0
[ :SOURce]:RADio:ARB:MARKer:RFBLank?
```

These commands enable or disable RF blanking when marker 2 is low. The choice is:

ON (1) - enables RF blanking when marker 2 is low

OFF (0) - disables RF blanking when marker 2 is low

### Defining a Waveform Sequence and Toggling Markers

```
[ :SOURce]:RADio:ARB:SEQuence "<file name>",<waveform>,<reps>,<mkr1(1|0)>,<mkr2(1|0)>{,<waveform>,<reps>,<mkr1(1|0)>,<mkr2(1|0)>}
[ :SOURce]:RADio:ARB:SEQuence? "<file name>"
```

This command defines a marker over a range of points on a waveform segment. The choices include:

"<file name>" - the name under which you want to store the new waveform sequence

<waveform> - name of waveform segment file

<reps> - number of repetitions of the waveform segment

<mkr1(1)> - turns marker 1 on

<mkr1(0)> - turns marker 1 off

<mkr2(1)> - turns marker 2 on

<mkr2(0)> - turns marker 2 off.

Repeat the sequence as desired.

## Reconstruction Filter

```
[ :SOURce]:RADio:ARB:RFILter <value>|THROUGH
```

```
[ :SOURce]:RADio:ARB:RFILter?
```

This command is used to modify the reconstruction filter. You may choose a filter with a cutoff frequency of 250.0 kHz, 2.500 MHz, 8.000 MHz or no filter (THROUGH). Acceptable values for the variable <value> are 250.0 kHz, 2.500 MHz, or 8.000 MHz.

At \*RST, this value is set to 2.500 MHz.

## Reference Frequency

```
[ :SOURce]:RADio:ARB:CLOCK:REference:EXternal:FREQuency <value>
```

```
[ :SOURce]:RADio:ARB:CLOCK:REference:EXternal:FREQuency?
```

This command sets the reference frequency of the external clock. It is only effective when you are using an external ARB reference applied to the BASEBAND GEN REF IN connector. The acceptable range for the variable <value> is 250.000 kHz to 20.000000 MHz.

At \*RST, this value is set to 10.000000 MHz.

## Retrigger Mode State

```
[ :SOURce]:RADio:ARB:RETRIGger ON|OFF|1|0
```

```
[ :SOURce]:RADio:ARB:RETRIGger?
```

This command sets the operating state of the retrigger mode. The choices are On or Off.

At \*RST, this value is set to On.

## Sample Clock

```
[ :SOURce]:RADio:ARB:CLOCK:SRATe <value>
```

```
[ :SOURce]:RADio:ARB:CLOCK:SRATe?
```

This command adjusts the sample clock rate. The acceptable range for the variable <value> is 1.0 Hz to 40 MHz.

At \*RST, this value is set to 6.1440000 MHz.

## Select Waveform

```
[ :SOURce]:RADio:ARB:WAVeform "ARBI|SEQ:"<file name>"
```

```
[ :SOURce]:RADio:ARB:WAVeform?
```

This command selects the type of signal for the dual arbitrary waveform generator to generate. Choose between a single waveform segment (ARBI:) or a sequence of segments (SEQ:). The appropriate file name of the sequence replaces the "<file name>" variable.

At \*RST, this value is set to (\*NONE\*)

## Trigger Source

```
[ :SOURce]:RADio:ARB:TRIGger[:SOURce] KEY|EXT|BUS
```

```
[ :SOURce]:RADio:ARB:TRIGger[:SOURce]?
```

This command sets the trigger source. The choices include the front panel Trigger key, a trigger command sent over the HP-IB bus, or an external trigger applied to the PATTERN TRIG IN connector.

At \*RST, this value is set to Ext.

## Trigger Type

```
[ :SOURce]:RADio:ARB:TRIGger:TYPE Continuous|SINGLE|GATE|SADVance
```

```
[ :SOURce]:RADio:ARB:TRIGger:TYPE?
```

This command sets the trigger type. The choices are Continuous, Single, Gated, and when a waveform sequence is active, Segment Advance.

At \*RST, this value is set to Continuous.

---

## Multitone Waveforms

The Multitone subsystem SCPI commands are used to set the parameters associated with the multitone waveform generator. These commands apply to Option UND only.

### Creating a Multitone Waveform

```
[ :SOURce ]:RADio:MTONE:ARB:SETup:TABLE
freq_spacing,num_tones,phase0,state0,phase1,state1,...
```

