GSM and EDGE Guide

Agilent Technologies
ESA-E Series Spectrum Analyzers

Option BAH and Option 252

This manual provides documentation for the following instruments:

ESA-E Series

E4402B (9 kHz - 3.0 GHz)
E4404B (9 kHz - 6.7 GHz)
E4405B (9 kHz - 13.2 GHz)
E4407B (9 kHz - 26.5 GHz)

Agilent Technologies

Manufacturing Part Number: E4402-90097
Supersedes E4402-90015, E4402-90017, and E4402-90018

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Contents

Contents

Contents

Contents

Contents

List of Commands

List of Commands

List of Commands

List of Commands

1 Introduction to GSM and EDGE

This chapter introduces you to basics of GSM and EDGE technology and the general functionality of the ESA with the GSM (w/EDGE) measurement personality installed. In addition, sources for additional information on digital communications are listed.

What does the GSM/EDGE Measurement Personality and Hardware Do?

When configured with GSM or GSM (w/EDGE) mode personality software, the ESA series spectrum analyzer can help determine if a GSM/EDGE transmitter or receiver is working correctly. Industry standards are created documenting the testing requirements. These standards are continually being updated by the communications industry. The instrument software performs to the standard/date shown under **Mode Setup**, **Radio**.

When you select the standard format for use, the instrument automatically makes measurements using the measurement methods and limits defined in the standards. Detailed measurement results are displayed allowing you to analyze GSM/EDGE system performance.

Measurement parameters may be altered for specialized analysis. This is done within narrow limits because the standards specify the test methods and settings.

For infrastructure testing, the instrument tests base station transmitters and receivers in a non-interfering manner by using a coupler or power splitter.

The instrument makes the following one-button measurements (measurements activated by a single key press):

- Cable Fault Location
- Monitor Band/Channel
- Out of Band Spurious
- GMSK Output RF Spectrum
- GMSK Phase and Frequency Error
- Power Steps
- GMSK Power vs Time
- Receive (Rx) Band Spurious
- Transmit (Tx) Band Spurious
- Transmitter Power
- EDGE Power vs Time
- EDGE EVM
- EDGE Output RF Spectrum

In addition, the following manual measurements (measurements which are not activated by a single key press) can be performed:

- Loss/Gain (available in Spectrum Analysis mode)
- Return Loss (VSWR) (available in Spectrum Analysis mode)

Other Sources Of Measurement Information.

Application Notes

The following application notes describe digital communications measurements in much greater detail than discussed in this User Guide:

- Application Note 1298
  Digital Modulation in Communications Systems - An Introduction
  Agilent Technologies part number 5965-7160E
- Application Note 1311
  Understanding GSM Transmitter Measurements for Base Transceiver stations and Mobile Stations
  part number 5966-2833E
- Application Note 1313
  Testing and Troubleshooting Digital RF Communications Transmitter Designs
  part number 5968-3578E
- Application Note 1314
  Testing and Troubleshooting Digital RF Communications Receiver Designs
  part number 5968-3579E
- Application Note 150
  Spectrum Analyzer Basics
  part number 5952-0292

Additional Information

- Additional measurement application information is available from your local Agilent Technologies sales and service office.
- The latest information on ESA spectrum analyzers is available from the following URL:

  http://www.agilent.com/find/esa/

Updating the Firmware

Updated versions of the ESA-E Series Spectrum Analyzer firmware will be available via several sources. Information on the latest firmware revision can be accessed from the following URL:

http://www.agilent.com/find/esa/

Installing Optional Measurement Personalities

Activate License Key

The measurement personality software you have purchased with your instrument has been installed and the license key has been enabled at the factory. With any future purchase of a new personality software, you will receive an entitlement which can be redeemed to obtain the license key. The license key enables you to install, or reinstall, any measurement personality you have purchased. If you return the instrument to the factory for the installation of measurement personality software, you will receive no documentation of the license key, nor will you receive documentation of the license key for the measurement personality software you have purchased with your instrument.

Installing the License Key

If you are installing a new option, follow these steps to install the unique license key for the measurement personality software that you want to install in your instrument:

1. Press **System**, **More**, **Licensing**, **Option**.

   When you press **Option** the alpha editor will be activated. For instructions on using the alpha editor, refer to the *Agilent ESA Spectrum Analyzers User's/Programmer's Reference*.

2. Use the alpha editor to enter the three letter designation for the software option that you wish to install in the instrument.
3. Press **Done** on the alpha editor menu.
4. Press **License Key**.

   When you press **License Key** the alpha editor will be activated. For instructions on using the alpha editor, refer to the *Agilent ESA Spectrum Analyzers User's/Programmer's Reference*.

5. Use the alpha editor to enter the 12 character license key for the software option that you wish to install in the instrument.
6. Press **Done** on the alpha editor menu.
7. Press **Activate** or **Activate License** to turn on the license key. You may now install the measurement personality option software.

Using Install Key

You may want to install a software revision, install new measurement software or reinstall measurement software that you have previously uninstalled, or uninstall measurement software. Before you can install software, you will need a set of installation diskettes.

If you have ordered a measurement personality, you will receive the installation disk set in the option upgrade package. If you are updating an existing, previously installed measurement option, you may order the diskettes from Agilent Technologies or create a set from the Agilent internet site shown in "Updating the Firmware" on page 38. When you order the updated software disk set, you will need to order Option UE2. (Option UE2 is a firmware update and is needed to ensure that the firmware and the software are compatible.) A set of diskettes can be ordered from your local Agilent Technologies service or sales office. To create a disk set refer to "Creating Software Installation Disks" below.

Creating Software Installation Disks

To create the installation disks on-line, visit the Agilent internet site shown in "Updating the Firmware" on page 38. Follow the instructions provided on the internet site for downloading the current measurement personalty software and creating the installation disk set. The instructions for creating the disk set will step you through the process to create a firmware disk set when you create the measurement personalty software disk set. (A firmware update may be needed to ensure that the firmware and the software are compatible.) After you have created the disk set, follow the on-line instructions to install the firmware. After successfully installing the firmware update, proceed with the following instructions for installing the measurement personalty software in your instrument.

Installing Personality/Software Options

This procedure gives steps to install a new software option in an ESA-E Series Spectrum Analyzer using the internal floppy drive of the instrument. Screen messages display the update progress and give directions. The instrument will not need to be re-calibrated after this procedure since no changes are made to calibration or adjustment files.

If you have a problem with the installation process, refer to "Troubleshooting the Installer" on page 42.

NOTE When the installer starts up, it examines the instrument to ensure that all the required software and hardware options are present. If they are not, the installer will generate an error and you will not be able to install the personality.

NOTE Because the current version of the GSM (w/EDGE) personality is so large (approximately 5 MB), it will not be possible to upgrade from an earlier version of GSM without uninstalling the earlier version first. After uninstalling the earlier version, cycle power on the analyzer before beginning the installation of the new version; this well ensure the maximum amount of memory is available for the installation. If the earlier version is not uninstalled, there will not be enough free memory to install the new version.

NOTE If you will be installing several personalities, Agilent recommends that you install the largest personality first and the smallest personality last.

1. If this is the installation of new personality option software, you must enter the License Key for the new option. For instructions on entering the License Key, refer to the "Installing the License Key" on page 39.

   When you have completed entering the license key, continue with the next step.

2. Insert disk one of the installation disk set into the disk drive located on the right side of the ESA front panel.

3. Press **System**, **More**, **Personalities**, and **Install**. The instrument will then load the installer from the floppy drive. If there is no floppy in the drive, the incorrect disk is inserted, or there is no installer on the disk, the error "No install disk present in disk drive" will be shown.

   Once the instrument has loaded the installer, the screen will change to the installer screen and the **Install Pers.** menu will be shown. For more information on the installer screen and menu, refer to "Installer Screen and Menu" on page 43.

4. When the installer first starts up, it will show a popup message. Select **Verify Disks**.

NOTE Once the installer has begun installing a personality, any error will cause the whole personality (including a previously installed version) to be removed from the instrument. Because of this, it is very important that you verify the disks prior to installing them. If any of the disks or files are bad, you will not be able to use the personality until you obtain a new installation disk set and run the install using them.

5. When prompted, insert the next disk and press **Verify Disks** again.

   When Verify Disks is running, the **Install Now** and **Exit Install** keys will be grayed out.

6. When the verification is complete, press **Install Now** and the installation of the personality will begin. Some of the disks may take

only a short time to load or be skipped entirely, while others can take up to about 30 minutes to load.

When Installer is running, the **Verify Disks** and **Exit Install** keys will be grayed out.

7. When prompted, insert the next disk and press **Install Now** again.
8. Once the installation is complete, press **Exit Install**.

Troubleshooting the Installer

If the installation process stalls or fails in another way, follow these steps to resolve your problem.

1. If the error message “Failed to load DLP c:dlp\gsm\gsm.o” appears after the installation has been completed:
    a. Press **Exit Install** to exit the installer.
    b. Press **Mode**. If **GSM (w/EDGE)** does not appear on one of the softkeys, cycle power on the analyzer.
    - If the error message “Failed to load DLP a:install.o” appears, ignore this message; the message indicates that the installer was not exited properly. Press the **Mode** key. If **GSM (w/EDGE)** now appears on one of the softkeys, the installation was successful.
    - If **GSM (w/EDGE)** does not appear on one of the softkeys, get in touch with your nearest Agilent sales and service office as described below in step 3.
2. If the instrument stops the update process before all the disks are loaded proceed as follows:
    a. Press **Exit Install** to abort the process.
    b. Return to step 2 under “Installing Personality/Software Options” and start the installation process again.
3. If the instrument fails after repeating the installation procedure, get in touch with your nearest Agilent sales and service office for assistance. Please provide the following information:

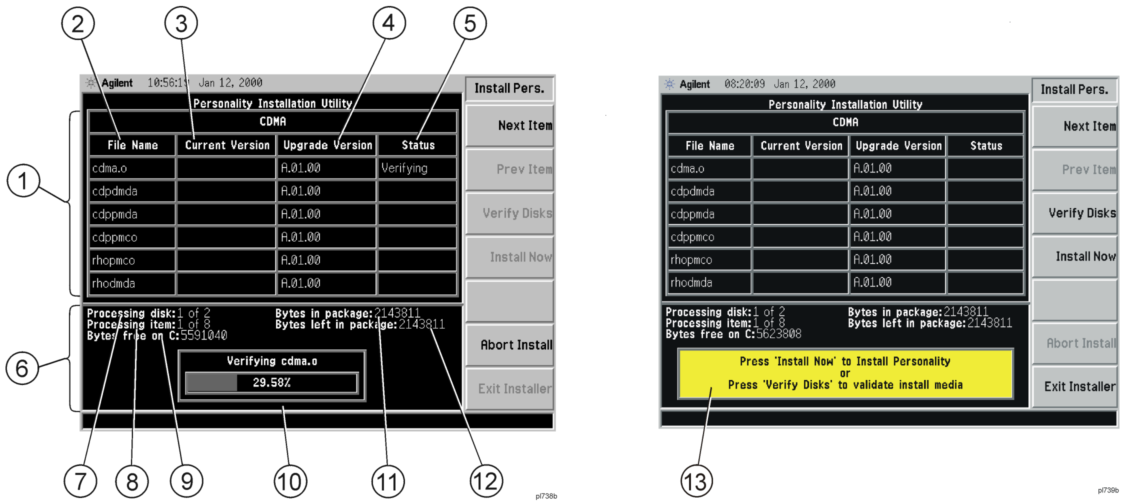
    Model Number:

    Serial Number:

    State that you are having trouble installing a software option update.

Installer Screen and Menu

The top portion of the install screen is a table in which the files that are about to be installed are listed. The bottom portion of the screen contains information needed to track the progress of the install.



1 **File Table** displays the files to be installed and various file information. If there are more then six files, **Next Item** and **Prev Item** allow you to scroll the table to view additional items.

2 **File Name** displays the name of the files on the installation disk.

3 **Current Version** displays the version of the file that is currently installed in the instrument. (This field will be blank if this file is not currently installed in the instrument or if the file is a data file that has no version.)

4 **Upgrade Version** shows the version of the file on the install disk. This is the version of the file that will replace the currently installed version.

5 **Status** is updated to reflect what the installer is doing to the current file as the install progress. The valid messages seen in this column are listed in Table 1-1 on page 44.

6 **Data Field** contains a status bar and various status information.

7 **Processing disk** shows the disk that is currently being read.

8 **Processing item** shows the file that is being processed by item number.

9 **Bytes free on C** is the number of bytes currently free on the instrument C: drive.

10 **Status Bar** contains a status bar that runs from 0 to 100% and tracks the progress of the current step and a message line displays the step that is currently being executed.

11 **Bytes in package** lists the number of bytes in the install package.

12 **Bytes left in package** lists the number of bytes left to be read.

13 Message and error popup window that displays over the status bar. Information in this box will prompt you for action required to proceed to the next phase of the installation. It may also inform you of errors in the installation process and may prompt you for action required to correct the problem.

Table 1-1 Installer Status Messages

`Failed`	This means that something has gone wrong while processing this item. It is a fatal error and the installation can not be completed. The installer will try to get the system back to a good state which may entail completely removing the currently installed personality.
`Loading`	The file is currently being copied from the install media to the instrument's file system.
`Verifying`	This may mean one of two things: 1. If "Verify Disks" was pressed then Verifying means that the installer is currently reading the install media and comparing the known checksums to ensure the data is good. 2. If "Install Now" was pressed, then Verifying means that the installer is reading what was just loaded to ensure the checksum is correct.
`Loaded`	This means that the data has been placed on the instrument disk but has not yet been registered with the firmware.
`Installed`	This means that the data has been loaded into the instrument and registered. The install for this file is complete.
`Skipping`	This means that the installer has determined that this file does not need to be loaded into the instrument.

Options Required

Installing the GSM or GSM with EDGE measurement personality firmware and making the associated measurements require certain basic equipment. This section lists the compatible ESA Spectrum Analyzers and required hardware options.

These measurement personalities are not compatible with all ESA spectrum analyzer models. Table 1-2 lists the models that are compatible and the upper frequency range of each.

Table 1-2 Compatible Agilent ESA Spectrum Analyzers

Model Number	Upper Frequency Range
E4402B	3 GHz
E4404B	6.7 GHz
E4405B	13.2 GHz
E4407B	26.5 GHz

Additional hardware options must be installed in the spectrum analyzer before the measurements can be made. Table 1-3 lists the hardware options available and the measurements that they enable. For optimum performance, Option B74 should be installed in your spectrum analyzer.

Not all of the options can be installed by the user. Some of the options require that the instrument be returned to the factory or an Agilent Technologies service center. In addition, some of the options require Performance Verification and Adjustments to be performed after installation. Refer to Table 1-3 on page 46 for option specific information.

Table 1-3 GSM/EDGE Hardware Options and measurements

Required/recommended option	Option Number	Measurement
Memory extension	B72	Required for all measurements.
DSP and Fast ADC	B7D[a]	Recommended options which enable Phase and Frequency Error and full triggering for all measurements. Note: these options must be ordered together.
RF Communications Hardware	B7E[a]	
50 Ohm Tracking Generator	1DN	Required for cable fault measurement.
Time Gated Spectrum Analysis	1D6	Required for Output RF Spectrum Modulation Swept measurement. The measurements will execute without the option but not to specification and the message “Gate option not installed. Results may not be accurate” displayed.
Fast Time Domain Sweep	AYX	Required for Output RF Spectrum, Transmitter Power, and Power vs Time measurements if options B7D/B7E are not ordered.
High Stability Frequency Reference	1D5[b]	Improves frequency reference accuracy.
RF and Digital Communication Hardware Option bundle	Option B74[b] Includes the following options: 1D6 B72 1D5 B7D B7E 1DS 1DR	Includes necessary hardware for the GSM measurement personality. The Cable Fault Location measurement also requires option 1DN.

a. Factory installation only.
b. Service center or factory installation, calibration required.

NOTE If the appropriate hardware is not present, the measurement softkey under the **Measure** menu will be grayed out and that measurement will not be available.

2 Making Measurements

This chapter introduces the basic measurement procedure including mode setup and changing measurement frequency.

Measurement topics described include:

- "Preparing To Make Measurements" on page 49
- Base Station Measurements:

"GMSK Output RF Spectrum (ORFS) Measurement" on page 52
"GMSK Phase and Frequency Error Measurement" on page 56
"GMSK Power vs. Time Measurement" on page 58
"Power Steps Measurement" on page 60
"Transmitter Power Measurement" on page 61

- Air Interface Measurements:

"Monitor Band/Channel Measurement" on page 63
"Out-of-Band Spurious Measurement" on page 65
"Transmitter Receive Band Spurious Measurement" on page 67
"Transmitter Transmit Band Spurious Measurement" on page 70
"Transmitter Power Measurement" on page 61

- Cable and Antenna Measurements:

"Making Cable Fault Location Measurements" on page 71
"Making Return Loss Measurements" on page 74
"Making Loss/Gain Measurements" on page 78

Preparing To Make Measurements

At initial power up, the analyzer is in Spectrum Analysis mode. To access the GSM or EDGE measurement personality, press the **MODE** front panel key and select the **GSM** or **GSM (w/EDGE)** menu key.

Initial settings

Before making a measurement, make sure the mode setup, measurement setup, and frequency channel parameters are set to the appropriate settings. For further information refer to "Mode Setup Menu" on page 454, "Frequency/Channel Menu" on page 437, and "Measurement Setup Menus" on page 440.

- Resetting parameters with **Preset**:

  To set all instrument parameters (including mode setup and measurement setup parameters) to factory default values, set the instrument **Preset Type** to **Factory**, then press the **Preset** front panel key. Note that the mode is changed to Spectrum Analysis. After pressing **Preset** with the preset type set to **Factory**, you must use the **MODE** key to return to GSM or GSM(w/EDGE) mode.

  To set all mode parameters to factory default values, set the instrument **Preset Type** to **Mode**, then press the **Preset** front panel key.

  The **Preset** front panel key can also be used to return the instrument to a set of user preset values. Refer to the ESA Spectrum Analyzers User's Guide for further information.

- Resetting mode setup parameters:

  Mode setup parameters apply to all measurements in this mode. To reset them to factory default values, press **Mode Setup** then **Restore Mode Setup Defaults**.

- Resetting measurement setup parameters:

  Measurement setup parameters affect the current measurement only. To reset them to factory default values (for the current measurement only), press **Meas Setup** then **Restore Meas Defaults**.

Making A Measurement

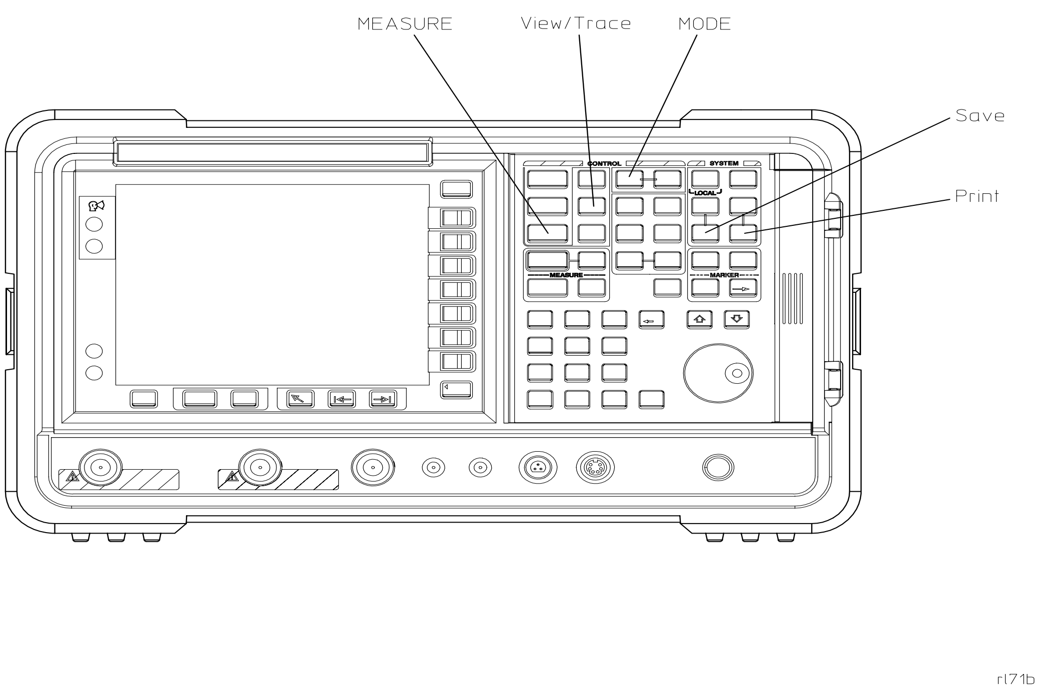
These measurements are intended to be used as "one button" measurements. This means that the appropriate measurement can be selected and run by a single key press once the instrument has been connected to the equipment to be tested. The measurement is made automatically using default parameters defined by the selected standard and the tuning plan.

Even though the measurements are designed as one-button measurements, you may change the default settings using various setup keys. However, changing the default settings may produce measurement results that are outside of the parameters of the selected standard and tuning plan requirements.

Most measurements can be performed using the simple four-step procedure outlined in the table below. Most measurements are performed using only the primary keys listed in conjunction with a minimum of setup keys. Measurement setup keys (**Meas Setup**) can be used for non-standards compliant testing. For more information see "Initial settings" above.

Step	Primary Key	Setup Keys	Related Keys
1. Select and set up mode	**MODE**	**Mode Setup**	**System**
2. Select and set up measurement	**MEASURE**	**Meas Setup**, Restore Meas Defaults, FREQUENCY Channel	**Meas Control**, **Restart**
3. Select and set up view	**View/Trace**	**Span X Scale**, **Amplitude Y Scale**, **Display**	**Marker**, **Search**
4. Saving and printing results	**File** **Print**	**Print Setup**	**Save**

Figure 2-1 Primary Keys Used for Performing Measurements



Saving Measurement Results

To save measurement results, follow the process shown below. For additional information on file management in the spectrum analyzer, refer to the *ESA Spectrum Analyzers User's/Programmer's Reference*.

1. Press **File**, **Save**, **Type**, **More**, and **Measurement Results**.
2. If you want to change the file name, press **Name**, and use the Alpha Editor the enter the new name. For more information on using the Alpha Editor, refer to the *ESA Spectrum Analyzers User's Guide*.
3. Press **Save Now** to complete the file saving process.
4. If you have used the default file name and wish to save additional measurement results, press **Save**. The current measurement result will be saved with the next default file name.
5. If you have not used the default file name and wish to save additional measurement results, repeat steps 1 through 3.

GMSK Output RF Spectrum (ORFS) Measurement

Making the Measurement

1. Press the **Measure** key.
2. Press the **Output RF Spectrum** key.

Factory default parameter settings provide a GSM compliant measurement. For special requirements, you may need to change default settings:

- Mode setup and frequency/channel parameters. Use the **Mode Setup** and **Frequency Channel** keys to change these parameters for all measurements made within the current mode. For further information refer to Chapter 1 of this document.
- Measurement setup parameters. These are measurement specific parameters changed using the Measurement setup (**Meas Setup**) menu. Parameters can be returned to default settings at any time by pressing **Meas Setup**, **More (1 of 2)** and **Restore Meas Defaults**. For further information on measurement setup parameters, refer to Chapter 3 , "Key Reference."

The following keys provide useful measurement functionality:

- Changing between multiple, single and swept modes:

  Press **Meas Setup** followed by **Meas Method**.
- Changing between modulation and switching:

  Press **Meas Setup** followed by **Meas Type**
- To change the table display:

  The table display can be changed to display results, the specification limits, or the margins. Press the **Display** front panel key followed by the **Table Display** menu key to toggle between these settings.

NOTE Parameters that exist under the **Meas Setup Advanced** key seldom need to be changed. Any changes from the default values may result in invalid measurement data.

Results

Figure 2-2 Output RF Spectrum (ORFS) Due To Modulation: Single Offset Measurement

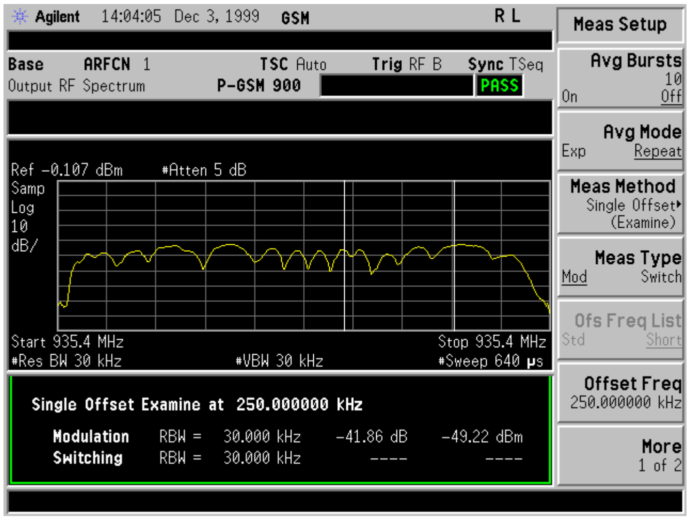


Figure 2-2 shows a single offset trace taken during an ORFS due to modulation measurement. The vertical bars show the portion used to measure power due to modulation. If averaging is turned on, the trace is averaged with previous traces using video averaging. The displayed value is the average of points within the vertical bars.

Figure 2-3 Output RF Spectrum (ORFS) Due To Modulation: Multiple Offset Measurement

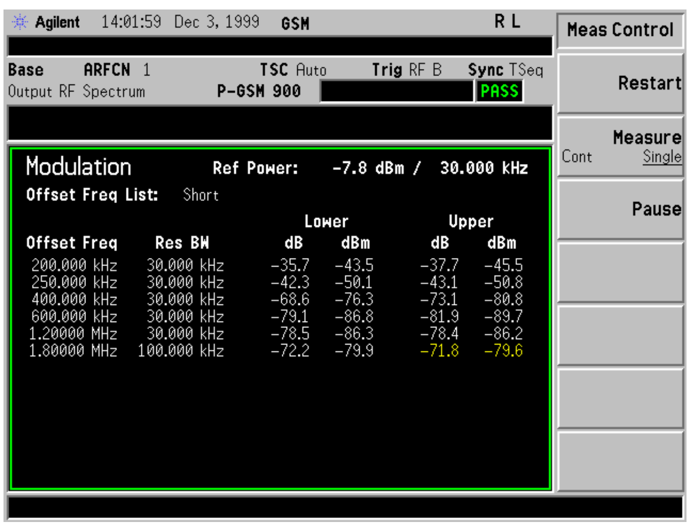


Figure 2-3 shows offset measurements taken during an ORFS due to modulation (multiple offset) measurement.

Figure 2-4 Output RF Spectrum (ORFS) Due To Modulation: Swept Measurement

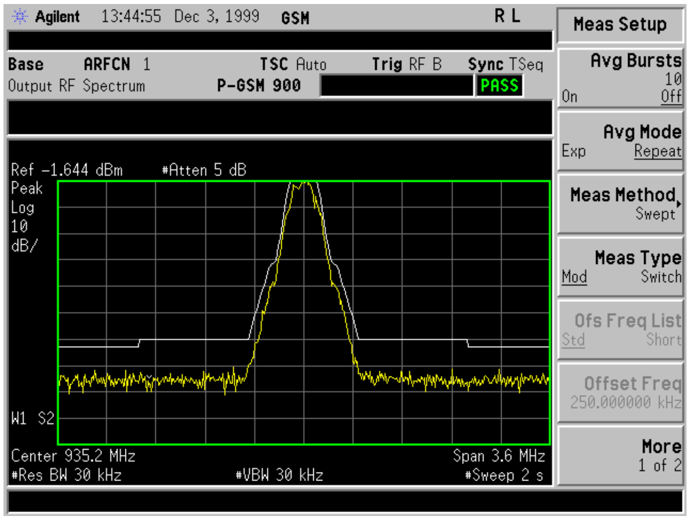


Figure 2-4 shows a swept trace taken during an ORFS due to modulation measurement. If averaging is turned on, the display is averaged over successive sweeps until the required number of sweeps has been reached. It then starts again with a fresh display.

Figure 2-5 Output RF Spectrum (ORFS) Due To Switching Transients: Single Offset Measurement

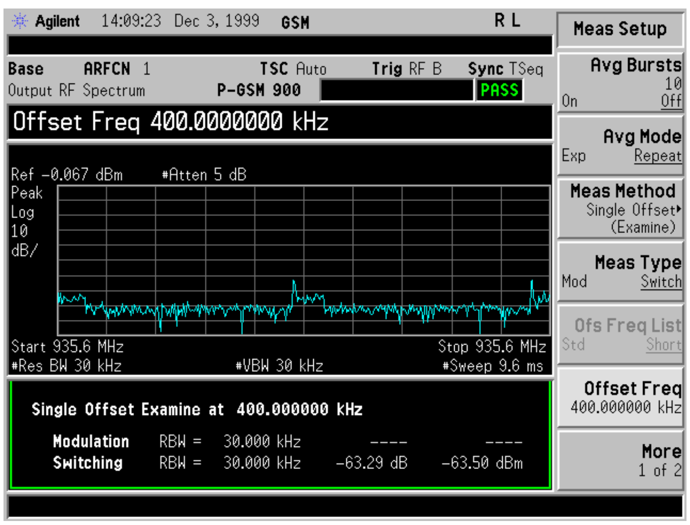


Figure 2-5 shows a single offset trace taken during an ORFS due to switching transients measurement. If averaging is turned on, the trace is averaged with previous traces. The peak of the traces is used. The displayed value is the maximum of all points for all traces (Max or Peak) over the entire frame.

Figure 2-6 Output RF Spectrum (ORFS) Due To Switching Transients: Multiple Offset Measurement

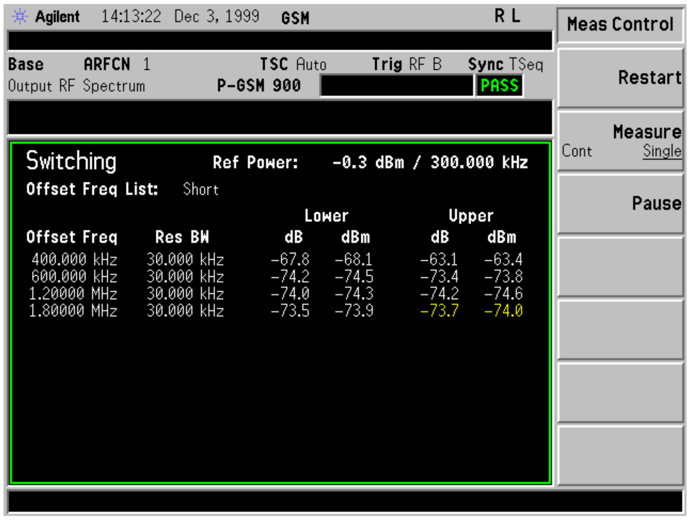


Figure 2-6 shows a table of multiple offset measurements taken during an ORFS due to switching transients measurement.

Figure 2-7 Output RF Spectrum (ORFS) Due To Switching Transients: Swept Measurement

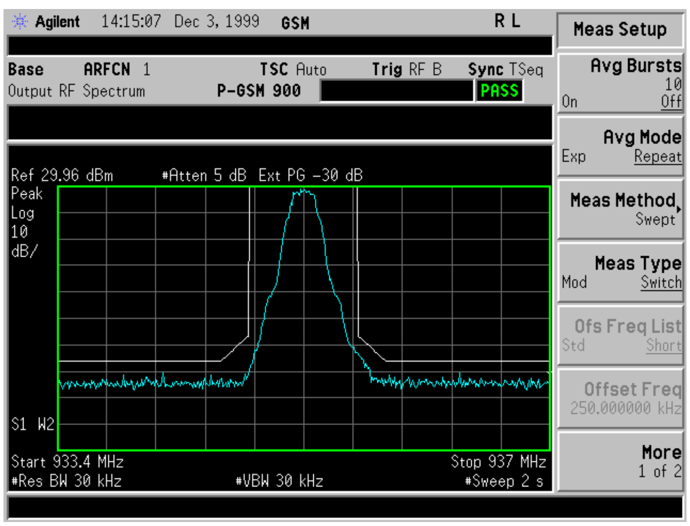


Figure 2-7 (above) shows a trace of a swept measurement taken during an ORFS due to switching transients measurement. If averaging is turned on, the display is averaged over successive sweeps until the required number of sweeps has been reached. It then starts again with a fresh display.

GMSK Phase and Frequency Error Measurement

Making the Measurement

1. Press the **Measure** key.
2. Press the **Phase and Frequency** key.

Factory default parameter settings provide a GSM compliant measurement. For special requirements, you may need to change default settings:

- Mode setup and frequency/channel parameters.
  Use the **Mode Setup** and **Frequency Channel** keys to change these parameters for all measurements made within the current mode. For further information refer to Chapter 1 of this document.
- Measurement setup parameters.
  These are measurement specific parameters changed using the Measurement setup (**Meas Setup**) menu. Parameters can be returned to default settings at any time by pressing **Meas Setup**, **More (1 of 2)** and **Restore Meas Defaults**. For further information on measurement setup parameters, refer to Chapter 3 , “Key Reference.”

Results

Figure 2-8 Phase and Frequency Error Result - I/Q Quad view

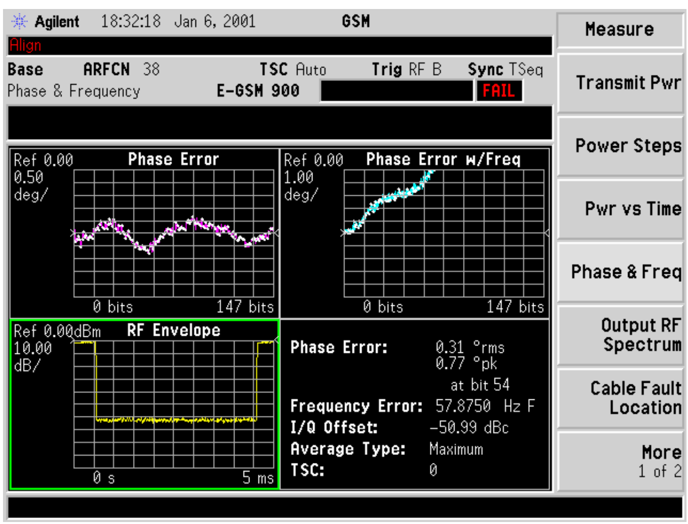
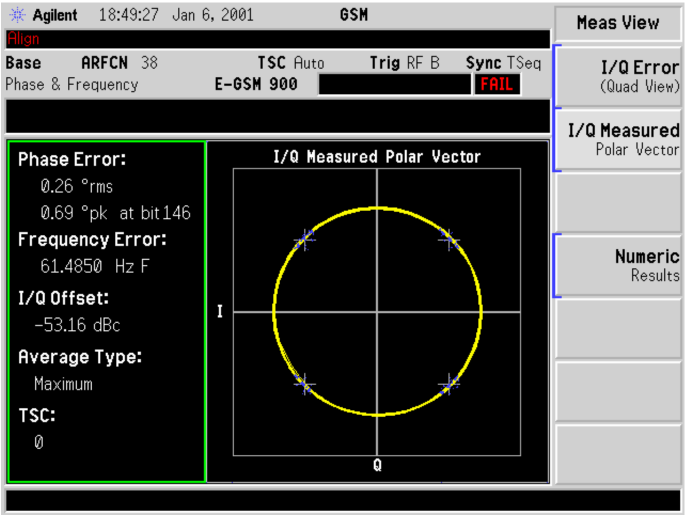


Figure 2-9 Phase and Frequency Error Result - I/Q Measured view



Troubleshooting Hints

Poor phase error indicates a problem with the I/Q baseband generator, filters, or modulator in the transmitter circuitry. The output amplifier in the transmitter can also create distortion that causes unacceptably high phase error. In a system, poor phase error will reduce the ability of a receiver to correctly demodulate, especially in marginal signal conditions. This ultimately affects range.

Occasionally, a Phase and Frequency Error measurement may fail the prescribed limits at only one point in the burst, for example at the beginning. This could indicate a problem with the transmitter power ramp or some undesirable interaction between the modulator and power amplifier.

GMSK Power vs. Time Measurement

Making the Measurement

1. Press the **Measure** key.
2. Press the **Power vs Time** key.

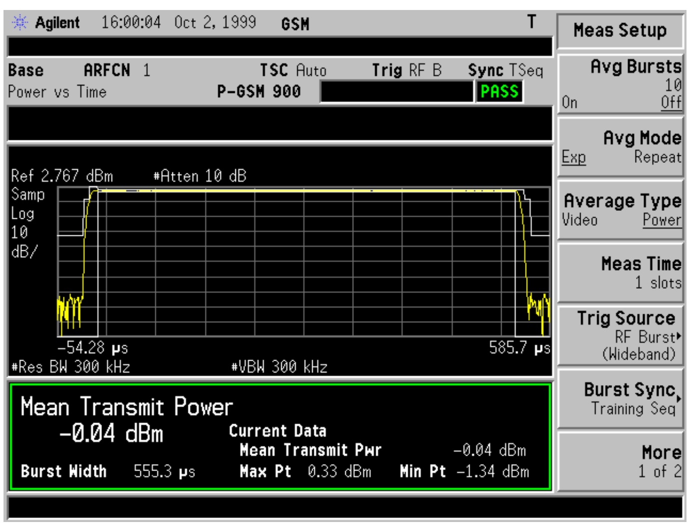
Factory default parameter settings provide a GSM compliant measurement. For special requirements, you may need to change default settings:

- Mode setup and frequency/channel parameters.
  Use the **Mode Setup** and **Frequency Channel** keys to change these parameters for all measurements made within the current mode. For further information refer to Chapter 1 of this document.
- Measurement setup parameters.
  These are measurement specific parameters changed using the Measurement setup (**Meas Setup**) menu. Parameters can be returned to default settings at any time by pressing **Meas Setup**, **More (1 of 2)** and **Restore Meas Defaults**. For further information on measurement setup parameters, refer to Chapter 3 , "Key Reference."

NOTE Parameters that exist under the **Meas Setup Advanced** key seldom need to be changed. Any changes from the default values may result in invalid measurement data.

Results

Figure 2-10 Power versus Time Measurement Result - Mask View

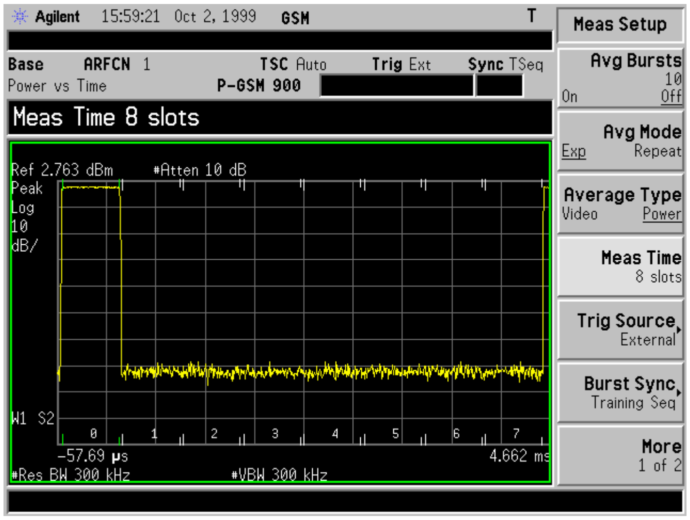


Making Measurements

Power vs Time Custom Masks

For the Power vs Time measurement, you can define a user configurable limit mask to apply to the measured burst. This feature can only be accessed via SCPI commands. For further information refer to Chapter 4 , "Programming Commands."