```
[ :SOURce ]:RADio:MTONE:ARB:SETup:TABLE?
```

These commands define a multitone waveform. This information is held in memory until you send the command that turns the waveform on (see [“Turning a Multitone Waveform On and Off”](#) below)

The choices include:

`freq_spacing` - sets the frequency spacing between tones; tones are equally spaced.

Range: 100 Hz through 5 MHz

Default: 10 kHz

`num_tones` - defines the number of tones.

Range: 2 through 64

Default: 8

`phase $n$`  - defines the phase of the  $n$ th tone.

Range: 0 through 359

Default: 0

`state $n$`  - defines whether the  $n$ th tone is on (1) or off (0).

Default: On (1)

### Turning a Multitone Waveform On and Off

```
[ :SOURce ]:RADio:MTONE:ARB[ :STATE ] ON|OFF|1|0
[ :SOURce ]:RADio:MTONE:ARB[ :STATE ]?
```

These commands toggle a multitone waveform. The choices include:

ON (1) - turns the waveform on.

OFF (0) - turns the waveform off. This is the default state.

### Storing a Multitone Waveform

```
[ :SOURce ]:RADio:MTONE:ARB:SETup:STORE "<file name>"
```

This command stores a multitone waveform.

"file name" - is the name of the file to be stored in the signal generator's catalog of MTONE files.

### Retrieving a Stored Multitone Waveform

```
[ :SOURce]:RADio:MTONE:ARB:SETup "<file name>"  
[ :SOURce]:RADio:MTONE:ARB:SETup?
```

This command retrieves a multitone waveform file.

"<file name>" - the name of a multitone waveform file stored in the signal generator's catalog of MTONE files. This information is held in memory until you send the command that turns the waveform on (see ["Turning a Multitone Waveform On and Off"](#) on page 5-21)

The following command queries the signal generator for the files stored in the catalog of MTONE files:

```
:MEMory:CATalog:MTONE?
```

## **6 Programming Command Cross-Reference**

This section lists the dual arbitrary waveform generator CDMA and Dual ARB softkeys and their corresponding SCPI commands. Table 6-1 describes the CDMA softkeys and Table 6-2 describes the Dual ARB softkeys. For a complete list of the signal generator hardkeys and softkeys and their corresponding SCPI commands, please refer to the Programming Guide.

**Table 6-1 Mode - AWGN (Additive White Gaussian Noise) Softkeys**

<b>Key</b>	<b>SCPI Command</b>
<b>16384</b>	[ :SOURce ] :RADio :AWGN :ARB :LENGth 16384 [ :SOURce ] :RADio :AWGN :ARB :LENGth?
<b>32768</b>	[ :SOURce ] :RADio :AWGN :ARB :LENGth 32768 [ :SOURce ] :RADio :AWGN :ARB :LENGth?
<b>65536</b>	[ :SOURce ] :RADio :AWGN :ARB :LENGth 65536 [ :SOURce ] :RADio :AWGN :ARB :LENGth?
<b>131072</b>	[ :SOURce ] :RADio :AWGN :ARB :LENGth 131072 [ :SOURce ] :RADio :AWGN :ARB :LENGth?
<b>262144</b>	[ :SOURce ] :RADio :AWGN :ARB :LENGth 262144 [ :SOURce ] :RADio :AWGN :ARB :LENGth?
<b>524288</b>	[ :SOURce ] :RADio :AWGN :ARB :LENGth 524288 [ :SOURce ] :RADio :AWGN :ARB :LENGth?
<b>1048576</b>	[ :SOURce ] :RADio :AWGN :ARB :LENGth 1048576 [ :SOURce ] :RADio :AWGN :ARB :LENGth?
<b>AWGN Off On</b>	[ :SOURce ] :RADio :AWGN :ARB [ :STATE ] ON   OFF   1   0 [ :SOURce ] :RADio :AWGN :ARB [ :STATE ] ?
<b>Bandwidth</b>	[ :SOURce ] :RADio :AWGN :ARB :BWIDth <value> [ :SOURce ] :RADio :AWGN :ARB :BWIDth?
<b>Noise Seed Fixed Random</b>	[ :SOURce ] :RADio :AWGN :ARB :SEED FIXed   RANDom [ :SOURce ] :RADio :AWGN :ARB :SEED?
<b>Waveform Length</b>	[ :SOURce ] :RADio :AWGN :ARB :LENGth <value> [ :SOURce ] :RADio :AWGN :ARB :LENGth?



**Table 6-2 Mode – CDMA Softkeys**

Key	SCPI Command
<b>250.0 kHz</b>	[:SOURCE]:RADio:ARB:RFILter 250.0 kHz [:SOURCE]:RADio:ARB:RFILter?
<b>2.500 MHz</b>	[:SOURCE]:RADio:ARB:RFILter 2.5 MHz [:SOURCE]:RADio:ARB:RFILter?
<b>8.000 MHz</b>	[:SOURCE]:RADio:ARB:RFILter 8.0 MHz [:SOURCE]:RADio:ARB:RFILter?
<b>9 Ch Fwd</b>	[:SOURCE]:RADio:CDMA:ARB:SETup FWD9 [:SOURCE]:RADio:CDMA:ARB:SETup?
<b>32 Ch Fwd</b>	[:SOURCE]:RADio:CDMA:ARB:SETup FWD32 [:SOURCE]:RADio:CDMA:ARB:SETup?
<b>64 Ch Fwd</b>	[:SOURCE]:RADio:CDMA:ARB:SETup FWD64 [:SOURCE]:RADio:CDMA:ARB:SETup?
<b>Adjust Code Domain Power</b>	[:SOURCE]:RADio:CDMA:ARB:SETup:CHANnel IS95 EQUal SCALE NONE,PILot SYNC PAGing TRAFFic, <walsh_value>, <power_value>, <pnofs_value>, RANDom <data_value> {,PILot SYNC PAGing TRAFFic, <walsh_value>, <power_value>, <pnofs_value>, RANDom <data_value>} [:SOURCE]:RADio:CDMA:ARB:SETup:CHANnel?
<b>ARB Reference Ext Int</b>	[:SOURCE]:RADio:ARB:CLOCK:REFerence[:SOURCE] INTernal EXTernal [:SOURCE]:RADio:ARB:CLOCK:REFerence[:SOURCE]?
<b>Bus</b>	[:SOURCE]:RADio:CDMA:ARB:TRIGger[:SOURCE] BUS [:SOURCE]:RADio:CDMA:ARB:TRIGger[:SOURCE]?
<b>CDMA Off On</b>	[:SOURCE]:RADio:CDMA:ARB[:STATE] ON OFF 1 0 [:SOURCE]:RADio:CDMA:ARB[:STATE]?