Figure 2-11 Power versus Time Measurement Result - Monitor View



Changing the View

The **View/Trace** key will access a menu which allows you to select the desired view of the measurement from the following selections:

- **Mask** - views the entire sweep as specified by the meas time and compares the burst against a predefined mask. An example of this is shown in Figure 2-10 (above).
- **Monitor** - views the entire sweep as specified by the meas time and displays frame structure annotation. An example of this is shown in Figure 2-11 (above). A Max Hold function is provided to allow monitoring over time.

Changing the Display

The **Display** key allows you to turn the limit mask on and off. This also disables the mask limit test, but still calculates the power in the useful part.

Troubleshooting Hints

If a transmitter fails the Power vs Time measurement this usually indicates a problem with the unit's output amplifier or leveling loop.

Power Steps Measurement

Making the Measurement

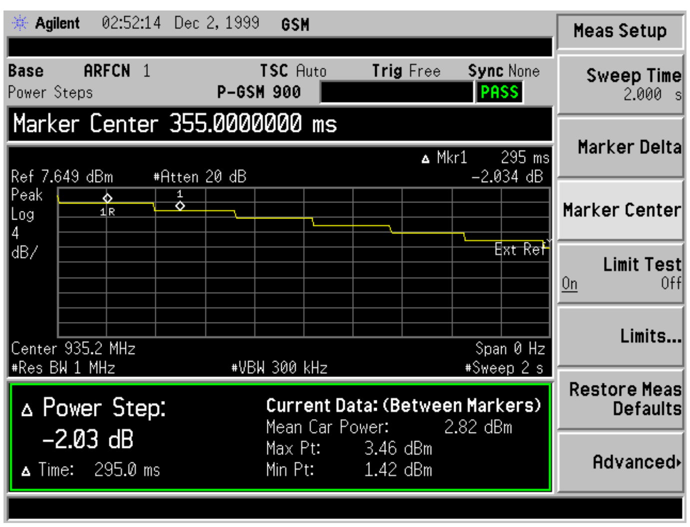
1. Press the **Measure** key.
2. Ensure the carrier level to be measured is set to the maximum power step level. The power steps measurement performs the auto level routine upon entering the measurement, positioning the signal level at the top of the screen.
3. Press the **Power Steps** key.

Factory default parameter settings provide a GSM/EDGE compliant measurement. For special requirements, you may need to change default settings:

- Mode setup and frequency/channel parameters.
  Use the **Mode Setup** and **Frequency Channel** keys to change these parameters for all measurements made within the current mode. For further information refer to Chapter 3 , “Key Reference.”
- Measurement setup parameters.
  These are measurement specific parameters changed using the Measurement setup (**Meas Setup**) menu. Parameters can be returned to default settings at any time by pressing **Meas Setup** and **Restore Meas Defaults**. For further information on measurement setup parameters, refer to Chapter 3 , “Key Reference.”

Results

Figure 2-12 Power Steps Measurement



Transmitter Power Measurement

Making the Measurement

1. Press the **Measure** key.
2. Press the **Transmitter Power** key.

Factory default parameter settings provide a GSM/EDGE compliant measurement. For special requirements, you may need to change default settings:

- Mode setup and frequency/channel parameters.
  Use the **Mode Setup** and **Frequency Channel** keys to change these parameters for all measurements made within the current mode. For further information refer to Chapter 1 of this document.
- Measurement setup parameters.
  These are measurement specific parameters changed using the Measurement setup (**Meas Setup**) menu. Parameters can be returned to default settings at any time by pressing **Meas Setup**, **More (1 of 2)** and **Restore Meas Defaults**. For further information on measurement setup parameters, refer to Chapter 3 , "Key Reference."

NOTE Parameters that exist under the **Meas Setup Advanced** key seldom need to be changed. Any changes from the default values may result in invalid measurement data.

Results

Figure 2-13 Transmitter Power Result - Single Burst

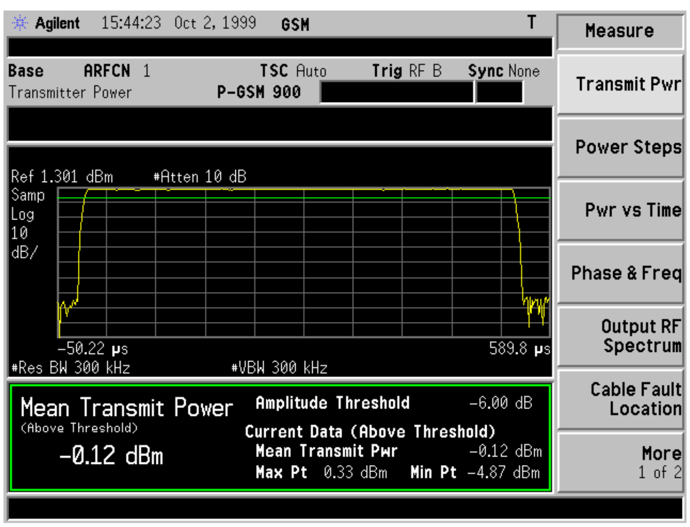
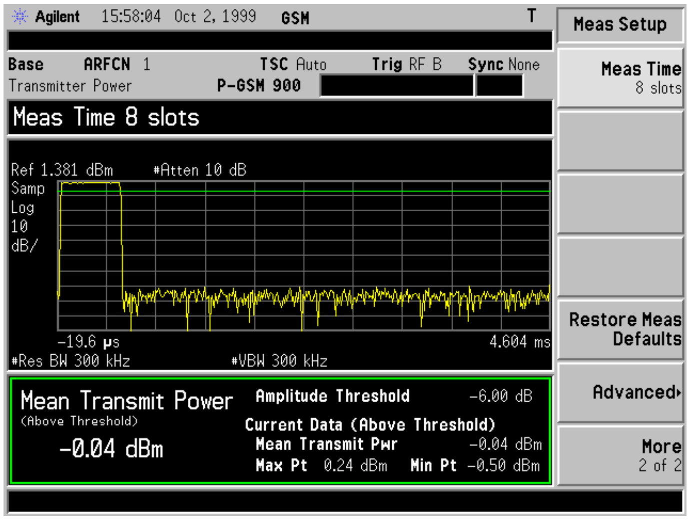


Figure 2-14 Transmitter Power Result - Multiple Bursts



Troubleshooting Hints

Low output power can lead to poor coverage and intermittent service for phone users. Out of specification power measurements indicate a fault usually in the power amplifier circuitry. They can also provide early indication of a fault with the power supply, that is the battery in the case of mobile stations.

Monitor Band/Channel Measurement

Making the Measurement

1. Press **Measure**, **More (1 of 3)**.
2. Press the **Monitor Band/Channel** key.
3. Press **Meas Setup**.
4. Press **Method** to set the measurement to **Band** or **Channel**.

Factory default parameter settings provide a GSM/EDGE compliant measurement. For special requirements, you may need to change default settings:

- Mode setup and frequency/channel parameters.
  Use the **Mode Setup** and **Frequency Channel** keys to change these parameters for all measurements made within the current mode. For further information refer to Chapter 1 of this document.

- Measurement setup parameters.
  These are measurement specific parameters changed using the Measurement setup (**Meas Setup**) menu. Parameters can be returned to default settings at any time by pressing **Meas Setup**, **More (1 of 2)** and **Restore Meas Defaults**. For further information on measurement setup parameters, refer to Chapter 3 , “Key Reference.”

NOTE Parameters that exist under the **Meas Setup Advanced** key seldom need to be changed. Any changes from the default values may result in invalid measurement data.

Results

Example screens from making a band measurement are shown in Figure 2-15 on page 64 and a channel measurement in Figure 2-16 on page 64.

Figure 2-15 Monitor Band/Channel Measurement Results—Band Method

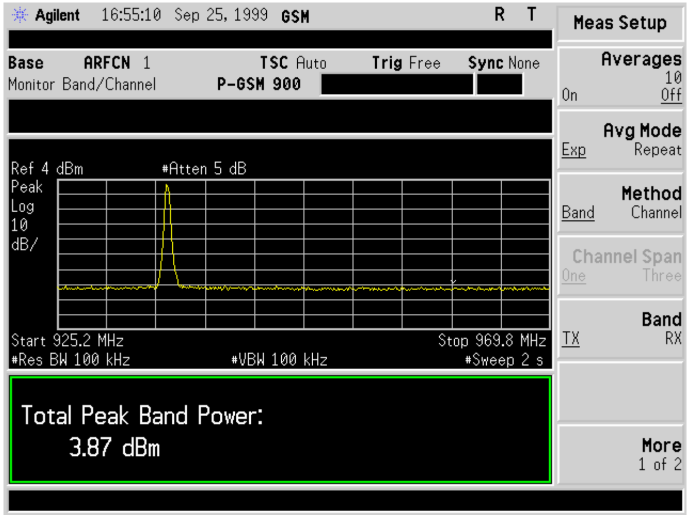
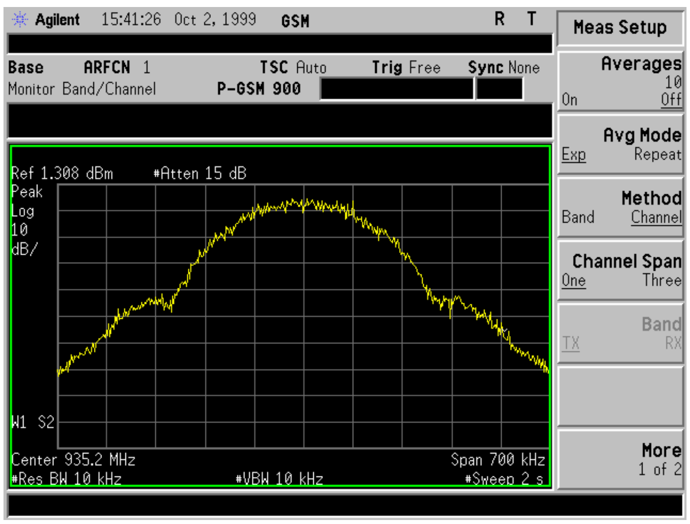


Figure 2-16 Monitor Band/Channel Measurement Results—Channel Method



Troubleshooting Hints

- If an external attenuator is used, be sure to include the attenuation value in the measurement. This can be done under the Input/Output key.
- If an external preamplifier is used, be sure to include the gain value in the measurement. This can be done under the Input/Output key.

Out-of-Band Spurious Measurement

Making the Measurement

1. Press **Measure**, **More (1 of 3)**.
2. Press the **Out Of Band Spurious** key.

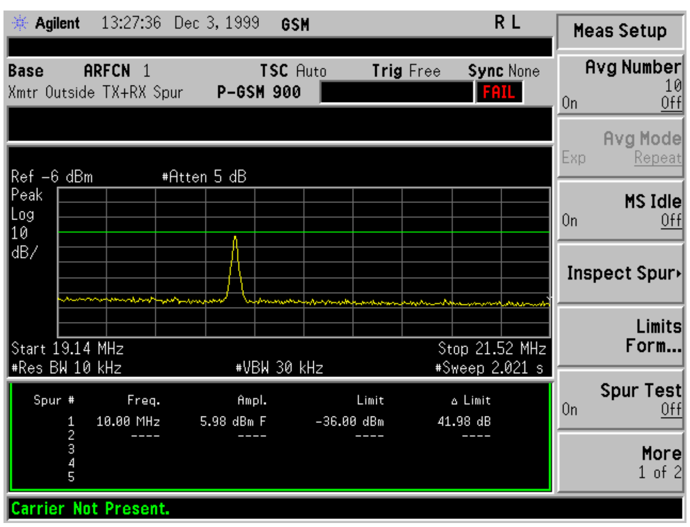
Factory default parameter settings provide a GSM/EDGE compliant measurement. For special requirements, you may need to change default settings:

- Mode setup and frequency/channel parameters.
  Use the **Mode Setup** and **Frequency Channel** keys to change these parameters for all measurements made within the current mode. For further information refer to Chapter 1 of this document.
- Measurement setup parameters.
  These are measurement specific parameters changed using the Measurement setup (**Meas Setup**) menu. Parameters can be returned to default settings at any time by pressing **Meas Setup**, **More (1 of 2)** and **Restore Meas Defaults**. For further information on measurement setup parameters, refer to Chapter 3 , “Key Reference.”

NOTE Parameters that exist under the **Meas Setup Advanced** key seldom need to be changed. Any changes from the default values may result in invalid measurement data.

Results

Figure 2-17 Out-of-Band Spurious Measurement Results



NOTE Results are shown in tabular format beneath the trace. To view this section of the window in its entirety, press the **Next Window** menu key until it is highlighted, then press the **Zoom** menu key.

Inspecting Results

1. Select a specific spur:
   - Press **Meas Setup**, **Inspect Spur** and **Inspect Spur ON**. If any spurs have been measured, the current spur number is highlighted in the results table.
   - Move up and down the list of spurs using the numeric keypad or tab keys.
2. Inspect a specific spur by using:
   - Parameters contained under the **Frequency**, **Span** and **Amplitude** front panel keys.
   - **Sweep Time**, **Res BW** and **Video BW** parameters, contained under **Meas Setup**, **and Inspect Spur**.

Troubleshooting Hints

- If an external attenuator is used, be sure to include the attenuation value in the measurement. This can be done under the **Input, Ext Atten** menu.
- If an external preamplifier is used, be sure to include the gain value in the measurement. This can be done under the Input and Ext Gain menu.

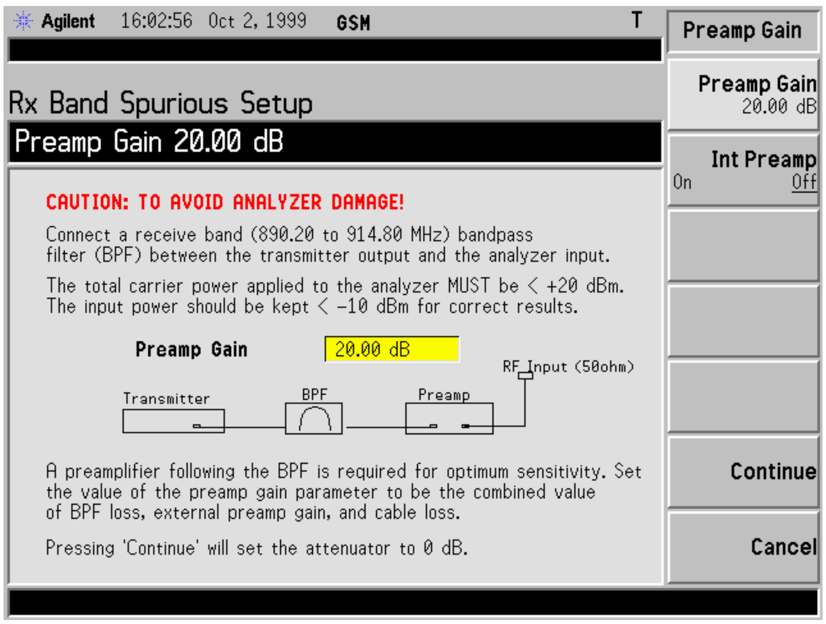
Transmitter Receive Band Spurious Measurement

Making the Measurement

1. Press **Measure**, **More (1 of 3)**.
2. Press the **Rx Band Spur** key.

   The following cautionary information form is displayed:

Figure 2-18 Rx Band Spurious Cautionary Information Form



CAUTION The spectrum analyzer is vulnerable to damage at the input if the above cautionary information is not observed before continuing with the measurement.

a. Connect a receive band bandpass filter (BPF) between the transmitter output and the analyzer input. This is required as the total carrier power applied to the analyzer must be < +20 dBm and to achieve correct results the input power must be kept at < –10 dBm.

b. Connect a preamplifier following the BPF. This can be either external or internal. If an internal preamp is not fitted the Int Preamp option is grayed out. This is required to achieve optimum sensitivity.

c. Enter a preamp gain value.

d. Press **Continue**.

Factory default parameter settings provide a GSM/EDGE compliant measurement. For special requirements, you may need to change default settings:

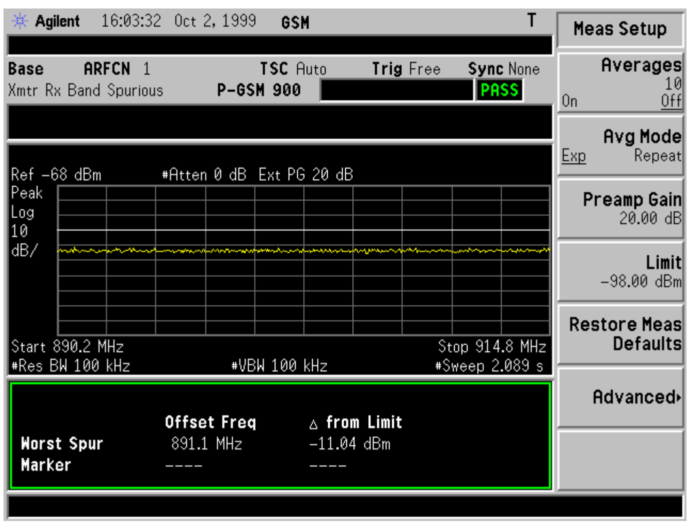
- Mode setup and frequency/channel parameters.
  Use the **Mode Setup** and **Frequency Channel** keys to change these parameters for all measurements made within the current mode. For further information refer to Chapter 1 of this document.
- Measurement setup parameters.
  These are measurement specific parameters changed using the measurement setup (**Meas Setup**) menu. Parameters can be returned to default settings at any time by pressing **Meas Setup**, and **Restore Meas Defaults**. For further information on measurement setup parameters, refer to Chapter 3 , “Key Reference.”

NOTE Parameters that exist under the **Meas Setup Advanced** key seldom need to be changed. Any changes from the default values may result in invalid measurement data.

Results

An example screen from a Transmitter Rx-Band Spurious measurement is shown below:

Figure 2-19 Transmitter Rx Band Spurious Measurement Results



Inspecting Results

Results are displayed according to the categories listed in the following table:

Result category	Units	Min	Max	Description
Worst spur frequency	Hz	N/A	N/A	Displays the frequency of the highest peak from all segments, or from the current segment if in examine mode.
Worst spur amplitude	dB	–200	100	Displays the amplitude of the highest peak from all segments, or from the current segment if in Examine mode.
Marker frequency	Hz	N/A	N/A	Displays the frequency of the active marker. Disabled if no markers are active.
Marker amplitude	dB	–200	100	Displays the amplitude of the active marker. Disabled if no markers are active.

Troubleshooting Hints

- If an external attenuator is used, be sure to include the attenuation value in the measurement. This can be done under the **Input**, **Ext Atten** menu or by using a negative value for **Meas Setup Preamp Gain**.
- If an external preamplifier is used, be sure to include the gain value in the measurement.

Transmitter Transmit Band Spurious Measurement

Making the Measurement

1. Press **Measure**, **More (1 of 3)**.
2. Press the **Tx Band Spur** key.

Inspecting Results

Results are displayed according to the categories listed in the following table:

Result category	Unit	Min	Max	Description
Worst spur frequency	Hz	N/A	N/A	Displays the frequency of the highest peak from all segments, or from the current segment if in examine mode.
Worst spur amplitude	dB	–200	100	Displays the amplitude of the highest peak from all segments, or from the current segment if in Examine mode.
Marker frequency	Hz	N/A	N/A	Displays the frequency of the active marker. Disabled if no markers are active.
Marker amplitude	dB	–200	100	Displays the amplitude of the active marker. Disabled if no markers are active.

Troubleshooting Hints

- If an external attenuator is used, be sure to include the attenuation value in the measurement. This can be done under the **Input**, **Ext Atten** menu.
- If an external preamplifier is used, be sure to include the gain value in the measurement. This can be done under the **Input** key.

Making Cable and Antenna Measurements

This section details how to make cable and antenna measurements. The following measurements are described:

- Cable fault location (performed in GSM or GSM with EDGE mode).
- Return loss (VSWR) (performed in Spectrum Analysis mode).
- Loss/gain (Transmit band LNA gain and flatness/receive band combiner loss and flatness) (performed in Spectrum Analysis mode).