<b>Chip Rate</b>	[:SOURCE]:RADio:CDMA:ARB:CRATE <value> [:SOURCE]:RADio:CDMA:ARB:CRATE?
<b>Continuous</b>	[:SOURCE]:RADio:CDMA:ARB:TRIGger:TYPE CONT [:SOURCE]:RADio:CDMA:ARB:TRIGger:TYPE?
<b>Custom CDMA State</b>	[:SOURCE]:RADio:CDMA:ARB:SETup "<file name>" [:SOURCE]:RADio:CDMA:ARB:SETup?
<b>Custom CDMA Carrier</b>	[:SOURCE]:RADio:CDMA:ARB:Setup:MCARrier "<file name>" [:SOURCE]:RADio:CDMA:ARB:Setup:MCARrier?
<b>Define User FIR</b>	MEMory:DATA:FIR "<file name>", osr,coefficient{,coefficient} MEMory:DATA:FIR? "<file name>"

Key	SCPI Command
<b>Edit Channel Setup</b>	<pre>[ :SOURce]:RADio:CDMA:ARB:SETup:CHANnel IS97 EQUal SCALE  NONE,PILot SYNC PAGing TRAFfic,&lt;walsh_value&gt;, &lt;power_value&gt;,&lt;pnofs_value&gt;,RANDom &lt;data_value&gt; {,PILot  SYNC PAGing TRAFfic,&lt;walsh_code&gt;,&lt;power_value&gt;, &lt;pnofs_value&gt;,RANDom &lt;data_value&gt;}  [:SOURce]:RADio:CDMA:ARB:SETup:CHANnel?</pre>
<b>Equal Powers</b>	<pre>[ :SOURce]:RADio:CDMA:ARB:SETup:CHANnel EQUal,PILot SYNC PAGing TRAFfic, &lt;walsh_value&gt;, &lt;power_value&gt;,&lt;pnofs_value&gt;,RANDom &lt;data_value&gt; {,PILot SYNC PAGing TRAFfic,&lt;walsh_code&gt;,&lt;power_value&gt;, &lt;pnofs_value&gt;,RANDom &lt;data_value&gt;}  [:SOURce]:RADio:CDMA:ARB:SETup:CHANnel?</pre>
<b>Ext</b>	<pre>[ :SOURce]:RADio:CDMA:ARB:TRIGger[:SOURce] EXT [:SOURce]:RADio:CDMA:ARB:TRIGger[:SOURce]?</pre>
<b>Ext Polarity Neg Pos</b>	<pre>[ :SOURce]:RADio:CDMA:ARB:TRIGger[:SOURce]:EXTernal:SLOPe POSitive NEGative  [:SOURce]:RADio:CDMA:ARB:TRIGger[:SOURce]:EXTernal:SLOPe?</pre>
<b>Ext Delay Off On</b>	<pre>[ :SOURce]:RADio:CDMA:ARB:TRIGger[:SOURce]:EXTernal:DElay: STATe ON OFF 1 0  [:SOURce]:RADio:CDMA:ARB:TRIGger[:SOURce]:EXTernal:DElay: STATe?</pre>
<b>Ext Delay Time</b>	<pre>[ :SOURce]:RADio:CDMA:ARB:TRIGger[:SOURce]:EXTernal:DElay &lt;value&gt;  [:SOURce]:RADio:CDMA:ARB:TRIGger[:SOURce]:EXTernal:DElay?</pre>
<b>Filter Alpha</b>	<pre>[ :SOURce]:RADio:CDMA:ARB:FILter:ALPHa &lt;value&gt; [:SOURce]:RADio:CDMA:ARB:FILter:ALPHa?</pre>
<b>Filter BbT</b>	<pre>[ :SOURce]:RADio:CDMA:ARB:FILter:BBT &lt;value&gt; [:SOURce]:RADio:CDMA:ARB:FILter:BBT?</pre>
<b>Gate Active</b>	<pre>[ :SOURce]:RADio:CDMA:ARB:TRIGger:TYPE:GATE:ACTive LOW HIGH [:SOURce]:RADio:CDMA:ARB:TRIGger:TYPE:GATE:ACTive?</pre>
<b>Gated</b>	<pre>[ :SOURce]:RADio:CDMA:ARB:TRIGger:TYPE GATE [:SOURce]:RADio:CDMA:ARB:TRIGger:TYPE?</pre>
<b>Gaussian</b>	<pre>[ :SOURce]:RADio:CDMA:ARB:FILter GAUSSain [:SOURce]:RADio:CDMA:ARB:FILter?</pre>
<b>IS-95</b>	<pre>[ :SOURce]:RADio:CDMA:ARB:FILter IS95 [:SOURce]:RADio:CDMA:ARB:FILTer?</pre>
<b>IS-95 Mod</b>	<pre>[ :SOURce]:RADio:CDMA:ARB:FILter IS95_MOD [:SOURce]:RADio:CDMA:ARB:FILTer?</pre>

Key	SCPI Command
<b>IS-95 Mod w/EQ</b>	[:SOURCE]:RADIO:CDMA:ARB:FILTer IS95_MOD_EQ [:SOURCE]:RADIO:CDMA:ARB:FILTer?