NOTE The return loss (VSWR) and loss/gain measurements are not “one button” measurements. All steps required to run them are fully detailed in this chapter.

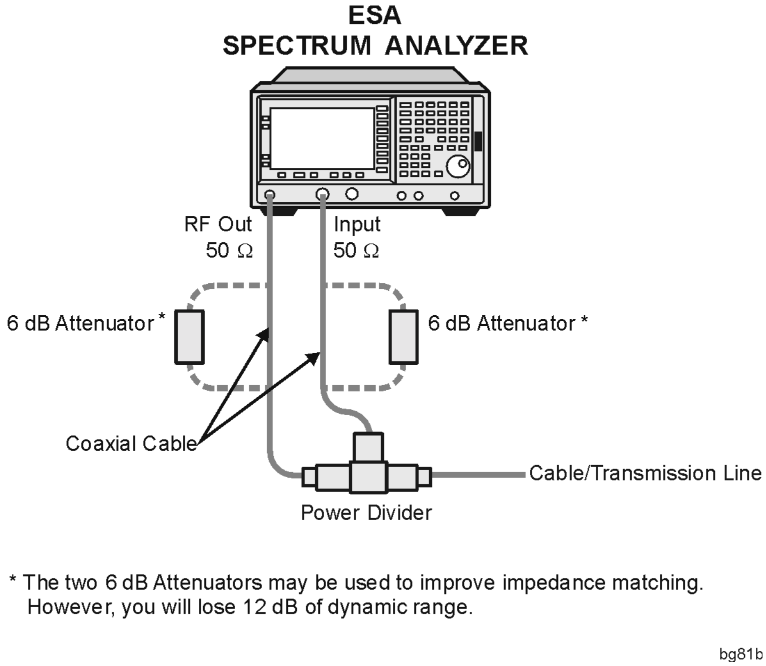
Making Cable Fault Location Measurements

Example

NOTE Cable fault measurements require the use of a power divider.

1. Enter GSM or GSM with EDGE mode and access the measurement.
   a. Press the **Mode** front panel key.
   b. Press the **GSM** (or **GSM (w/EDGE)**)menu key.
   c. Press the **Cable Fault Location** menu key.
   d. Connect up the equipment as prompted by the dialog box and illustrated in Figure 2-20 on page 72.

Figure 2-20 Cable Fault Location Measurement Set-up



2. Configure the spectrum analyzer for the appropriate cable type.

   a. Press the **Cable Type** menu key.

   b. Page through available cable types using the **tab**, **RPG**, or **Step** keys.

   c. Press the **Select** menu key to select the appropriate cable type.

3. Set up a maximum range value just greater than the length of the cable to be tested:

   a. Press the **Max Range** menu key.

   b. Enter the appropriate value using the numeric key pad.

4. Calibrate the spectrum analyzer.

   Calibration removes any errors introduced by the cabling and components of the test setup before making the measurement.

NOTE Press the **Esc** front panel key to cancel this procedure at any stage.

   a. Disconnect the cable to be tested.

   b. Press the **Meas Setup** front panel key.

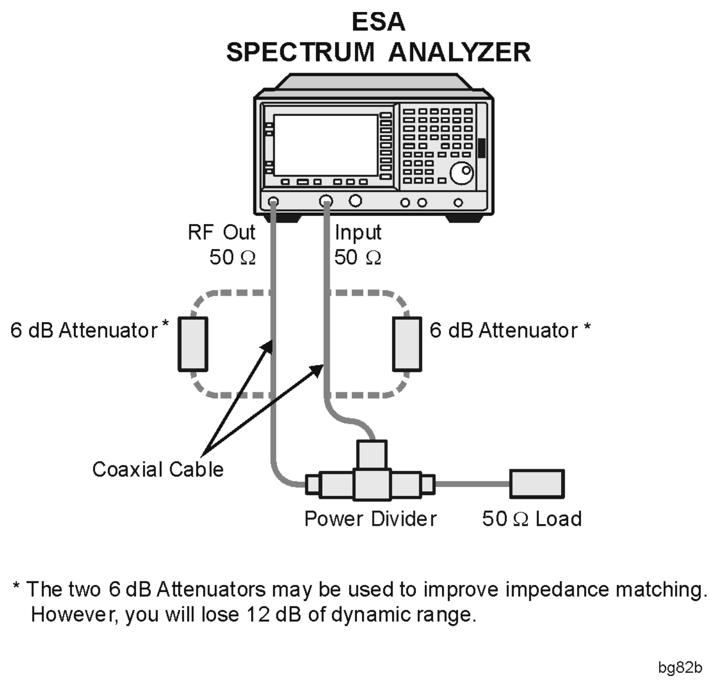
   c. Press the **Calibrate** menu key.
   Connect a 50 ohm termination to the analyzer via the power divider as prompted (see Figure 2-21).

   d. Press the **Calibrate** menu key.

e. Re-connect the cable to be tested in place of the load, as prompted by the dialog box.

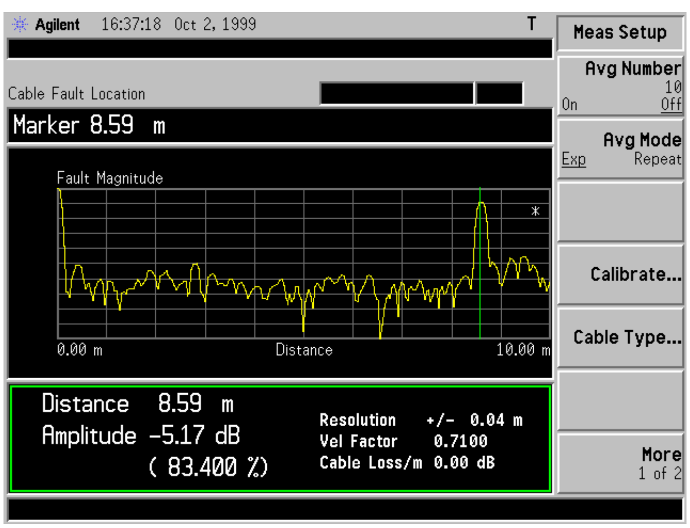
f. Press the **Esc** front panel key to remove the dialog box and end the calibration procedure.

Figure 2-21 Calibrating the spectrum analyzer for cable fault location



5. The result is shown on the screen. Read the measurement and save it if required. Press the **Marker** front panel key to move the marker to the fault(s) of interest. An example is shown in Figure 2-22.

Figure 2-22 Example Cable Fault Location Measurement Screen



Making Return Loss Measurements

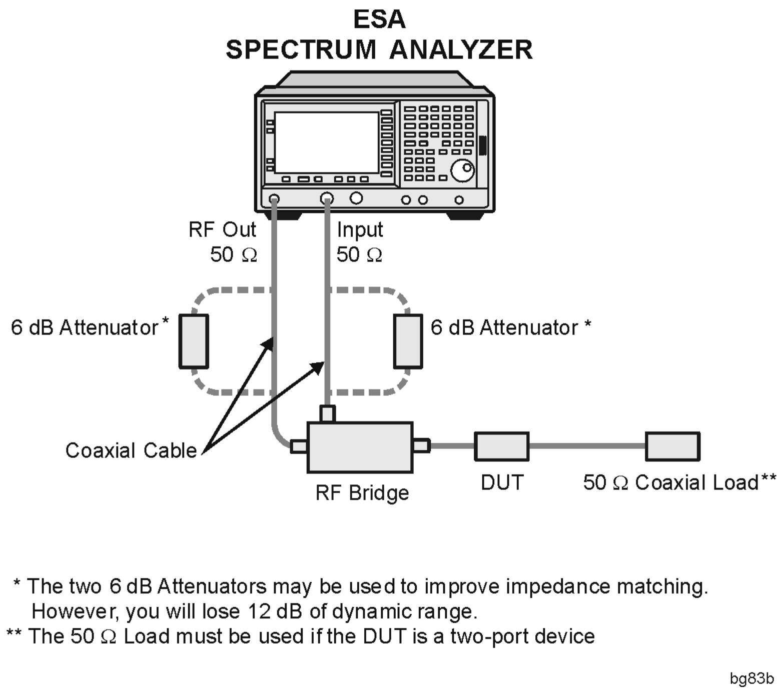
NOTE The return loss (VSWR) measurement is not a “one button” measurement. All steps required to run it is fully detailed in this chapter.

A return loss measurement requires the use of a signal separation device such as a directional coupler or bridge in addition to the device being tested for return loss.

NOTE The spectrum analyzer must be in spectrum analyzer mode for this measurement.

1. Connect the tracking generator, signal separation device, device being measured and the spectrum analyzer input as shown in Figure 2-23.

Figure 2-23 Return Loss Measurement Set-up



2. Turn on the tracking generator.
   a. Press the **Source** front panel key.
   b. Press the **Amplitude** menu key so that the tracking generator is turned on.
   c. Set an amplitude level appropriate for the device under test. The default value = –10 dBm. 0 dBm may be used for systems with higher loss.

3. Adjust the spectrum analyzer control settings (for example frequency, resolution bandwidth, sweep time and input attenuation) as appropriate for the signal separation device and device being tested.

4. Establish a 0 dB reference trace for normalizing the measured data.

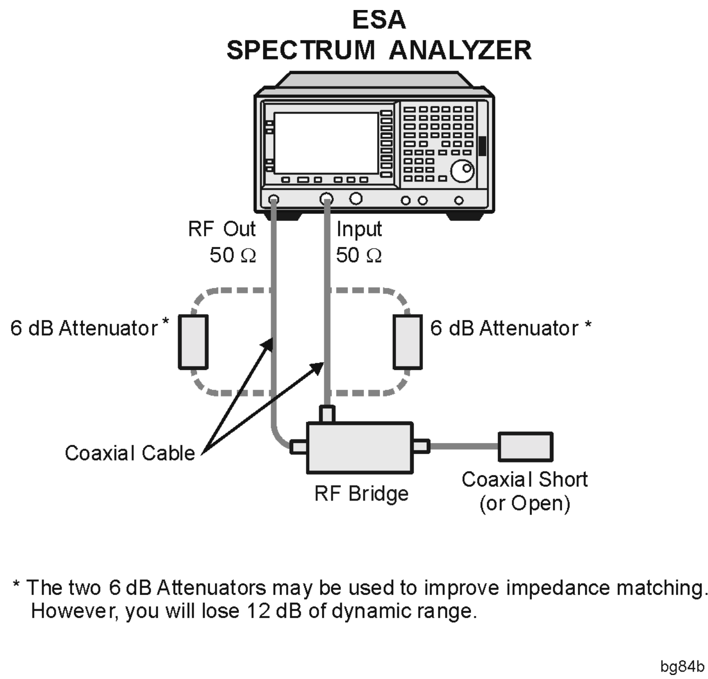
   a. Remove the device to be measured and replace it with a short or open as shown in Figure 2-24.

   b. Press the **View/Trace** front panel key.

   c. Press the **More** menu key.

   d. Press the **Normalize** menu key, **Store Ref (1 - 3)** and normalize **On.**

Figure 2-24 Calibrating the Spectrum Analyzer for Return Loss



5. Make the measurement.

   a. Re-connect the device to be measured to the signal separation device.

   b. Read the measurement and save it if required.

Example

The following example measures the return loss of a bandpass filter (BPF).

1. Adjust the spectrum analyzer control settings.

   With the BPF in the measurement path, adjust the spectrum analyzer control settings for the correct frequency coverage, resolution bandwidth, input attenuation and source power.

NOTE Having adjusted the control settings, do not alter them during the course of the measurement.

To obtain a faster sweep, change the coupling from normal spectrum analyzer mode to stimulus response mode by pressing the **Sweep** front panel key and **Swp Coupling SR SA** menu key until **SR** is underlined.

2. Establish a 0 dB reference trace for normalizing the measured data.

   Normalization removes any frequency-response errors introduced by the components of the test setup before making the measurement. It is performed by removing the device to be tested and measuring a short or open. As neither can dissipate the energy of the incident signal—100% reflection takes place, the wave is reflected back from the short or open—that is, 100% reflection takes place—to the spectrum analyzer where its value is displayed:

   a. Remove the BPF and connect a short in its place as shown in Figure 2-24.

   b. Press the **View/Trace** front panel key.

   c. Press the **More** menu key.

   d. Press the **Normalize** menu key, **Store Ref (1 - 3)** and normalize **On.**

      This procedure establishes a 0 dB reference trace which is stored in the ESA/spectrum analyzer. It is then used to normalize the measured data automatically by subtracting the short circuit calibration from the measurement obtained with the device.

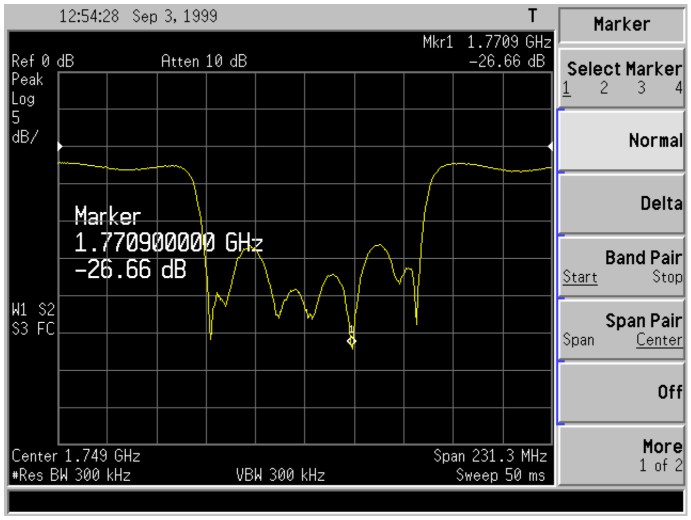
3. Make the measurement.

   a. Re-connect the device in place of the short/open.

   b. Read the measurement and save it if required.
      The return loss of the device is displayed on the screen. Use the marker to evaluate the result and save the trace if required.

      An example is shown in Figure 2-25 on page 77.

Figure 2-25 Example Return Loss Measurement for a Bandpass Filter



Converting Return Loss to VSWR

Return loss can be expressed as a voltage standing wave ratio (VSWR) value using the following formula:

$$VSWR = \frac{1 + 10^{\frac{-RL}{20}}}{1 - 10^{\frac{-RL}{20}}}$$

Where: RL is the measured return loss value.

You can also use Table 2-1 on page 78 to find the VSWR at each listed return loss value.

VSWR is sometimes stated as a ratio. For example: 1.2:1 (“one point two to one”) VSWR. The first number is the VSWR value taken from the table or calculated using the formula. The second number is always 1.

Table 2-1 Power to VSWR Conversion

Return Loss (dB)	VSWR	Return Loss (dB)	VSWR	Return Loss (dB)	VSWR	Return Loss (dB)	VSWR	Return Loss (dB)	VSWR
4.0	4.42	14.0	1.50	18.0	1.29	28.0	1.08	38.0	1.03
6.0	3.01	14.2	1.48	18.5	1.27	28.5	1.08	38.5	1.02
8.0	2.32	14.4	1.47	19.0	1.25	29.0	1.07	39.0	1.02
10.0	1.92	14.6	1.46	19.5	1.24	29.5	1.07	39.5	1.02
10.5	1.85	14.8	1.44	20.0	1.22	30.0	1.07	40.0	1.02
11.0	1.78	15.0	1.43	20.5	1.21	30.5	1.06	40.5	1.02
11.2	1.76	15.2	1.42	21.0	1.20	31.0	1.06	41.0	1.02
11.4	1.74	15.4	1.41	21.5	1.18	31.5	1.05	41.5	1.02
11.6	1.71	15.6	1.40	22.0	1.17	32.0	1.05	42.0	1.02
11.8	1.69	15.8	1.39	22.5	1.16	32.5	1.05	42.5	1.02
12.0	1.67	16.0	1.38	23.0	1.15	33.0	1.05	43.0	1.01
12.2	1.65	16.2	1.37	23.5	1.14	33.5	1.04	43.5	1.01
12.4	1.63	16.4	1.36	24.0	1.13	34.0	1.04	44.0	1.01
12.6	1.61	16.6	1.35	24.5	1.13	34.5	1.04	44.5	1.01
12.8	1.59	16.8	1.34	25.0	1.12	35.0	1.04	45.0	1.01
13.0	1.58	17.0	1.33	25.5	1.11	35.5	1.03	45.5	1.01
13.2	1.56	17.2	1.32	26.0	1.11	36.0	1.03	46.0	1.01
13.4	1.54	17.4	1.31	26.5	1.10	36.5	1.03	46.5	1.01
13.6	1.53	17.6	1.30	27.0	1.09	37.0	1.03	47.0	1.01
13.8	1.51	17.8	1.30	27.5	1.09	37.5	1.03	47.5	1.01

Making Loss/Gain Measurements

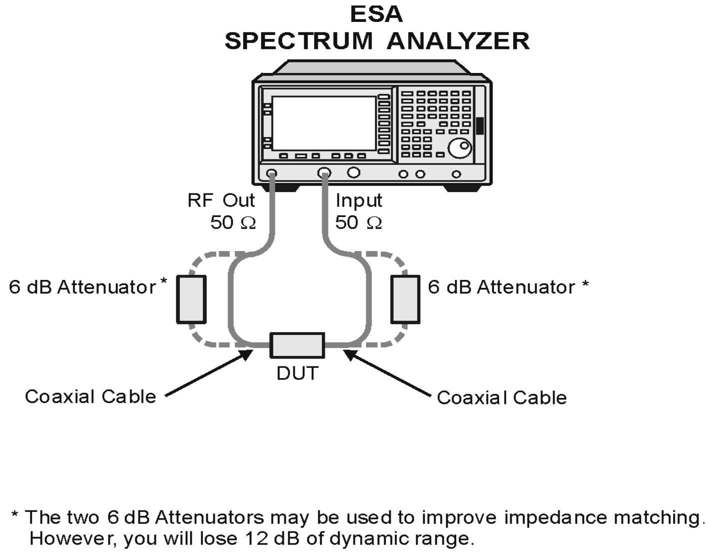
NOTE The loss/gain measurement is not a “one button” measurement. All steps required to run it is fully detailed in this chapter.

NOTE The spectrum analyzer must be in spectrum analyzer mode for this measurement.

1. Connect the tracking generator to the device input and the device

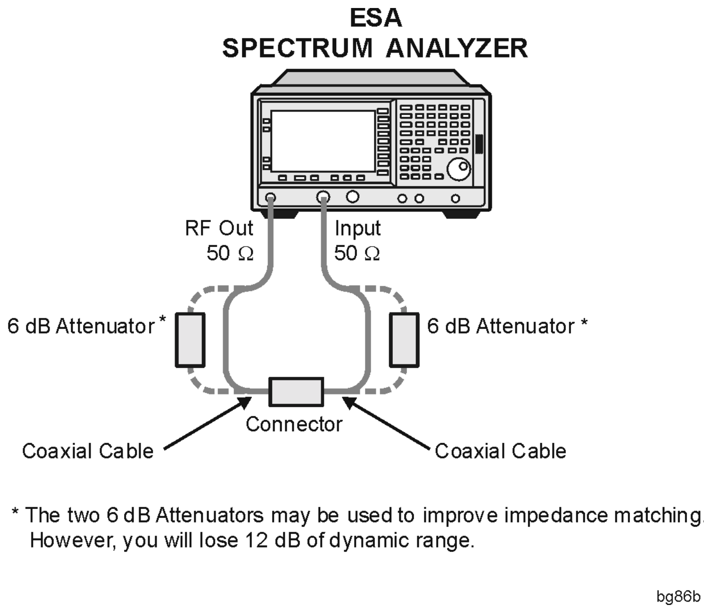
output to the input of the spectrum analyzer as shown in Figure 2-26.