<b>IS-95 w/EQ</b>	[:SOURCE]:RADIO:CDMA:ARB:FILTer IS95_EQ [:SOURCE]:RADIO:CDMA:ARB:FILTer?
<b>IS-97 Levels</b>	[:SOURCE]:RADIO:CDMA:ARB:SETup:CHANnel IS97,PILot SYNc PAGing TRAFFic,<walsh_value>, <power_value>,<pnofs_value>,RANDom <data_value> {,PILot  SYNc PAGing TRAFFic,<walsh_code>,<power_value>, <pnofs_value>,RANDom <data_value>} [:SOURCE]:RADIO:CDMA:ARB:SETup:CHANnel?
<b>Multicarrier Define</b>	[:SOURCE]:RADIO:CDMA:ARB:SETup:MCARrier:TABLE {FWD9 FWD32 FWD64 PILot CUSTom,"<file name>"  ",<freq_offset>,<power>} [:SOURCE]:RADIO:CDMA:ARB:SETup:MCARrier:TABLE?
<b>Multicarrier Off On</b>	[:SOURCE]:RADIO:CDMA:ARB:SETup MCARrier [:SOURCE]:RADIO:CDMA:ARB:SETup?
<b>Nyquist</b>	[:SOURCE]:RADIO:CDMA:ARB:FILTer NYQuist [:SOURCE]:RADIO:CDMA:ARB:FILTer?
<b>Optimize FIR For EVM ACP</b>	[:SOURCE]:RADIO:CDMA:ARB:FILTer:CHANnel EVM ACP [:SOURCE]:RADIO:CDMA:ARB:FILTer:CHANnel?
<b>Oversample Ratio</b>	[:SOURCE]:RADIO:CDMA:ARB:OSAMple <value> [:SOURCE]:RADIO:CDMA:ARB:OSAMple?
<b>Paging</b>	[:SOURCE]:RADIO:CDMA:ARB:SETup:CHANnel NONE,PAGing,<walsh_value>,<power_value>,<pnofs_value>, RANDom <data_value> {,PILot SYNc PAGing TRAFFic, <walsh_value>,<power_value>,<pnofs_value>,RANDom  <data_value>} [:SOURCE]:RADIO:CDMA:ARB:SETup:CHANnel?
<b>Pilot (in the CDMA Select menu)</b>	[:SOURCE]:RADIO:CDMA:ARB:SETup: PIlot [:SOURCE]:RADIO:CDMA:ARB:SETup?
<b>Pilot (in the Channel Select menu)</b>	[:SOURCE]:RADIO:CDMA:ARB:SETup:CHANnel NONE,PILot, <walsh_value>,<power_value>,<pnofs_value>,RANDom  <data_value> {,PILot SYNc PAGing TRAFFic,<walsh_code>, <power_value>,<pnofs_value>,RANDom <data_value>} [:SOURCE]:RADIO:CDMA:ARB:SETup:CHANnel?
<b>Random</b>	[:SOURCE]:RADIO:CDMA:ARB:SETup:CHANnel NONE,PILot, <walsh_value>,<power_value>,<pnofs_value>,RANDom  <data_value> {,PILot SYNc PAGing TRAFFic,<walsh_code>, <power_value>,<pnofs_value>,RANDom} [:SOURCE]:RADIO:CDMA:ARB:SETup:CHANnel?

Key	SCPI Command
<b>Reconstruction Filter</b>	[ :SOURce]:RADio:CDMA:ARB:FILTer <value> THROUGH [ :SOURce]:RADio:CDMA:ARB:FILTer?
<b>Rectangle</b>	[ :SOURce]:RADio:CDMA:ARB:FILTer RECTangle [ :SOURce]:RADio:CDMA:ARB:FILTer?
<b>Reference Frequency</b>	[ :SOURce]:RADio:ARB:CLOCK:REFerence:EXTernal:FREQuency <value> [ :SOURce]:RADio:ARB:CLOCK:REFerence:EXTernal :FREQuency?
<b>Restore Default Filter</b>	[ :SOURce]:RADio:CDMA:ARB:FILTer IS95_MOD_EQ [ :SOURce]:RADio:CDMA:ARB:FILTer?
<b>Retrigger Mode Off On</b>	[ :SOURce]:RADio:CDMA:ARB:RETRigger ON OFF 1 0 [ :SOURce]:RADio:CDMA:ARB:RETRigger?
<b>Reverse</b>	[ :SOURce]:RADio:CDMA:ARB:SETup REVerse [ :SOURce]:RADio:CDMA:ARB:SETup?
<b>Root Nyquist</b>	[ :SOURce]:RADio:CDMA:ARB:FILTer RNYQuist [ :SOURce]:RADio:CDMA:ARB:FILTer?
<b>Scale To 0dB</b>	[ :SOURce]:RADio:CDMA:ARB:SETup:CHANnel SCALE,PIlot   SYNC PAGing TRAFFic,<walsh_value>,<power_value>, <pnofs_value>,RANDOM <data_value> {,PIlot SYNC PAGing  TRAFFic,<walsh_code>,<power_value>,<pnofs_value>,RANDOM  <data_value>} [ :SOURce]:RADio:CDMA:ARB:SETup:CHANnel?
<b>Select</b>	[ :SOURce]:RADio:CDMA:ARB:FILTer RNYQuist NYQuist  GAUSSian RECTangle IS95 IS95_EQ IS95_MOD IS95_MOD_EQ  "<file name>" [ :SOURce]:RADio:CDMA:ARB:FILTer?
<b>Select File</b>	[ :SOURce]:RADio:CDMA:ARB:FILTer "<file name>" [ :SOURce]:RADio:CDMA:ARB:FILTer?
<b>Setup Select</b>	[ :SOURce]:RADio:CDMA:ARB:SETup:CHANnel FWD9 FWD32 FWD64 PIlot REVerse "<file name>" [ :SOURce]:RADio:CDMA:ARB:SETup:CHANnel? [ :SOURce]:RADio:CDMA:ARB:SETup:MCARrier CAR3 CAR4  "<file name>" [ :SOURce]:RADio:CDMA:ARB:SETup:MCARrier?
<b>Single</b>	[ :SOURce]:RADio:CDMA:ARB:TRIGger:TYPE SINGLE [ :SOURce]:RADio:CDMA:ARB:TRIGger:TYPE?
<b>Store Custom CDMA State</b>	[ :SOURce]:RADio:CDMA:ARB:SETup:STORE "<file name>"

Key	SCPI Command
<b>Store Custom Multicarrier</b>	[:SOURCE]:RADIO:CDMA:ARB:SETup:MCARrier:STORE "<file name>"
<b>Sync</b>	[:SOURCE]:RADIO:CDMA:ARB:SETup:CHANnel NONE, SYNC, <walsh_value>, <power_value>, <pnofs_value>, RANDOM  <data_value> {, PILOt SYNC PAGing TRAFfic, <walsh_code>, <power_value>, <pnofs_value>, RANDOM <data_value>} [:SOURCE]:RADIO:CDMA:ARB:SETup:CHANnel?
<b>Through</b>	[:SOURCE]:RADIO:CDMA:ARB:RFILter THROugh [:SOURCE]:RADIO:CDMA:ARB:RFILter?
<b>Traffic</b>	[:SOURCE]:RADIO:CDMA:ARB:SETup:CHANnel NONE, TRAFfic, <walsh_value>, <power_value>, <pnofs_value>, RANDOM  <data_value> {, PILOt SYNC PAGing TRAFfic, <walsh_code>, <power_value>, <pnofs_value>, RANDOM <data_value>} [:SOURCE]:RADIO:CDMA:ARB:SETup:CHANnel?
<b>Trigger</b>	[:SOURCE]:RADIO:CDMA:ARB:TRIGger:TYPE CONT SINGLE GATE [:SOURCE]:RADIO:CDMA:ARB:TRIGger:TYPE?
<b>Trigger Key</b>	[:SOURCE]:RADIO:CDMA:ARB:TRIGger[:SOURCE] KEY [:SOURCE]:RADIO:CDMA:ARB:TRIGger[:SOURCE]?
<b>Trigger Source</b>	[:SOURCE]:RADIO:CDMA:ARB:TRIGger[:SOURCE] KEY EXT BUS [:SOURCE]:RADIO:CDMA:ARB:TRIGger[:SOURCE]?
<b>Waveform Length</b>	[:SOURCE]:RADIO:CDMA:ARB:WLENgth <value> [:SOURCE]:RADIO:CDMA:ARB:WLENgth?

**Table 6-3 Mode – Dual ARB Softkeys**

Key	SCPI Command
# Skipped Points	[ :SOURce ]:RADio:ARB:MARKer[:SET] "<file name>", <mkr(1 2)>, <first_point>, <last_point>, <skip_count>
250.0 kHz	[ :SOURce ]:RADio:ARB:RFILter 2.5 MHz [ :SOURce ]:RADio:ARB:RFILter?
2.500 MHz	[ :SOURce ]:RADio:ARB:RFILter 8.0 MHz [ :SOURce ]:RADio:ARB:RFILter?
8.000 MHz	[ :SOURce ]:RADio:ARB:RFILter 250.0 kHz [ :SOURce ]:RADio:ARB:RFILter?
Apply to Waveform	[ :SOURce ]:RADio:ARB:MARKer:CLEar "<file name>", <mkr(1 2)>, <first_point>, <last_point>
ARB Off On	[ :SOURce ]:RADio:ARB[:STATe] ON OFF 1 0 [ :SOURce ]:RADio:ARB[:STATe]?
ARB Reference Ext Int	[ :SOURce ]:RADio:ARB:CLOCK:REFErence[:SOURce] INTernal  EXTernal [ :SOURce ]:RADio:ARB:CLOCK:REFErence[:SOURce]?
ARB Sample Clock	[ :SOURce ]:RADio:ARB:CLOCK:SRATE <value> [ :SOURce ]:RADio:ARB:CLOCK:SRATE?