Figure 2-26 Loss/Gain Measurement Set-up



2. Turn on the tracking generator.
   a. Press the **Source** front panel key.
   b. Press the **Amplitude** menu key so that the tracking generator is turned on.
   c. Set an amplitude level appropriate for the device under test.
3. Adjust the spectrum analyzer control settings (for example frequency, resolution bandwidth, sweep time and input attenuation) as appropriate for the device being tested.
4. Establish a 0 dB reference trace for normalizing the measured data.
   a. Remove the device from the measurement path and connect the equipment as shown in Figure 2-27.
   b. Press the **View/Trace** front panel key.
   c. Press the **More** menu key.
   d. Press the **Normalize** menu key, **Store Ref (1 - 3)** and normalize **On**.

Figure 2-27 Calibrating the Analyzer for Loss/Gain Measurement



5. Make the measurement.

   a. Re-connect the device.
      Re-connect the tracking generator RF output to the device input and the device output to the spectrum analyzer input as shown in Figure 2-26 on page 79.

   b. Read the measurement and save it if required.

Example

The following example measures the gain/loss of a bandpass filter (BPF).

1. Adjust the spectrum analyzer control settings.

   With the BPF in the measurement path, adjust the spectrum analyzer control settings for the specific type of measurement to be made. For example:

   - If making a passband-ripple measurement, the spectrum analyzer requires a narrow span and typically < 10 dB per vertical division to get more resolution on the display.
   - If making a stop-band attenuation measurement, the spectrum analyzer requires a wide span and a narrow RBW filter.

NOTE Having adjusted the control settings, do not alter them during the course of the measurement.

To obtain a faster sweep, change the coupling from normal spectrum analyzer mode to stimulus response mode by pressing the **Sweep** front panel key and **Swp Coupling SR SA** menu key until SR is underlined. Note that the limitation on sweep speed is typically determined by the device and care must be taken to allow the device sufficient time to respond to the signal being passed through it. If the auto stimulus-response-mode sweep is too fast, slow it down until no changes in amplitude occur on the trace.

2. Establish a 0 dB reference trace for normalizing the measured data.

   Normalization removes any frequency-response errors introduced by the components of the test setup before making the measurement. It is performed by removing the device and measuring a 'thru' from the source directly to the receiver. This establishes a 0 dB reference trace which is stored in the spectrum analyzer and then used to normalize the measured data:

   a. Remove the BPF and connect the tracking generator output directly to the spectrum analyzer input, as shown in Figure 2-27, using the same test cables to be used when making the measurement. Use a thru adaptor to connect the test cables if necessary.

   b. Press the **View/Trace** front panel key.

   c. Press the **More** menu key.

   d. Press the **Normalize** menu key, **Store Ref (1 - 3)** and normalize **On**.

   This procedure automatically subtracts the measured 'thru' level from an ideal 'thru' (a flat reference line) and stores it. This reference is then used to normalize the measured signal where:

   normalized signal = measured signal – error

   With the device disconnected, the displayed trace is then flat, or normalized.

   The normalized trace can be moved to a different position on the display by pressing the **Norm Ref Posn** menu key. This may be useful if the device to be tested has positive gain, such as an amplifier.

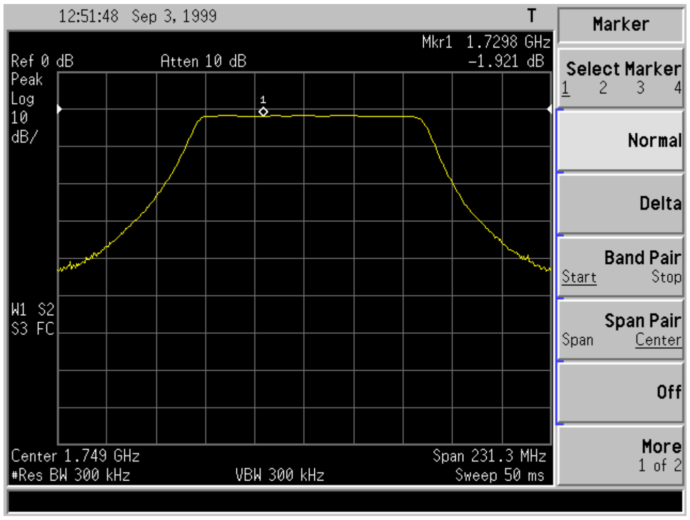
3. Make the measurement.

   a. Re-connect the tracking generator to the BPF input and the BPF output to the spectrum analyzer.

   b. Read the measurement and save it if required.
      Use the marker to evaluate the result and save the trace if required.

      An example is shown in Figure 2-28 on page 82.

Figure 2-28 Example Loss/Gain Measurement for a Bandpass Filter



3 Key Reference

This chapter provides detailed descriptions of the keys used to set up, make, and view GSM (w/EDGE) measurements. The keys are described in the order they appear under each of the front panel menu keys.

Key Descriptions and Locations

This chapter provides information on GSM (w/EDGE) front panel keys which do not exist in Spectrum Analysis mode or keys which have different functionality from SA mode equivalents. For information on SA mode keys not described in this chapter, refer to the *ESA Spectrum Analyzers User's/Programer's Reference*.

Mode and Mode Setup Keys

MODE

The **MODE** front panel key provides access to menu keys for selecting the analyzer measurement mode.

The basic spectrum analyzer comes with only Spectrum Analysis mode installed—measurement personality firmware must be installed for other **MODE** menu keys to be labelled and functional.

Spectrum Analysis Accesses the base-instrument spectrum analyzer mode menu keys.

GSM (w/EDGE) Accesses the GSM with EDGE measurement personality menu keys and associated functions.

NOTE EDGE measurements require Option 252 in addition to Option BAH. If Option 252 is not installed, the EDGE measurements are not available and the measurement keys are grayed out.

Mode Setup

The **Mode Setup** front panel key provides access to front panel keys for setting up parameters that apply to all measurements for the selected mode. This contrasts to the **Meas Setup** hardkey which provides access to parameters which are measurement specific.

Radio... Provides access to a screen enabling the following parameters to be changed:

Band/Standard Sets the band/standard for the measurement: **P-GSM 900**, **E-GSM 900**, **R-GSM 900**, **DCS 1800**, **PCS 1900**, **GSM 450**, **GSM 480** or **GSM 850**. Refer to Table 3-1 on page 93 for center frequency and channel data for each band/standard.

The default is **E-GSM 900**.

Device Sets the device to test: **MS** (mobile station), **BTS** (base station), **uBTS M1-3** (micro base station class M1-M3) or **pBTS P1** (pico base station class P1).

The default is **BTS**.

Freq Hopping Repetition Factor Sets frequency hopping to **On** or **Off**, and sets the value of SFH Repeat, the repetition factor when frequency hopping is **On**. **Freq Hopping Repetition Factor** is not available and set to **Off** when Power Steps, GMSK Phase and Frequency Error, Transmit Band

Spurious, or EDGE EVM measurements are selected. The previous settings are restored upon entering any measurement not listed above.

The defaults are **Off** and 3.

DCS/PCS Overlap Priority The DCS 1800 and PCS 1900 bands have a large number of overlapping channel numbers. Set to **DCS** or **PCS** to determine which band to use in cases of ambiguity.

Example: Preset the analyzer. Set DCS/PCS Overlap Priority set to **DCS**, then set **ARFCN** to 512. The DCS channel frequency is automatically set to 1805.2 MHz. Now preset the analyzer and set **DCS/PCS Overlap Priority** to **PCS**, then set **ARFCN** to 512. the PCS channel frequency is automatically set to 1930.2 MHz.

The default is **DCS**.

R-GSM 900/GSM 850 Overlap Priority The GSM 850 and R-GSM 900 bands have a large number of overlapping channel numbers. Set to **R-GSM 900** or **GSM 850** to determine which band to use in cases of ambiguity.

Example: Set the **R-GSM 900/GSM 850 Overlap Priority** to **GSM 850**, then enter a **Channel Frequency** of 876.2 MHz. The GSM 850 BTS band is automatically set to an **ARFCN** setting of 163.

The default is **R-GSM 900**.

Input... Provides access to a screen enabling the following parameters to be changed:

RF Carriers Set **RF Carriers** to **Single** if there is a single RF carrier present at the RF Input. Select **Multiple** if there is more than one carrier present at the RF Input. This will reject any adjacent channels for the modulation accuracy measurements. This setting is not available with the Cable Fault Location measurement.

The default is **Single**.

RF Input Range Set the **RF Input Range** to **Auto** to allow the instrument to automatically set the attenuator and reference level based on the total power level of single RF carrier input signals. If there are multiple RF carriers present, the total power might overdrive the front end. In this case, select **Manual** and enter the expected **Max Total Power**. Manual is also used if you want to hold the input attenuation constant (for the best relative power accuracy). This setting is not available with the GMSK Phase and Frequency Error, Cable Fault Location, and

EDGE EVM measurements.

The default is **Auto**.

Max Total Power Sets the maximum total power at the UUT (Unit Under Test). This is the maximum expected value of the mean carrier power referenced to the output of the UUT (may include multiple carriers). The **Max Total Power** value is coupled to the **Input Attenuation** setting. This setting is not available with the GMSK Phase and Frequency Error, Cable Fault Location, and EDGE EVM measurements.

The default is –15 dBm.

Input Attenuation Sets the input attenuator value. The input attenuator value is coupled to the **Max Total Power** setting. The **Input Attenuation** key reads out the actual internal input attenuator value that will be used for the current measurement. If more than one input attenuator value is used in a single measurement, the value used at the carrier frequency will be displayed. This setting is not available with the GMSK Phase and Frequency Error measurement.

The default is 5.00 dB.

NOTE As the **Max Total Power** and **Input Attenuation** settings are coupled together, changing the input **Max Total Power** setting can change the **Input Attenuation** setting, and vice-versa for a given measurement. When you switch to a different measurement, the **Max Total Power** is kept constant, but the **Input Attenuation** may change if the two measurements have different mixer margins. Thus, you can directly set the analyzer input attenuation, or you can set it indirectly by specifying the maximum expected power at the UUT (**Max Total Power** setting).

Internal Preamp Set to **On** to activate the internal preamplifier for additional measurement sensitivity. The measurement does not use the internal preamplifier when **Off** is selected. This setting is not available with the GMSK Phase and Frequency Error, Cable Fault Location, and EDGE EVM measurements, or when the Option 1DS: RF Preamp is not installed.

The default is **Off**.

Mobile Gain/Attenuation Use to input the external gain or attenuation settings for any devices between a **Mobile** station UUT and the analyzer. This enables the instrument to display the measurement results referenced to the output of the UUT.

The default is 0.00 dB for both **Gain** and **Attenuation**.

Base Gain/Attenuation Use to enter the external gain or attenuation setting for any devices between a **Base** station UUT and the analyzer. This enables the instrument to display the measurement results referenced to the output of the UUT.

The default is 0.00 dB for both **Gain** and **Attenuation**.

Trigger... Provides access to a screen enabling parameter changes to **External**, **RF Burst**, or **Frame** trigger sources.

Set the **Delay**, **Level**, and **Slope** for each trigger source where applicable. **Delay**, **Level**, and **Slope** are grayed out when not applicable. Note that the trigger source for each measurement may be selected separately (under the **Meas Setup** key).

Delay For trigger delay use positive values. For pre-trigger, use negative values. The **Delay** setting for **RF Burst** is not available when Option B7E: RF Comms Hardware is not installed.

The default is 0.000 s for all trigger sources.

Level or
Peak Level For the **RF Burst** trigger source, the **Level** value is relative to the peak level of the RF signal. For **External** and **Frame** trigger sources, **Level** is always set to TTL. The **RF Burst** setting is not available when Option B7E: RF Comms Hardware is not installed.

The default is –25 dB for **RF Burst** trigger source.
The default is –6 dB for **RF Burst** if the Option B7E: RF Comms Hardware part number is E4401-60087.
(See the following note for more information.)

NOTE Option B7E: RF Comms Hardware has at least three possible part numbers. Press **System**, **More**, **Show Hdwr** to show your instrument's RF Comms Hardware and view the part number. If the part number is E4401-60087 (the original version), the **Peak Level** default will be -6 dB.

Slope Select **Pos** (positive) to trigger on the leading edge, or **Neg** (negative) to trigger on the trailing edge of the signal. **Slope** is only available when the trigger source is set to **External**. The **RF Burst** setting is not available when Option B7E: RF Comms Hardware is not installed.

The default is **Pos** for all trigger sources.

Key Reference

NOTE The trigger **External Level**, **RF Burst Slope**, **Frame Level** and **Frame Slope** settings are not user definable.

Demod... Provides access to a screen enabling the following parameters to be changed:

Burst Alignment Sets the sync alignment to the **GSM** standard, or to **1/2 Bit Offset**.

The default is **GSM**.

RF Sync Delay Sets the delay or offset applied when in RF Burst alignment mode. When **Burst Sync** = **RF Amptd**, the **RF Sync Delay** value provides a common delay or offset of the burst alignment.

The default is 0.000 s.

Burst Search Threshold Sets the relative power threshold from the peak power. This setting is used by the burst alignment algorithm to determine the burst rising and falling edge when **Burst Sync** is set to **RF Amptd** or **Training Sequence**.

The default is –20.00 dB.

IQ Invert Select **On** to reverse the direction of the phase rotation of the internal Q signal, as required by some radio standards.

The default is **Off**.

Opt Freq Ref Sets the reference source for the DDRF assembly. **Int** (internal) sets the reference oscillator in the Option B7E RF Comms Hardware assembly as the reference oscillator source, **Ext** (external) sets the external oscillator as the reference oscillator source. This setting is not available if the Option B7E: RF Comms Hardware assembly is not installed.

The default is **Int**.

Opt Freq Ref Sets the frequency of the external reference oscillator being supplied to the Option B7E RF Comms Hardware assembly Ext Ref In jack. This provides the proper frequency division in the Option B7E RF assembly to achieve the required 10 MHz reference frequency. This setting is not available if the Option B7E: RF Comms Hardware assembly is not installed.

The default is 10.0000000 MHz.

Opt 10MHz Out Turns the Option B7E RF Comms Hardware assembly 10 MHz Ref Out **On** or **Off**. This setting is not available if the Option B7E: RF Comms Hardware assembly is not installed, or if **Opt Freq Ref** is set to **Int**.

The default is **Off**.

Properties... Provides access to a screen displaying the GSM (w/EDGE) Application Version, DSP Bootrom Version, DSP GSM Code Version, and DSP EDGE Code Version.

Restore Mode Setup Defaults Restores all GSM (w/EDGE) mode parameters to factory defaults. Does not change measurement parameters.

AMPLITUDE Y Scale

The **Amplitude Y Scale** front panel hardkey leads to one of the GSM with EDGE measurement display menus depending on which measurement is selected when the key is pressed.

Transmitter Power, Power Steps, Transmitter Band Spurious, Receive Band Spurious, and Monitor Band/Channel

Ref Level Sets the reference level value of the display graticule. Data can be entered in power or voltage units. When voltage units are entered, they are converted to the equivalent level in dBm.

The default is signal level dependent.

Attenuation Setting the **Attenuation** function to **Man** (manual) uncouples the input attenuator from the reference level control, and enables you to set the **Attenuation** value in 5 dB increments. **Auto** restores input attenuator coupling to the reference level control.

The defaults are **Man** and 5.00 dB.

Scale/Div Sets the vertical amplitude scaling (per division) of the display graticule.

The default is 10.00 dB.

GMSK and EDGE Power versus Time

NOTE The Amplitude Y Scale keys for GMSK and EDGE Power vs Time are available only when a graph window has been selected as the active window. Any other active window selection results in a blank Amplitude Y Scale key menu.

Scale/Div Sets the vertical amplitude scaling (per division) of the display graticule.

The default is 10.00 dB for all measurement views except ‘On’ Burst.
The default is 0.50 dB for GMSK ‘On’ Burst view.
The default is 3.00 dB for EDGE ‘On’ Burst view.

Ref Value Sets the reference level value of the display graticule. Data can be entered in power or voltage units. When voltage units are entered, they are converted to the equivalent level in dBm.

The default is signal level dependent.

Ref Position Sets the position of the reference level to either the **Top**, **Ctr** (center), or **Bot** (bottom) of the display graticule.

The default is **Top**.

GMSK Phase and Frequency

Scale/Div Sets the vertical amplitude scaling (per division) of the display graticule.

The default is 10.00 dB.

Ref Value Sets the reference level value of the display graticule. Data can be entered in power or voltage units. When voltage units are entered, they are converted to the equivalent level in dBm.

The default is signal level dependent.

Ref Position Sets the position of the reference level to either the **Top**, **Ctr** (center), or **Bot** (bottom) of the display graticule.

The default is **Top**.

Cable Fault Location

Scale/Div Sets the vertical amplitude scaling (per division) of the display graticule.

The default is 10.00 dB.

Ref Value Sets the reference level value of the display graticule. Data can be entered in power units only.

The default is signal level dependent.

Ref Position Sets the position of the reference level to either the **Top**, **Ctr** (center), or **Bot** (bottom) of the display graticule.

The default is **Top**.

Out of Band Spurious

Ref Level Sets the reference level value of the display graticule. This key is not available if **Inspect Spur** has not been selected.

The default is 0.00 dBm.

Atten Sets the input attenuator value in 5 dB increments. This key is not available if **Inspect Spur** has not been selected.

The default is 0.00 dB.

EDGE EVM I/Q Error (Quad View)

Scale/Div Sets the vertical amplitude scaling (per division) of the Phase Error, Magnitude or EVM display graticule. Scaling is in degrees for Phase Error, and percentage for Magnitude and EVM.

The default is 1.00° for the Phase Error graticule.
The default is 1.00 % for the Magnitude and EVM graticule.

Ref Value Sets the reference level value of the Phase Error, Magnitude or EVM display graticule. The reference value is in degrees for Phase Error, and percentage for Magnitude and EVM.

The default is 0.00° for the Phase Error graticule.
The default is 0.00 % for the Magnitude and EVM graticule.

Ref Position Sets the position of the reference level to either the **Top**, **Ctr** (center), or **Bot** (bottom) of the Phase Error, Magnitude or EVM display graticule.

The default is **Ctr** for the Phase Error and Magnitude graticules.
The default is **Bot** for the EVM graticule.

FREQUENCY Channel

The **FREQUENCY Channel** front panel key provides access to menu keys which control the center frequency or channel number to be used for measurements. These parameters apply to all measurements in the current mode.

ARFCN Sets the Absolute RF Channel Number to be measured for the selected band. **ARFCN** is coupled with **Channel Freq**—setting **ARFCN** updates **Channel Freq** to the value corresponding to that **ARFCN**. Range is limited to valid channels for the selected band.

The default is 38.

Channel Freq Sets the channel frequency to be measured for the selected band. Channel Freq is coupled with **ARFCN**—setting **Channel Freq** updates the **ARFCN** value to the closest channel number corresponding to that frequency. If the **Channel Freq** value entered does not exactly correlate with an **ARFCN**, the softkey label displays a > or < symbol to indicate whether the channel frequency is above or below that **ARFCN**.

The default is 942.600 MHz.

BMT ARFCN Leads to a menu that lets you quickly set the **Bottom**, **Middle**, or **Top** **ARFCN** and corresponding **Channel Freq** from a subset of the available **ARFCN** numbers, as shown in Table 3-1.

Table 3-1

	Bottom		Middle		Top	
Band	**Channel Freq**	**ARFCN**	**Channel Freq**	**ARFCN**	**Channel Freq**	**ARFCN**
P-GSM 900	935.2	1	947.4	63	959.8	124
E-GSM 900	925.2	975	942.6	38	959.8	124
R-GSM 900	921.2	955	940.6	28	959.8	124
DCS 1800	1805.2	512	1842.4	698	1879.8	885
PCS 1900	1930.2	512	1960.0	661	1989.8	810
GSM450	460.4	259	464.0	277	467.6	295
GSM480	488.8	306	492.4	324	496.0	342
GSM850	869.0	128	881.4	190	894.0	253

Note that the above values apply when **Device** is set to BTS. When **Device** is set to MS, **ARFCN** values are the same but **Channel Freq** values are different.

Auto ARFCN Invokes the Auto ARFCN routine which locates the strongest signal and sets the RF Channel Frequency, ARFCN, and Band accordingly.

Timeslot Leads to a menu with the following Reference Time Slot parameters:

Timeslot Sets the specific time slot (0 to 7) for the demodulation measurement, and toggles the time slot function **On** or **Off**. The key is grayed out if Options B7D and B7E are not installed, or if trigger source is not set to external or frame.

The defaults are **Off** and 0.

Ref Burst Sets one of the following types of bursts to be used as the frame reference burst: **Normal** (TCH & CCH), **Sync** (SCH) or **Access** (RACH). The key is not available if Options B7D and B7E are not installed, or if trigger source is not set to frame.

The default is **Normal** (TCH & CCH).

Ref TSC (Std) Sets the Training Sequence Code frame reference to **Auto** or **Man** (manual), and sets the TSC value. **Auto** selects the first burst found to have any one of the valid TSCs in the range of 0-7 to be the frame reference burst. **Man** sets the entered TSC value as the frame reference burst. The key is not available if Options B7D and B7E are not installed, if trigger source is not set to frame, or when **Ref Burst** other than **Normal** (TCH & CCH) is selected.

The defaults are **Auto** and 0.

Burst Type Sets the type of burst to be measured to one of the following options: **Normal** (TCH & CCH), **Sync** (SCH) or **Access** (RACH). The key is not available if Options B7D and B7E are not installed.

The default is **Normal** (TCH & CCH).

TSC (Std) Auto Man Sets the TSC (Training Sequence Code) to **Auto** or **Man** (manual), and sets the TSC value. The key is not available if Options B7D and B7E are not installed, or when a **Ref Burst** other than Normal (TCH & CCH) is selected.

The defaults are **Auto** and 0.

SPAN X Scale

The **SPAN X Scale** front panel key leads to one of the GSM/EDGE measurement display menus depending on which measurement is selected when the key is pressed.

Cable Fault Location

Scale/Div Sets the horizontal distance scaling (per division) of the display graticule.

The default is 2.00 m.

Ref Value Sets the horizontal reference position value.

The default is 0.00 m.

Ref Position Sets the reference position to either the **Left**, **Ctr** (center), or **Right** side of the display graticule.

The default is **Left**.

GMSK Phase and Frequency

Scale/Div Sets the horizontal time scaling (per division) of the display graticule.

The default is 500 µs.

Ref Value Sets the horizontal reference time value.

The default is 0.000 s.

Ref Position Sets the reference time position to either the **Left**, **Ctr** (center), or **Right** side of the display graticule.

The default is **Left**.

GMSK and EDGE Power versus Time

NOTE The Span X Scale keys described for GMSK and EDGE Power vs Time measurements are available only when a graph window has been selected as the active window. Any other active window selection results in a blank Span X Scale key menu.

Scale/Div Sets the horizontal time scaling (per division) of the display graticule.

The default is 66.28 µs for the **Monitor**, **Mask**, and **'On' Burst** view graticules.
The default is 5.000 µs for the **Rise & Fall** view graticules.

Ref Value Sets the horizontal reference time value.

The default is –60.00 µs for the **Monitor**, **Mask**, and **'On' Burst** view graticules.
The default is –30.00 µs for the **Rise & Fall** view rise graticule, and 524.00 µs for the **Rise & Fall** view fall graticule.

Ref Position Sets the reference position to either the **Left**, **Ctr**, (Center) or **Right** side of the display graticule.

The default is **Left**.

Marker

Marker functions are not available with the following measurements:

- GMSK Output RF Spectrum
- GMSK Phase and Frequency
- EDGE Error Vector Magnitude
- EDGE Output RF Spectrum

Basic marker functionality is provided with the Cable Fault Location, GMSK Power vs. Time, and EDGE Power vs. Time measurements.

For the remaining GSM/EDGE measurements, functions accessed by the Marker key are identical to those accessed in Spectrum Analysis mode. For further information refer to the Agilent ESA User's and Programmer's Reference.

Key Reference

Measurement Keys

The GSM and GSM w/EDGE modes include many different measurements and each measurement has a unique set of adjustable functions that are measurement specific.

MEASURE

The MEASURE front panel key provides access to menu keys which enable you to make the following measurements:

- **Transmitter Power**
- **Power Steps**
- **GMSK Power versus Time**
- **GMSK Phase And Frequency Error**
- **GMSK Output RF Spectrum**
- **Cable Fault Location**
- **Transmit (Tx) Band Spurious**
- **Receive (Rx) Band Spurious**
- **Out Of Band Spurious**
- **Monitor Band/Channel**
- **EDGE Power versus Time**
- **EDGE EVM (Error Vector Magnitude)**
- **EDGE Output RF Spectrum**

Meas Setup

The Meas Setup front panel key displays a menu that allows you to enter custom setup parameters for a measurement. The setup menu displayed depends on the measurement selected from the **MEASURE** menu.

Display

The **Display** front panel key leads to one of the GSM/EDGE measurement display menus, depending on which measurement is selected when the key is pressed.

View/Trace

The **View/Trace** front panel key leads to one of the GSM/EDGE measurement view/display menus depending on which measurement is selected when the key is pressed. Used to select between different measurement views where appropriate.

Transmitter Power

Meas Setup (Transmitter Power)

To access the keys for setting up a transmitter power measurement, press **MEASURE**, **Transmit Power**, and then the front panel **Meas Setup** key.

Avg Number Toggles measurement averaging **On** or **Off**, and sets the number of measurement averages used to calculate the measurement result when **On** is selected. After the specified number of averages has been reached, the **Avg Mode** termination control setting determines the averaging action.

The defaults are On and 10.

Avg Mode Sets the termination control method used for the averaging function. The termination control methods are:

Exp Exponential averaging. After the number of averages specified by **Avg Number** has been reached, each successive data acquisition is exponentially weighted and combined with the existing average.

Repeat Repeat averaging. After the number of averages specified by **Avg Number** has been reached, the averaging is reset and a new average is started.

The default is **Exp**.

Average Type Sets the type of averaging to be performed.

Video Sums the trace data and divides by the number of averages specified in **Avg Number**.

Power Converts the trace data from dB to power units, then averages the power trace data. This is more time consuming than **Video** averaging.

The default is **Power**.

Threshold Lvl Sets the threshold level to **Abs** (absolute in dBm), or **Rel** (relative in dB) to the carrier. A green line on the trace area will be displayed at the Y-position associated with the current threshold level value, which is converted to the current amplitude display units.

The defaults are –6 dB and **Rel**.

Trig Source Sets the trigger source for the transmitter power measurement. Choose one of the following trigger sources:

Free Run (Immediate) Trigger occurs at the time the data is requested, completely asynchronous to the RF or IF signal.

External Activates the rear panel external trigger input. The external trigger must be a TTL signal.

RF Burst (Wideband) Activates an internal wideband RF burst trigger that has an automatic level control for burst signals. It triggers on a level that is relative to the peak of the RF burst.

Frame Uses the internal frame clock to generate a trigger signal. The clock parameters are controlled under the **Mode Setup** key or the measurement firmware, but not both. See the specific measurement for details.

The default is **RF Burst (Wideband)** when hardware Options B7D and B7E are installed, otherwise the default is **External**.

NOTE **RF Burst (Wideband)** and **Frame** are available only when hardware Options B7D and B7E are installed.

Burst Sync Sets the synchronization of the measurement to the correct part of the burst. Choose one of the following synchronization methods:

Training Seq (GMSK Only) Synchronizes the measurement to the timing of the demodulated training sequence of the burst. This is the most precise method, but requires a burst with a valid TSC (Training Sequence Code). This key is grayed out and not available if hardware Options B7D and B7E are not installed. This synchronization method supports GMSK transmitter power measurements only.

RF Amptd (GMSK Only) Synchronizes the measurement to the burst transition of the measured RF carrier. This synchronization method supports GMSK transmitter power measurements only.

None Uses the start of the time record as the start of the useful part of the burst. This synchronization method supports both EDGE and GMSK transmitter power measurements.

The default is **None**.

Meas Time Sets the number of slots displayed. Up to 8 time slots can be displayed on the trace with each measurement cycle. This measurement is closely tied to sweep time.

The default is 1 slot.

Restore Meas Defaults Restores all **Meas Setup** parameter values for the current measurement to their factory defaults.

Advanced Provides access to the following advanced measurement parameter settings:

Res BW Sets the 3 dB resolution bandwidth in a 1, 3, 10 sequence.

The default is 300 kHz.

Video BW Sets the analyzer post detection filter in a 1, 3, 10 sequence.

The default is 300 kHz.

Display (Transmitter Power)

Current Data The values for Mean Transmit Power, Max Pt, and Min Pt for the current trace are calculated and displayed on the results screen by default. **Current Data** toggles the calculation and display of these values **On** or **Off**. The measurement executes faster when the parameter is set to off.

The default is **On**.

View Trace (Transmit Power)

RF Envelope Shows measurement results in an RF Envelope data view.

Power Steps

Meas Setup (Power Steps)

To access the keys for setting up a power steps measurement, press **MEASURE**, **Power Steps,** and then the front panel **Meas Setup** key.

Sweep Time Sets the length of the measurement interval.

The default is 2.000 s.

Marker Delta Sets the marker separation distance. The distance between markers is displayed in time as the power steps measurement is performed in zero span. The results are updated as soon as the marker positions are changed.

Marker Center Moves the delta marker’s position on the trace without affecting the separation distance. The position is in time as the power steps measurement is performed in zero span. The results are updated as soon as the marker positions are changed.

Limit Test Sets the active limit checking of numeric phase and frequency error results to **On** or **Off**—this does not turn on or off the limit lines which are accessed through the **Display** front panel key menu.

The default setting is **On**.

Limits.... Leads to a screen with the following settings:

Upper Limit The absolute power step value must be less than or equal to this limit. If it exceeds it, the power step result is displayed in red and appended with a “F”.

The default is 3.5 dB.

Lower Limit The absolute power step value must be greater than or equal to this limit. If it is less, the power step result is displayed in red and appended with a “F”.

The default is 0.5 dB.

Restore Meas Defaults Restores all **Meas Setup** parameter values for the current measurement to their factory defaults.

Advanced Provides access to the following advanced measurement parameter settings:

Res BW Sets the 3 dB resolution bandwidth in a 1, 3, 10 sequence.

The default is 1 MHz.

Video BW Sets the analyzer post detection filter in a 1, 3, 10 sequence.

The default is 300 kHz.

View Trace (Power Steps)

Numeric Results Shows measurement results with a numeric data view.

GMSK Power versus Time

Meas Setup (GMSK Power versus Time)

To access the keys for setting up a GMSK power versus time measurement, press **MEASURE**, **GMSK Pwr vs Time**, and then the front panel **Meas Setup** key.

Avg Number Toggles measurement averaging **On** or **Off**, and sets the number of measurement averages used to calculate the measurement result when **On** is selected. After the specified number of averages has been reached, the **Avg Mode** termination control setting determines the averaging action.

The defaults are **Off** and 10.

Avg Mode Sets the termination control method used for the averaging function. The termination control methods are:

Exp Exponential averaging. After the number of averages specified by **Avg Number** has been reached, each successive data acquisition is exponentially weighted and combined with the existing average.

Repeat Repeat averaging. After the number of averages specified by **Avg Number** has been reached, the averaging is reset and a new average is started.

The default is **Exp**.

Average Type Sets the type of averaging to be performed.

Video Sums the trace data and divides by the number of averages specified in **Avg Number**.

Power Converts the trace data from dB to power units, then averages the power trace data. This is more time consuming than **Video** averaging.

The default is **Power**.

Meas Time Sets the number of slots displayed. Up to 8 time slots can be displayed on the trace with each measurement cycle. This measurement is closely tied to sweep time.

The default is 1 slot.

Trig Source Sets the trigger source for the GMSK power versus time measurement. Choose one of the following trigger sources:

Free Run (Immediate) This key is not available with this measurement.

External Activates the rear panel external trigger input. The external trigger must be a TTL signal.

RF Burst (Wideband) Activates an internal wideband RF burst trigger that has an automatic level control for burst signals. It triggers on a level that is relative to the peak of the RF burst.

Frame Uses the internal frame clock to generate a trigger signal. The clock parameters are controlled under the **Mode Setup** key or the measurement firmware, but not both.

The default is RF Burst (Wideband) when hardware Options B7D and B7E are installed, otherwise the default is **External**.

NOTE **RF Burst (Wideband)** and **Frame** are available only when hardware Options B7D and B7E are installed.

Burst Sync Sets the synchronization of the measurement to the correct part of the burst. Choose one of the following synchronization methods:

Training Seq Synchronizes the measurement to the timing of the demodulated training sequence of the burst. This is the most precise method, but requires a burst with a valid TSC (Training Sequence Code). This key is grayed out and not available if hardware Options B7D and B7E are not installed.

RF Amptd Synchronizes the measurement to the burst transition of the measured RF carrier.

None Uses the start of the time record as the start of the useful part of the burst.

The default is **Training Seq** when hardware Options B7D and B7E are installed, otherwise the default is **RF Amptd**.

Pwr Ctrl Lvl Sets the output power of the transmitter when testing MS devices. The appropriate power level for measuring the device under test will correspond with the transmitter power control level setting. **Pwr Ctrl Lvl** does not affect BTS limit masks.

The default is 0.

Max Hold Toggles trace maximum hold **On** or **Off** while the **Monitor** view is enabled. With any other view, **Max Hold** is grayed out and set to **Off**. The last state is restored if you exit to another view and then return to **Monitor** view.

The default is **Off**.

Limit Test Toggles active limit checking **On** or **Off**—this does not turn on or off the limit lines, which are accessed through the **Display** front panel key menu.

The default is **On**.

Restore Meas Defaults Restores all **Meas Setup** parameter values for the current measurement to their factory defaults.

Advanced Provides access to the following advanced measurement parameter settings:

Res BW Sets the 3 dB resolution bandwidth in a 1, 3, 10 sequence.

The default is 300 kHz.

Video BW Sets the analyzer post detection filter in a 1, 3, 10 sequence.

The default is 300 kHz.

Trace Points Leads to a menu listing the available trace point samples that can be selected for the measurement:

401 samples Provides fastest measurement times, with lowest resolution.

801 samples Provides faster measurement times with less resolution.

1601 samples Optimizes measurement time and accuracy.

3201 samples Recommended setting for the **Rise & Fall** view.

6401 samples Provides highest accuracy with slowest measurement times.

The default is **1601 samples**.

Sweep Time Shows the sweep time used for the current **Meas Time** parameter setting. This information can be used with the **Trace Points** setting to help calculate the burst mask alignment uncertainty. The key is available only for viewing sweep time.

The default is 720 µs.

Display (GMSK Power versus Time)

Limit Display Toggles the limit mask display **On** or **Off**. This does not affect any calculations that are taking place.

The default is **On**.

Current Data The values for Mean Transmit Power, Max Pt, and Min Pt for the current trace are calculated and displayed on the results screen by default. **Current Data** toggles the calculation and display of these values **On** or **Off**. The measurement executes faster when the parameter is set to **Off**.

The default is **On**.

View Trace (GMSK Power versus Time)

Mask Select Mask view to analyze a complete burst and compare it to the set of upper and lower limit lines specified by the 3GPP Standards, or to custom sets of upper and lower limit lines that can be constructed using SCPI commands (see the Programming Commands chapter for more information). **Max Hold** and **Full Screen** are not available with this view.

Monitor Select **Monitor** to view up to 8 time slots (an entire frame). **Limit Display** lines are not available in this view.

Rise & Fall Select **Rise & Fall** to zoom in on the rising and falling portions of the current time slot. **Markers**, **Max Hold**, and **Full Screen** are not available with this view.

'On' Burst Select **'On' Burst** to view the portion of the burst which lies between the rising and falling edges. **Markers**, **Max Hold**, and **Full Screen** are not available with this view.

The default is **Mask**.

GMSK Phase and Frequency Error

Meas Setup (GMSK Phase and Frequency Error)

To access the keys for setting up a GMSK phase and frequency error measurement, press **MEASURE**, **GMSK Phase & Freq**, and then the front panel **Meas Setup** key.

NOTE The GMSK Phase and Frequency Error measurement is not available when hardware Options B7D and B7E are not installed.

Avg Number Toggles measurement averaging **On** or **Off**, and sets the number of measurement averages used to calculate the measurement result when **On** is selected. After the specified number of averages has been reached, the **Avg Mode** termination control setting determines the averaging action.

The defaults are **Off** and 10.

Avg Mode Sets the termination control method used for the averaging function. The termination control methods are:

Exp Exponential averaging. After the number of averages specified by **Avg Number** has been reached, each successive data acquisition is exponentially weighted and combined with the existing average.

Repeat Repeat averaging. After the number of averages specified by **Avg Number** has been reached, the averaging is reset and a new average is started.

The default is **Exp**.

Average Type Sets the type of averaging to be performed.

Mean The mean values are restored (the average of all values is retained).

Maximum The maximum values are restored (the maximum of all values is retained).

The default setting is **Maximum**.

Trig Source Sets the trigger source for phase and frequency measurement. Choose one of the following trigger sources:

Free Run (Immediate) Trigger occurs at the time the data is requested, completely asynchronous to the RF or IF signal.

RF Burst (Wideband) Activates an internal wideband RF burst trigger that has an automatic level control for burst signals. It triggers on a level that is relative to the peak of the RF burst.

External Activates the rear panel external trigger input. The external trigger must be a TTL signal.

Frame Uses the internal frame clock to generate a trigger signal. The clock parameters are controlled under the **Mode Setup** key or the measurement firmware, but not both.

The default is **RF Burst (Wideband)** when hardware Options B7D and B7E are installed, otherwise the default is **External**.

NOTE **RF Burst (Wideband)** and **Frame** are available only when hardware Options B7D and B7E are installed.

Burst Sync Sets the synchronization of the measurement to the correct part of the burst. Choose one of the following synchronization methods:

Training Seq Synchronizes the measurement to the timing of the demodulated training sequence of the burst. This is the most precise method, but requires a burst with a valid TSC (Training Sequence Code). This key is grayed out and not available if hardware Options B7D and B7E are not installed.

RF Amptd Synchronizes the measurement to the burst transition of the measured RF carrier.

None Uses the start of the time record as the start of the useful part of the burst.

The default is **Training Seq** when hardware Options B7D and B7E are installed, otherwise the default is **RF Amptd**.

Limit Test Toggles the active limit checking of numeric phase and frequency error results **On** or **Off**—this does not turn on or off the limit lines, which are accessed through the **Display** front panel key menu.

The default is **On**.

Limits.... Leads to a screen with the following settings:

RMS Phase Limit The RMS phase error must be less than or equal to this limit. If the RMS phase error exceeds it, the measurement display shows the RMS phase error in red and appends a red “F” to the value.

The default is 5.00 °rms.

Peak Phase Limit The peak phase error must be less than or equal to this limit. If the peak phase error exceeds it, the measurement display shows the peak phase error in red and appends a red “F” to the value.

The default is 20.00 °pk.

Frequency Limit The frequency error must be less than or equal to this limit. If the frequency error exceeds it, the measurement display shows the frequency error in red and appends a red “F” to the value.

The default is 0.05 ppm for BTS, and 0.1 ppm for MS and pBTS.

Restore Meas Defaults Restores all **Meas Setup** parameter values for the current measurement to their factory defaults.

Display (GMSK Phase and Frequency)

Bit Dots (Constellation) Toggles the display of the measured values used to calculate the constellation view **On** or **Off**. When set to **On**, the values (coordinates) are superimposed on the constellation.

The default is **On**.

Bit Dots (Graph) Toggles the display of the measured values used to calculate the graphical view **On** or **Off**. When set to **On**, these values (coordinates) are superimposed on the graph.

The default is **Off**.

View Trace (GMSK Phase and Frequency)

I/Q Error (Quad View) Sets the display to I/Q Error Quad view.