Build New Waveform Sequence	[ :SOURce ]:RADio:ARB:SEQuence "<file name>", <waveform>, <reps>{, <waveform>, <reps>} [ :SOURce ]:RADio:ARB:SEQuence? "<file name>"
Bus	[ :SOURce ]:RADio:ARB:TRIGger[:SOURce] BUS [ :SOURce ]:RADio:ARB:TRIGger[:SOURce]?
Continuous	[ :SOURce ]:RADio:ARB:TRIGger:TYPE CONT [ :SOURce ]:RADio:ARB:TRIGger:TYPE?
Delete All ARB Files	:MMEMory:DELEte:ARB
Delete All NVARB Files	:MMEMory:DELEte:NVARb
Ext	[ :SOURce ]:RADio:ARB:TRIGger[:SOURce] EXT [ :SOURce ]:RADio:ARB:ARB:TRIGger[:SOURce]?
Ext Polarity Neg Pos	[ :SOURce ]:RADio:ARB:TRIGger[:SOURce]:EXTernal:SLOPe POSitive NEGative [ :SOURce ]:RADio:ARB:TRIGger[:SOURce]:EXTernal:SLOPe?
Ext Delay Off On	[ :SOURce ]:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELAy: STATe ON OFF 1 0 [ :SOURce ]:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELAy: STATe?

Key	SCPI Command
<b>Ext Delay Time</b>	[:SOURce]:RADio:ARB:TRIGger[:SOURce]:EXTernal:DElay <value> [:SOURce]:RADio:ARB:TRIGger[:SOURce]:EXTernal:DElay?
<b>First Marker Point</b>	[:SOURce]:RADio:ARB:MARKer:[SET] "<file name>", <mkr(1 2)>, <first_point>, <last_point>, <skip_count> [:SOURce]:RADio:ARB:MARKer:CLEar "<file name>", <mkr(1 2)>, <first_point>, <last_point>
<b>Gated</b>	[:SOURce]:RADio:ARB:TRIGger:TYPE GATE [:SOURce]:RADio:ARB:TRIGger:TYPE?
<b>Gate Active</b>	[:SOURce]:RADio:ARB:TRIGger:TYPE:GATE:ACTive LOW HIGH [:SOURce]:RADio:ARB:TRIGger:TYPE:GATE:ACTive?
<b>Last Marker Point</b>	[:SOURce]:RADio:ARB:MARKer:[SET] "<file name>", <mkr(1 2)>, <first_point>, <last_point>, <skip_count> [:SOURce]:RADio:ARB:MARKer:CLEar "<file name>", <mkr(1 2)>, <first_point>, <last_point>
<b>Marker 1 2</b>	[:SOURce]:RADio:ARB:MARKer:[SET] "<file name>", <mkr(1 2)>, <first_point>, <last_point>, <skip_count>
<b>Marker Polarity Neg Pos</b>	[:SOURce]:RADio:ARB:MARKer:POLarity NEG POS [:SOURce]:RADio:ARB:MARKer:POLarity?
<b>Marker 2 To RF Blank Off On</b>	[:SOURce]:RADio:ARB:MARKer:RFBLank ON OFF 1 0 [:SOURce]:RADio:ARB:MARKer:RFBLank?
<b>Reconstruction Filter</b>	[:SOURce]:RADio:ARB:RFILter <value> THROUGH [:SOURce]:RADio:ARB:RFILter?
<b>Reference Frequency</b>	[:SOURce]:RADio:ARB:CLOCK:REFerence:EXTernal:FREQuency <value> [:SOURce]:RADio:ARB:CLOCK:REFerence:EXTernal:FREQuency?
<b>Rename Segment</b>	:MMEMory:MOVE <src_file>,<dest_file>
<b>Retrigger Mode Off On</b>	[:SOURce]:RADio:ARB:RETRigger ON OFF 1 0 [:SOURce]:RADio:ARB:RETRigger?
<b>Segment Advance</b>	[:SOURce]:RADio:ARB:TRIGger:TYPE SADVance [:SOURce]:RADio:ARB:TRIGger:TYPE?
<b>Select Waveform</b>	[:SOURce]:RADio:ARB:WAVEform "<file name>" [:SOURce]:RADio:ARB:WAVEform?
<b>Select Waveform (ARBI: or SEQ:)</b>	[:SOURce]:RADio:ARB:WAVEform "ARBI SEQ:"<file name>" [:SOURce]:RADio:ARB:WAVEform?
<b>Set Markers</b>	[:SOURce]:RADio:ARB:MARKer:[SET] "<file name>", <mkr(1 2)>, <first_point>, <last_point>, <skip_count>

Key	SCPI Command