I/Q Measured Polar Vector Sets the display to I/Q Measured Polar Vector view.

Numeric Results Shows measurement results with a numeric data view.

GMSK Output RF Spectrum

Meas Setup (GMSK Output RF Spectrum)

To access the keys for setting up a GMSK output RF spectrum measurement, press **MEASURE**, **GMSK Output RF Spectrum** and then the front panel **Meas Setup** key.

Avg Number Toggles measurement averaging **On** or **Off**, and sets the number of measurement averages used to calculate the measurement result when **On** is selected. After the specified number of averages has been reached, the **Avg Mode** termination control setting determines the averaging action.

The defaults are **Off** and 10.

Avg Mode Sets the termination control method used for the averaging function. The **Avg Mode** key is grayed out and set to **Repeat** when the **Multi-Offset** measurement method is selected. The previous **Avg Mode** state is restored upon exiting **Multi-Offset**.
The termination control methods are:

Exp Exponential averaging. After the number of averages specified by **Avg Number** has been reached, each successive data acquisition is exponentially weighted and combined with the existing average.

Repeat Repeat averaging. After the number of averages specified by **Avg Number** has been reached, the averaging is reset and a new average is started.

The default is **Repeat**.

Meas Method Leads to a menu with the following measurement method selections:

Multi-Offset Automatically makes measurements at all offset frequencies listed in the **Standard** or **Short** frequency list. (See Table 3-2, “Offset Frequency Lists.”)

Single Offset (Examine) Makes a measurement at a single offset frequency as set by the **Offset Freq** softkey.

Swept Sets the trigger source to **Free Run**, and disables the **Trigger Source** softkey when selected. The **Trigger Source** state is restored when measurement method is returned to **Single Offset** or **Multi-Offset**.

The default is **Multi-Offset**.

Meas Type Toggles the measurement type between **Mod** (Output RF Spectrum due to modulation), and **Switch** (Output RF Spectrum due to switching transients or burst ramping).

The default is **Mod**.

Key Reference

Ofs Freq List Set to **Std** (standard) or **Short** to define which frequency offsets to scan. See Table 3-2, "Offset Frequency Lists." **Ofs Freq List** is not available when **Meas Method** is set to **Single Offset** or **Swept**.

The default is **Short**.

Table 3-2 Offset Frequency Lists

List	Modulation Offsets (kHz)	Switching Offsets (kHz)
Std (Standard)	100, 200, 250, 400, 600, 800, 1000, 1200, 1400, 1600, 1800, 3000, 6000	400, 600, 1200, 1800
Short	200, 250, 400, 600 1200, 1800	400, 600, 1200, 1800

Offset Freq Sets a frequency offset from the carrier at which to perform a single offset Output RF Spectrum measurement. **Offset Freq** is not available when **Meas Method** is set to **Multi-Offset** or **Swept**.

The default is 250 kHz.

Trig Source Sets the trigger source for the GMSK ORFS measurement. The **Trig Source** key is grayed out and set to **External** when the **Swept** measurement method is selected. The previous **Trigger Source** state is returned when the measurement method is returned to **Single Offset** or **Multi-Offset**. Choose one of the following trigger sources:

Free Run (Immediate) Allows trigger to occur at the time the data is requested, completely asynchronous to the RF or IF signal. This key is not available if **Single Offset** or **Multi-Offset** measurement method is selected.

RF Burst (Wideband) Activates an internal wideband RF burst trigger that has an automatic level control for burst signals. It triggers on a level that is relative to the peak of the RF burst.

External Activates the rear panel external trigger input. The external trigger must be a TTL signal.

Frame Uses the internal frame clock to generate a trigger signal. The clock parameters are controlled under the **Mode Setup** key or the measurement firmware, but not both.

The default is **RF Burst** when hardware Options B7D and B7E are installed, otherwise the default is **External**.

NOTE **RF Burst (Wideband)** and **Frame** are available only when hardware Options B7D and B7E are installed.

Burst Sync Sets the synchronization of the measurement to the correct part of the burst. Choose one of the following synchronization methods:

Training Seq Synchronizes the measurement to the timing of the demodulated training sequence of the burst. This is the most precise method, but requires a burst with a valid TSC (Training Sequence Code). This key is not available if hardware Options B7D and B7E are not installed.

RF Amptd Synchronizes the measurement to the burst transition of the measured RF carrier.

None Uses the start of the time record as the start of the useful part of the burst.

The default is **Training Seq** when hardware Options B7D and B7E are installed, otherwise the default is **RF Amptd**.

Widebnd Noise Sets the frequency range that is swept on either side of the carrier center frequency. Available only when **Meas Type** is set to **Mod** and measurement method is **Swept**.

On The analyzer tunes to the carrier, and the whole relevant band plus 2 MHz either side of center frequency is swept.

Off The analyzer tunes to the carrier, and 1800 kHz below and above either side of the center frequency is swept.

The default is **Off**.

Restore Meas Defaults Restores all **Meas Setup** parameter values for the current measurement to their factory defaults.

Advanced Provides access to the following advanced measurement parameter settings:

Ref Pwr Avg Sets the number of averages to be taken when determining the reference power (at 0 Hz offset). Available only when **Meas Method** is set to **Single Offset**.

Auto Uses the number of averages equal to that specified in the **Avg Number** parameter.

Manual Lets you manually specify the number of averages.

The defaults are **Auto** and 10.

Max Mxr Lvl Sets the maximum power at the RF mixer input. The instrument will automatically set the optimum attenuation value based on the value entered.

The default is –4.00 dBm.

Mod BWs Leads to a menu with custom RBW settings that deviate from the GSM standard for ORFS due to modulation:

<**1800 kHz Offset RBW** Sets the RBW for measuring offsets of less than 1800 kHz.

The default is 30 kHz.

≥**1800 kHz Offset RBW** Sets the RBW for measuring offsets greater than or equal to 1800 kHz.

The default is 100 kHz.

Switch BWs Leads to a menu with custom RBW settings that deviate from the GSM standard for ORFS due to switching:

<**1800 kHz Offset RBW** Sets the RBW for measuring offsets of less than 1800 kHz.

The default is 30 kHz.

≥**1800 kHz Offset RBW** Sets the RBW for measuring offsets greater than or equal to 1800 kHz.

The default is 30 kHz.

Display (GMSK Output RF Spectrum)

Table Display When the measurement method is set to Multi-Offset, the results table can be changed to show any of the following sets of values:

Rslt Displays the actual measurement results.

Lim Displays the absolute and relative limits for all offsets.

Mrgn Displays the margin by which the result meets specifications. Negative numbers indicate that the result has failed.

The default is **Rslt**.

View Trace (GMSK Output RF Spectrum)

Numeric Results Shows measurement results with a numeric data view. **Numeric Results** are not available unless **Meas Method** = **Multi-Offset**.

Key Reference

Cable Fault Location

Meas Setup (Cable Fault Location)

To access the keys for setting up a cable fault location measurement, press **MEASURE**, **Cable Fault Location**, and then the front panel **Meas Setup** key.

NOTE Upon entering the Cable Fault Location measurement, a screen appears prompting you to connect a power divider between the cable under test, the analyzer RF input, and the tracking generator output. Press **ESC** or **Meas Setup** to exit the screen.

Avg Number Toggles measurement averaging **On** or **Off**, and sets the number of measurement averages used to calculate the measurement result when **On** is selected. After the specified number of averages has been reached, the **Avg Mode** termination control setting determines the averaging action.

The defaults are Off and 10.

Avg Mode Sets the termination control method used for the averaging function. The termination control methods are:

Exp Exponential averaging. After the number of averages specified by **Avg Number** has been reached, each successive data acquisition is exponentially weighted and combined with the existing average.

Repeat Repeat averaging. After the number of averages specified by **Avg Number** has been reached, the averaging is reset and a new average is started.

The default is **Exp**.

Calibrate Leads to the calibration setup screen. Follow the screen instructions to calibrate the measurement. Calibrate removes any errors introduced by the cabling and components of the test setup.

Continue Press once after the test setup has been connected to calibrate the spectrum analyzer.

Cancel Aborts the calibration screen and menu.

Cable Type Leads to the Cable Editor form and menu. Set the type and parameters of the cable being tested:

Cable Select an entry in the cable type table. Accepts numeric values.

Vel Factor Set the velocity factor for the cable type selected. The field's numeric value represents a proportion of the speed of light. The value can be edited and saved using the **Store Table** key.

Cable Loss/m Set the amount of signal lost per meter for the cable type selected, expressed in dB. The value can be edited and saved using the **Store Table** key.

Store Table Saves any changes made to the **Cable**, **Vel Factor** or **Cable Loss/m** parameters.

Start Distance Sets the starting point (in meters) for the cable fault measurements.

The default is 0.00 m.

Stop Distance Sets the finishing point (in meters) for the cable fault measurements.

The default is 20.0 m.

NOTE The **Stop Distance** should normally be set to slightly more than the full length of the cable being tested.

Trace Points Sets the number of trace points used in the measurement. The analyzer determines the optimum setting in **Auto**. Use **Man** to set the number of trace points manually. Changing the number of trace points affects the minimum and maximum measurable distances. As a general rule, the longer the cable, the more trace points you should use. It is possible to select up to 8192 trace points but due to the computational intensive FFT, the higher the value, the slower the measurement becomes. To ensure the fastest possible speed, use a value that is a power of 2—for example 512, 1024 and so on.

The defaults are **Auto** and 512.

Window Leads to a menu of FFT windowing functions. The cable fault measurement uses an FFT to convert the analyzer frequency trace into a distance trace. To get the best possible results from the FFT, it is important to apply the most suitable windowing function to the frequency trace before performing the FFT. Select from **Rectangular**, **Flat Top**, **Gaussian**, or **Hanning**. The following table describes these values.

Function	Description	Max Side-Lobe Level	Side-Lobe Roll Off	Max Main
Rectangular	Results in no windowing.	–13.261 dB	20 dB/decade	–3.9224 dB
Flat Top (default)	The five term flat-top window.	–95.1 dB		±0.002077456085 dB
Gaussian	A five term cosine window that resembles a Gaussian window.	–125.4 dB		–0.680056 dB

Function	Description	Max Side-Lobe Level	Side-Lobe Roll Off	Max Main
Hanning	Has a good frequency resolution and reasonably good side-lobe roll-off, but poor main-lobe flatness and relatively large side-lobe peaks.	–31.46730784 dB	60 dB/decade	–1.423622 dB

The default is **Flat Top**.

Restore Meas Defaults Restores all **Meas Setup** parameter values for the current measurement to their factory defaults.

Advanced Provides access to the following advanced measurement parameter settings:

Res BW Sets the resolution bandwidth for the measurement and defines whether it is Auto or **Man** (**manual**).

The defaults are **Auto** and 3 MHz.

Video BW Sets the video bandwidth for the measurement and defines whether it is Auto or **Man** (**manual**).

The defaults are **Auto** and 3 MHz.

TG Amplitude Sets the power level of the internal source.

The default is –10.00 dBm.

View Trace (Cable Fault Location)

FFT Shows FFT data view.

Transmit Band Spurious

Meas Setup (Transmit Band Spurious)

To access the keys for setting up a transmit band spurious measurement, press **MEASURE**, **Tx Band Spurs**, and then the front panel **Meas Setup** key.

Avg Number Toggles measurement averaging **On** or **Off**, and sets the number of measurement averages used to calculate the measurement result when **On** is selected. After the specified number of averages has been reached, the **Avg Mode** termination control setting determines the averaging action.

The defaults are **Off** and 10.

Avg Mode This key is always grayed out for this measurement and cannot be accessed. It shows that the averaging action taken after reaching the number of averages set with **Avg Number** is always **Repeat** (the averaging is reset and a new average is started).

Meas Type Sets one of the measurement types described below:

Examine A full measurement is performed on all segments to find the segment with the worst spur. The measurement then selects and continuously updates that segment. While set to **Examine**, any of the other segments can be selected using the **View/Trace** menu.

Full In continuous measure, the measurement repeatedly does a full search of all segments.

The default is **Full**.

MS Idle Sets the correct specification limits, depending on whether there is an active mobile station carrier or not. **MS Idle** is coupled to the **Limit** parameter. This setting is not available unless **Device Type** is set to MS in the **Radio Mode** setup menu.

On Use this setting when no active mobile station carrier is present to force the measurement to use the correct limits.

Off Limits are set to the correct values when an active mobile station carrier is present.

The default is **Off**.

Limit Sets the upper limit value for testing spurs. The default setting is based on the 3GPP Standard Specifications. It changes depending on the **MS Idle** mode, **Band/Standard**, and **Device** settings.

The default is –36 dBm with measurement set to factory defaults.

Restore Meas Defaults Restores all **Meas Setup** parameter values for the current measurement to their factory defaults.

View Trace (Transmit Band Spurious)

The measurement splits the transmit band into four segments (or less if the currently selected ARFCN is at the edge of the band). Two of these segments are on each side of the 3GPP Standard Specification transmit band. View/Trace allows you to view each segment in sequence after the measurement completes (**Meas Type Full**), to automatically identify the worst performing segment (**Meas Type Examine**) or to manually select which segment to view (**Meas Type Examine**).

Lower Segment With **Meas Type Examine**, you can choose to examine the lower segment only.

Lower Adj Segment With **Meas Type Examine**, you can choose to examine the lower adjacent segment only.

Upper Adj Segment With **Meas Type Examine**, you can choose to examine the upper adjacent segment only.

Upper Segment With **Meas Type Examine**, you can choose to examine the upper segment only.

Receive Band Spurious

Meas Setup (Receive Band Spurious)

To access the keys for setting up a receive band spurious measurement, press **MEASURE**, **Rx Band Spur**, then follow the instructions on the **Rx Band Spurious Setup** screen before continuing to the front panel **Meas Setup** key.

CAUTION Upon entering the Receive Band Spurious measurement, a setup screen appears cautioning you to avoid analyzer damage. The total carrier power applied to the analyzer MUST be < +20 dBm. Follow the instructions on the setup screen to avoid damaging the analyzer.

Avg Number Toggles measurement averaging **On** or **Off**, and sets the number of measurement averages used to calculate the measurement result when **On** is selected. After the specified number of averages has been reached, the **Avg Mode** termination control setting determines the averaging action.

The defaults are Off and 10.

Avg Mode Sets the termination control method used for the averaging function. The termination control methods are:

Exp Exponential averaging. After the number of averages specified by **Avg Number** has been reached, each successive data acquisition is exponentially weighted and combined with the existing average.

Repeat Repeat averaging. After the number of averages specified by **Avg Number** has been reached, the averaging is reset and a new average is started.

The default is **Exp**.

Limit Sets the upper limit value for testing spurs. By default the parameter is based on the 3GPP Standard Specification. It changes depending on the **Band/Standard** and **Device** settings.

The default is –98 dBm with measurement set to factory defaults.

Restore Meas Defaults Restores all **Meas Setup** parameter values for the current measurement to their factory defaults.

Advanced Provides access to the following advanced measurement parameter settings:

Res BW Sets the 3 dB resolution bandwidth in a 1, 3, 10 sequence.

The default is 100 kHz.

Video BW Sets the analyzer post detection filter in a 1, 3, 10 sequence.

The default is 100 kHz.

View Trace (Receive Band Spurious)

Spectrum Displays a spectrum trace view.

Out of Band Spurious

Meas Setup (Out Of Band Spurious)

To access the keys for setting up an out of band spurious measurement, press **MEASURE**, **Out Of Band Spurious**, and then the front panel **Meas Setup** key.

Avg Number Toggles measurement averaging **On** or **Off**, and sets the number of measurement averages used to calculate the measurement result when **On** is selected. After the specified number of averages has been reached, the **Avg Mode** termination control setting determines the averaging action.

The defaults are Off and 10.

Avg Mode This key is always grayed out for this measurement and cannot be accessed. It shows that the averaging action taken after reaching the number of averages set with **Avg Number** is always **Exp** (exponential averaging—each successive data acquisition is exponentially weighted and combined with the existing average).

Meas Type Sets the measurement to **Full Range** (the full frequency range of the base station), or to **Intermod Bands** (only the relevant intermodulation frequency bands of the base station). The measurement uses the corresponding filter bandwidths and the sweep times appropriate to the BTS specifications.

The default is **Full Range**.

MS Idle Sets the correct specification limits, depending on whether there is an active mobile station carrier or not. **MS Idle** is coupled to the **Limit** setting. This key is only available when **Device Type** is set to **MS** in the **Radio Mode** setup menu.

On — Use this setting when no active mobile station carrier is present to force the measurement to use the correct limits.

Off — Limits are set to the correct values when an active mobile station carrier is present.

The default is **Off**.

Inspect Spur — Leads to the inspect spur menu once the measurement has finished running (all menu keys are grayed out while a measurement is running):

Inspect Spur — Sets **On** or **Off** the inspect spur functionality once the measurement has finished running. Also sets the inspect spur number for further examination.

The defaults are **Off** and 0.

Sweep Time — Sets the sweep time used to inspect the spur.

The default is 2.000 s.

Res BW — Sets the resolution bandwidth used to inspect the spur.

The default is 1 MHz.

Video BW — Sets the video bandwidth used to inspect the spur.

The default is 3 MHz.

Limits.... — Leads to the limits form for changing limits values for the currently selected radio band and device. The measurement is restarted if any limits value is changed.

Restore Meas Defaults — Restores all **Meas Setup** parameter values for the current measurement to their factory defaults.

Advanced — Provides access to the following advanced measurement parameter setting:

Max Mxr Lvl — Sets the maximum power level at the RF mixer input for the measurement. The instrument uses this value to automatically set the required attenuation to maintain the mixer input below the critical level.

The default is 5 dBm.

View Trace (Out Of Band Spurious)

Spectrum — Displays a spectrum trace view.

Monitor Band/Channel

Meas Setup (Monitor Band/Channel)

To access the keys for setting up a monitor band/channel measurement, press **MEASURE**, **Monitor Band/Channel**, and then the front panel **Meas Setup** key.

Avg Number

Toggles measurement averaging **On** or **Off**, and sets the number of measurement averages used to calculate the measurement result when **On** is selected. After the specified number of averages has been reached, the **Avg Mode** termination control setting determines the averaging action.

The defaults are Off and 10.

Avg Mode

Sets the termination control method used for the averaging function. The termination control methods are:

Exp Exponential averaging. After the number of averages specified by **Avg Number** has been reached, each successive data acquisition is exponentially weighted and combined with the existing average.

Repeat Repeat averaging. After the number of averages specified by **Avg Number** has been reached, the averaging is reset and a new average is started.

The default is **Exp**.

Method

Sets the monitoring method to **Band** or **Channel**.

The default is **Band**.

Channel Span

Toggles between monitoring **One** (the current ARFCN by itself) or **Three** (the ARFCN and its two adjacent channels). **Channel Span** is not available when **Method** is set to **Band**.

The default is **One**.

Band

Toggles between monitoring **Tx** (**transmit**) or **Rx** (receive). **Band** is not available when **Method** is set to **Channel**.

The default is **Tx**.

Chan Setup

Leads to the channel setup menu. **Chan Setup** is available only when **Method** is set to **Channel**. The channel setup parameters are:

Res BW Sets the 3 dB resolution bandwidth in a 1, 3, 10 sequence.

The default is 10 kHz.

Video BW Sets the analyzer post detection filter in a 1, 3, 10 sequence.

The default is 10 kHz.

Max Hold Toggles **On** or **Off** a trace of the maximum values for a measurement.

The default is **Off**.

Detector Sets the type of video detection used. Select from **Peak**, **Sample** and **Neg Peak** detection. **Detector** is not available when **Method** is set to **Band**.

The default is **Peak**.

Band Setup Leads to the band setup menu. **Band Setup** is available only when **Method** is set to **Band**. The band setup parameters are:

Res BW Sets the 3 dB resolution bandwidth in a 1, 3, 10 sequence.

The default is 100 kHz.

Video BW Sets the analyzer post detection filter in a 1, 3, 10 sequence.

The default is 100 kHz.