<b>Set Marker Off All Points</b>	[:SOURCE]:RADio:ARB:MARKer:CLEar:All "<file name>", <mk1(1 2)>
<b>Set Marker Off Range Of Points</b>	[:SOURCE]:RADio:ARB:MARKer:CLEar "<file name>", <mk1(1 2)>, <first_point>, <last_point>
<b>Set Marker On First Point</b>	[:SOURCE]:RADio:ARB:MARKer:[SET] "<file name>", <mk1(1 2)>, <first_point>, <last_point>, <skip_count>
<b>Set Marker On Range Of Points</b>	[:SOURCE]:RADio:ARB:MARKer:[SET] "<file name>", <mk1(1 2)>, <first_point>, <last_point>, <skip_count>
<b>Single</b>	[:SOURCE]:RADio:ARB:TRIGger:TYPE SINGLE [:SOURCE]:RADio:ARB:TRIGger:TYPE?
<b>Through</b>	[:SOURCE]:RADio:ARB:RFILter THROUGH [:SOURCE]:RADio:ARB:RFILter?
<b>Toggle Marker 1</b>	[:SOURCE]:RADio:ARB:SEQuence "<file name>", <waveform>, <reps>, <mk1(1 0)>, <mk2(1 0)> {, <waveform>, <reps>, <mk1(1 0)>, <mk2(1 0)>} [:SOURCE]:RADio:ARB:SEQuence? "<file name>"
<b>Toggle Marker 2</b>	[:SOURCE]:RADio:ARB:SEQuence "<file name>", <waveform>, <reps>, <mk1(1 0)>, <mk2(1 0)> {, <waveform>, <reps>, <mk1(1 0)>, <mk2(1 0)>} [:SOURCE]:RADio:ARB:SEQuence? "<file name>"
<b>Toggle Markers</b>	[:SOURCE]:RADio:ARB:MARKer:[SET] "<file name>", <mk1(1 2)>, <first_point>, <last_point>, <skip_count>  [:SOURCE]:RADio:ARB:MARKer:CLEar:All "<file name>", <mk1(1 2)>
<b>Trigger</b>	[:SOURCE]:RADio:ARB:TRIGger:TYPE CONT SINGLE GATE [:SOURCE]:RADio:ARB:TRIGger:TYPE?
<b>Trigger Key</b>	[:SOURCE]:RADio:ARB:TRIGger[:SOURCE] KEY [:SOURCE]:RADio:ARB:TRIGger[:SOURCE]?
<b>Trigger Source</b>	[:SOURCE]:RADio:ARB:TRIGger[:SOURCE] KEY EXT BUS [:SOURCE]:RADio:ARB:TRIGger[:SOURCE]?



**Table 6-4 Mode – Multitone Softkeys**

<b>Key</b>	<b>SCPI Command</b>
<b>Apply Multitone</b>	[ :SOURce]:RADio:MTONE:ARB[:STATe] ON
<b>Edit Phase</b>	[ :SOURce]:RADio:MTONE:ARB:SETup:TABLE freq_spacing,num_tones,phase0,state0,phase1,statel,...  [ :SOURce]:RADio:MTONE:ARB:SETup:TABLE?
<b>Freq Spacing</b>	[ :SOURce]:RADio:MTONE:ARB:SETup:TABLE freq_spacing,num_tones,phase0,state0,phase1,statel,...  [ :SOURce]:RADio:MTONE:ARB:SETup:TABLE?
<b>Load From Selected File</b>	[ :SOURce]:RADio:MTONE:ARB:SETup "<file name>" [ :SOURce]:RADio:MTONE:ARB:SETup?
<b>MTONE</b>	:MEMory:CATalog:MTONE?
<b>Multitone Off On</b>	[ :SOURce]:RADio:MTONE:ARB[:STATe] ON OFF 1 0 [ :SOURce]:RADio:MTONE:ARB[:STATe]?
<b>Number of Tones</b>	[ :SOURce]:RADio:MTONE:ARB:SETup:TABLE freq_spacing,num_tones,phase0,state0,phase1,statel,...  [ :SOURce]:RADio:MTONE:ARB:SETup:TABLE?
<b>Store To File</b>	[ :SOURce]:RADio:MTONE:ARB:SETup:STORe "<file name>"
<b>Toggle State</b>	[ :SOURce]:RADio:MTONE:ARB:SETup:TABLE freq_spacing,num_tones,phase0,state0,phase1,statel,...  [ :SOURce]:RADio:MTONE:ARB:SETup:TABLE?



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32768 softkey, 3-3  
524288 softkey, 3-4  
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65536 softkey, 3-3  
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