Max Hold Toggles **On** or **Off** a trace of the maximum values for a measurement.

The default is **Off**.

Detector Sets the type of video detection used. Select from **Peak**, **Sample** and **Neg Peak** detection. **Detector** is not available when **Method** is set to **Band**.

The default is **Peak**.

Restore Meas Defaults Restores all **Meas Setup** parameter values for the current measurement to their factory defaults.

Display (Monitor Band/Channel)

Display Line Toggles **On** or **Off** an adjustable horizontal line that can be used as a visual reference line.

The default is **Off**.

View Trace (Monitor Band/Channel)

Spectrum Displays a spectrum trace view.

EDGE Power Versus Time

Meas Setup (EDGE Power Versus Time)

To access the keys for setting up an EDGE power versus time measurement, press **MEASURE**, **EDGE Pwr vs Time**, and then the front panel **Meas Setup** key.

Avg Number Toggles measurement averaging **On** or **Off**, and sets the number of measurement averages used to calculate the measurement result when **On** is selected. After the specified number of averages has been reached, the **Avg Mode** termination control setting determines the averaging action.

The defaults are **Off** and 10.

Avg Mode Sets the termination control method used for the averaging function. The termination control methods are:

Exp Exponential averaging. After the number of averages specified by **Avg Number** has been reached, each successive data acquisition is exponentially weighted and combined with the existing average.

Repeat Repeat averaging. After the number of averages specified by **Avg Number** has been reached, the averaging is reset and a new average is started.

The default is **Exp**.

Average Type Sets the type of averaging to be performed.

Video Sums the trace data and divides by the number of averages specified in **Avg Number**.

Power Converts the trace data from dB to power units, then averages the power trace data. This is more time consuming than **Video** averaging.

The default is **Power**.

Meas Time Sets the number of slots displayed. Up to 8 time slots can be displayed on the trace with each measurement cycle. This measurement is closely tied to sweep time.

The default is 1 slot.

Trig Source Sets the trigger source for the EDGE power versus time measurement. Choose one of the following trigger sources:

Free Run (Immediate) This key is not available with this measurement.

External Activates the rear panel external trigger input. The external trigger must be a TTL signal.

RF Burst (Wideband) Activates an internal wideband RF burst trigger that has an automatic level control for burst signals. It triggers on a level that is relative to the peak of the RF burst. This setting is available only when hardware Option B7D and newer versions of Option B7E: RF Comms Hardware are installed. See the following note for details.

Frame Uses the internal frame clock to generate a trigger signal. The clock parameters are controlled under the **Mode Setup** key or the measurement firmware, but not both. This setting is available only when hardware Options B7D and B7E are installed.

The default is RF Burst (Wideband) when hardware Option B7D and newer versions of Option B7E: RF Comms Hardware are installed, otherwise the default is **External**. See the following note for details.

NOTE Option B7E: RF Comms Hardware has at least three possible part numbers. Press **System**, **More**, **Show Hdwr** to show your instrument's RF Comms Hardware and view the part number. If the part number is E4401-60087 (the original version), the **RF Burst** trigger source will not be available with this measurement, and the default will be **External**.

Burst Sync Sets the synchronization of the measurement to the correct part of the burst. Choose one of the following synchronization methods:

Training Seq Synchronizes the measurement to the timing of the demodulated training sequence of the burst. This is the most precise method, but requires a burst with a valid TSC (Training Sequence Code). This key is grayed out and not available if hardware Options B7D and B7E are not installed.

RF Amptd Synchronizes the measurement to the burst transition of the measured RF carrier.

None Uses the start of the time record as the start of the useful part of the burst.

The default is **Training Seq** when hardware Options B7D and B7E are installed, otherwise the default is **RF Amptd**.

Pwr Ctrl Lvl Sets the output power of the transmitter when testing MS devices. The appropriate power level for measuring the device under test will correspond with the transmitter power control level setting. **Pwr Ctrl Lvl** does not affect BTS limit masks.

The default is 0.

Max Hold Toggles trace maximum hold **On** or **Off** while the **Monitor** view is enabled. With any other view, **Max Hold** is not available and set to **Off**.

The last state is restored if you exit to another view and then return to **Monitor** view.

The default is **Off**.

Limit Test Toggles active limit checking **On** or **Off**—this does not turn on or off the limit lines which are accessed through the **Display** front panel key menu.

The default is **On**.

Restore Meas Defaults Restores all **Meas Setup** parameter values for the current measurement to their factory defaults.

Advanced Provides access to the following advanced measurement parameter settings:

Res BW Sets the 3 dB resolution bandwidth settings in a 1, 3, 10 sequence.

The default is 300 kHz.

NOTE To achieve an adequately low noise floor for the EDGE measurement, the ESA uses the 300 kHz RBW filter as default. Since this RBW is narrower than an EDGE signal, the carrier power will be under measured by 0.29 dB, and as such the reference point for positioning the mask in the Y axis will be offset by the same amount. Therefore, to ensure optimum positioning of the mask when a 300 kHz RBW is selected, the measurement will automatically correct the mask position by 0.29 dB. Note that this correction can be reversed by setting the mask offset to -0.29 dB.

Video BW Sets the analyzer post detection filter in a 1, 3, 10 sequence.

The default is 300 kHz.

Mask Ref Pwr Sets the calculation of the mask reference power to either the **TSC Symbols** method or the **Demodulation** method.

The default is **TSC Symbols**.

Mask Offset Sets the amplitude offset of the limit mask to apply when calculating the relative portions of power versus time.

The default is 0.00 dB.

Trace Points Leads to a menu listing the available trace point samples that can be selected for the measurement:

401 samples Provides fastest measurement times, with lowest resolution.

801 samples Provides faster measurement times with less resolution.

1601 samples Optimizes measurement time and accuracy.

3201 samples Recommended setting for the **Rise & Fall** view.

6401 samples Provides highest accuracy with slowest measurement times.

The default is **1601 samples**.

Sweep Time Shows the sweep time used for the current **Meas Time** parameter setting. This information can be used with the **Trace Points** setting to help calculate the burst mask alignment uncertainty. The key is available only for viewing sweep time.

The default is 720 µs.

Display (EDGE Power versus Time)

Limit Display Toggles the limit mask display **On** or **Off**. This does not affect any calculations that are taking place.

The default is **On**.

Current Data The values for Mean Transmit Power, Max Pt, and Min Pt for the current trace are calculated and displayed on the results screen by default. **Current Data** to toggles the calculation and display of these values **On** or **Off**. The measurement executes faster when the parameter is set to Off.

The default is **On**.

View Trace (EDGE Power versus Time)

Mask Select **Mask** view to analyze a complete burst and compare it to the set of upper and lower limit lines specified by the 3GPP Standards, or to custom sets of upper and lower limit lines that can be constructed using SCPI commands (see the Programming Commands chapter for more information). **Max Hold** and **Full Screen** are not available with this view.

Monitor Select **Monitor** to view up to 8 time slots (an entire frame). **Limit Display** lines are not available in this view.

Rise & Fall Select **Rise & Fall** view to zoom in on the rising and falling portions of the current time slot. **Markers**, **Max Hold**, and **Full Screen** are not available with this view.

'On' Burst Select **'On' Burst** to view the portion of the burst which lies between the

Key Reference

rising and falling edges. **Markers**, **Max Hold**, and **Full Screen** are not available with this view.

The default is **Mask**.

EDGE EVM

Meas Setup (EDGE EVM)

To access the keys for setting up an EDGE EVM measurement, press **MEASURE**, **EDGE EVM**, and then the front panel **Meas Setup** key.

Avg Number Toggles measurement averaging **On** or **Off**, and sets the number of measurement averages used to calculate the measurement result when **On** is selected. After the specified number of averages has been reached, the **Avg Mode** termination control setting determines the averaging action.

The defaults are **Off** and 10.

Avg Mode Sets the termination control method used for the averaging function. The termination control methods are:

Exp Exponential averaging. After the number of averages specified by **Avg Number** has been reached, each successive data acquisition is exponentially weighted and combined with the existing average.

Repeat Repeat averaging. After the number of averages specified by **Avg Number** has been reached, the averaging is reset and a new average is started.

The default is **Repeat**.

Trig Source Sets the trigger source for the EDGE EVM measurement. Choose one of the following trigger sources:

Free Run (Immediate) Trigger occurs at the time the data is requested, completely asynchronous to the RF or IF signal.

RF Burst (Wideband) Activates an internal wideband RF burst trigger that has an automatic level control for burst signals. It triggers on a level that is relative to the peak of the RF burst. If the data sent is all 0 bits, this trigger will give erratic or falsely high EVM results. This setting is available only when hardware Option B7D and newer versions of Option B7E: RF Comms Hardware are installed. See the following note for details.

External Activates the rear panel external trigger input. The external trigger must be a TTL signal.

Frame Uses the internal frame clock to generate a trigger signal. The clock parameters are controlled under the **Mode Setup** key or the measurement firmware, but not both. This setting is available only when hardware Options B7D and B7E are installed.

The default is RF Burst (Wideband) when hardware Option B7D and newer versions of Option B7E: RF Comms Hardware are installed, otherwise the default is **External**. See the following note for details.

NOTE Option B7E: RF Comms Hardware has at least three possible part numbers. Press **System**, **More**, **Show Hdwr** to show your instrument's RF Comms Hardware and view the part number. If the part number is E4401-60087 (the original version), the **RF Burst** trigger source will not be available with this measurement, and the default will be **External**.

Burst Sync The EDGE EVM measurement only supports measurements of standard compliant EDGE normal bursted signals containing a valid Training Sequence Code. **Burst Sync** is not available for any other settings, and is always set to **Training Seq** (Training Sequence).

Droop Comp Sets the droop compensation algorithm to **On** or **Off**.

The default is **On**.

Rotation Sets apply rotation to the I/Q Constellation diagram **On** or **Off**.

The default is **On**.

Limit Test Toggles active limit checking **On** or **Off**—this does not turn on or off the limit lines, which are accessed through the **Display** front panel key menu.

The default is **On**.

Limits... Leads to a screen with the following EVM phase and frequency settings:

RMS EVM Limit The RMS phase error must be less than or equal to this limit.

The default is 7 % when Device is BTS, and 9 % when Device is MS.

Peak EVM Limit The peak phase error must be less than or equal to this limit.

The default is 22 % when Device is BTS, and 30 % when Device is MS.

95th Percentile EVM Limit The 95th percentile EVM must be less than or equal to this limit.

The default is 11 % when Device is BTS, and 15 % when

Device is MS.

I/Q Origin Offset Suppression Limit The I/Q origin offset must be greater than this limit.

The default is –35.0 dBc when Device is BTS, and –30.0 dBc when Device is MS.

Frequency Offset Limit The frequency offset error must be less than or equal to this limit.

The default setting is:

- 0.05 ppm when Device is BTS or uBTS
- 0.1 ppm when Device is pBTS
- 0.1 ppm when Device is MS (except for Band/Standard GSM 450 or GSM 480)
- 0.2 ppm when Device is MS and Band/Standard is GSM 450 or GSM 480

Restore Meas Defaults Restores all **Meas Setup** parameter values for the current measurement to their factory defaults.

Display (EDGE EVM)

Symbol Dots (Polar Vector) Sets the display of the measured values used to calculate the polar vector view **On** or **Off**. If turned **On**, these values (coordinates) are superimposed on the polar vector view.

The default is **On**.

Symbol Dots (Quad View) Sets the display of the measured values used to calculate the quad view **On** or **Off**. If turned **On**, these values (coordinates) are superimposed on the quad graph view.

The default is **On**.

View Trace (EDGE EVM)

I/Q Measured Polar Vector Sets the display to I/Q Measured Polar Vector view.

I/Q Measured Polar Constln Sets the display to I/Q Measured Polar Constellation view.

I/Q Error (Quad View) Sets the display to I/Q Error Quad view.

EDGE Output RF Spectrum

Meas Setup (EDGE Output RF Spectrum)

To access the keys for setting up an EDGE Output RF Spectrum (ORFS) measurement, press **MEASURE**, **EDGE Output RF Spectrum**, and then the front panel **Meas Setup** key.

Avg Number Toggles measurement averaging **On** or **Off**, and sets the number of measurement averages used to calculate the measurement result when **On** is selected. After the specified number of averages has been reached, the **Avg Mode** termination control setting determines the averaging action.

The defaults are **Off** and 10.

Avg Mode Sets the termination control method used for the averaging function. The key is not available and set to **Repeat** when the **Multi-Offset** measurement method is selected. The termination control methods are:

Exp Exponential averaging. After the number of averages specified by **Avg Number** has been reached, each successive data acquisition is exponentially weighted and combined with the existing average.

Repeat Repeat averaging. After the number of averages specified by **Avg Number** has been reached, the averaging is reset and a new average is started.

The default is **Repeat**.

Meas Method Leads to a menu with the following measurement method selections:

Multi-Offset Automatically makes measurements at all offset frequencies listed in the **Standard** or **Short** frequency list. (See Table 3-2, “Offset Frequency Lists.”)

Single Offset (Examine) Makes a measurement at a single offset frequency as set by the **Offset Freq** softkey.

Swept Sets the trigger source to **Free Run**, and disables the **Trigger Source** softkey when selected. The **Trigger Source** state is restored when the measurement mode is returned to **Single Offset** or **Multi-Offset**.

The default is **Multi-Offset**.

Meas Type Toggles the measurement type between **Mod** (EDGE ORFS due to modulation), and **Switch** (EDGE ORFS due to switching transients or burst ramping).

The default is **Mod**.

Ofs Freq List Set to **Std** (standard) or **Short** to define which frequency offsets to scan.

See Table 3-2, “Offset Frequency Lists.” **Ofs Freq List** is not available when **Meas Method** is set to **Single Offset** or **Swept**.

The default is **Short**.

Offset Freq Sets a frequency offset from the carrier at which to perform a single offset EDGE Output RF Spectrum measurement. **Offset Freq** is not available when **Meas Method** is set to **Multi-Offset** or Swept.

The default is 250 kHz.

Trig Source Sets the trigger source for the EDGE ORFS measurement. The **Trig Source** key is grayed out and set to **External** when the **Swept** measurement method is selected. The previous **Trigger Source** state is returned when the measurement method is returned to **Single Offset** or **Multi-Offset**. Choose one of the following trigger sources:

Free Run (Immediate) Allows trigger to occur at the time the data is requested, completely asynchronous to the RF or IF signal. This key is not available if **Single Offset** or **Multi-Offset** measurement method is selected.

RF Burst (Wideband) Activates an internal wideband RF burst trigger that has an automatic level control for burst signals. It triggers on a level that is relative to the peak of the RF burst. This setting is available only when hardware Option B7D and newer versions of Option B7E: RF Comms Hardware are installed. See the following note for details.

External Activates the rear panel external trigger input. The external trigger must be a TTL signal.

Frame Uses the internal frame clock to generate a trigger signal. The clock parameters are controlled under the **Mode Setup** key or the measurement firmware, but not both. This setting is available only when hardware Options B7D and B7E are installed.

The default is RF Burst (Wideband) when hardware Option B7D and newer versions of Option B7E: RF Comms Hardware are installed, otherwise the default is **External**. See the following note for details.

NOTE Option B7E: RF Comms Hardware has at least three possible part numbers. Press **System**, **More**, **Show Hdwr** to show your instrument’s RF Comms Hardware and view the part number. If the part number is E4401-60087 (the original version), the **RF Burst** trigger source will not be available with this measurement, and the default will be **External**.

Burst Sync Sets the synchronization of the measurement to the correct part of the burst. Choose one of the following synchronization methods:

Training Seq Synchronizes the measurement to the timing of the demodulated training sequence of the burst. This is the most precise method, but requires a burst with a valid TSC (Training Sequence Code). This key is not available if hardware Options B7D and B7E are not installed.

RF Amptd Synchronizes the measurement to the burst transition of the measured RF carrier.

None Uses the start of the time record as the start of the useful part of the burst.

The default is **Training Seq** when hardware Options B7D and B7E are installed, otherwise the default is **RF Amptd**.

Widebnd Noise Sets the frequency range that is swept on either side of the carrier center frequency. Available only when **Meas Type** is set to **Mod** and measurement method is **Swept**.

On The analyzer tunes to the carrier, and the whole relevant band plus 2 MHz either side of center frequency is swept.

Off The analyzer tunes to the carrier, and 1800 kHz below and above either side of the center frequency is swept.

The default is **Off**.

Restore Meas Defaults Restores all **Meas Setup** parameter values for the current measurement to their factory defaults.

Advanced Provides access to the following advanced measurement parameter settings:

Ref Pwr Avg Sets the number of averages to be taken when determining the reference power (at 0 Hz offset). Available only when **Meas Method** is set to **Single Offset**.

Auto Uses the number of averages equal to that specified in the **Avg Number** parameter.

Manual Lets you manually specify the number of averages.

The defaults are **Auto** and 10.

Max Mxr Lvl Sets the maximum power at the RF mixer input. The instrument will automatically set the optimum attenuation value based on the value entered.

The default is –4.00 dBm.

Mod BWs Leads to a menu with custom RBW settings that deviate from the GSM standard for EDGE ORFS due to modulation:

<1800 kHz Offset RBW Sets the RBW for measuring offsets of less than 1800 kHz.

The default is 30 kHz.

≥1800 kHz Offset RBW Sets the RBW for measuring offsets greater than or equal to 1800 kHz.

The default is 100 kHz.

Switch BWs Leads to a menu with custom RBW settings that deviate from the GSM standard for EDGE ORFS due to switching:

<1800 kHz Offset RBW Sets the RBW for measuring offsets of less than 1800 kHz.

The default is 30 kHz.

≥1800 kHz Offset RBW Sets the RBW for measuring offsets greater than or equal to 1800 kHz.

The default is 30 kHz.

Display (EDGE Output RF Spectrum)

Table Display When the measurement method is set to **Multi-Offset**, the results table can be changed to show any of the following sets of values:

Rslt Displays the actual measurement results.

Lim Displays the absolute and relative limits for all offsets.

Mrgn Displays the margin by which the result meets specifications. Negative numbers indicate that the result has failed.

The default setting is **Rslt**.

View Trace (EDGE Output RF Spectrum)

Numeric Results Shows measurement results with a numeric data view. Numeric Results are not available unless **Meas Method** = **Multi-Offset**.

Programming Commands

4 Programming Commands

These commands are only available when the GSM (w/EDGE) mode has been selected using INSTrument:SELect. Once a mode is selected, commands that are unique to another mode are not available.

Functional Index to SCPI Subsection

The following table lists the SCPI subsystems or subsections associated with the instrument GSM, EDGE function categories. The commands listed are for GSM, EDGE specific functions. If you require information on the commands for the Agilent ESA Spectrum Analyzers, refer to the *ESA Spectrum Analyzers User's/Programmer's Reference*.

Function Category	SCPI Subsection or Subsystem
AMPLITUDE	:CALCulate:EORFspectr :CALCulate:ORFSpectrum :CALCulate:PSTeps :CALCulate:RSPur :CALCulate:TSPur [:SENSe]:EPVTime [:SENSe]:PVTime [:SENSe]:TXPower [:SENSe]:OOBSpur [:SENSe]:POWer :CONFigure :FETCh :MEASure :READ
ATTENUATION	[:SENSe]:POWer [:SENSe]:CORRection [:SENSe]:OOBSpur
AVERAGING	[:SENSe]:EORFspectr [:SENSe]:ORFSpectrum [:SENSe]:MONitor [:SENSe]:OOBSpur [:SENSe]:CFLocation [:SENSe]:PFERror [:SENSe]:EPVTime [:SENSe]:PVTime [:SENSe]:TSPur [:SENSe]:TXPower

Function Category	SCPI Subsection or Subsystem
BAND, BANDWIDTH	[:SENSe]:MONitor [:SENSe]:OOBSpur [:SENSe]:RADio [:SENSe]:CFLocation [:SENSe]:TXPower [:SENSe]:PSTeps [:SENSe]:EPVTime [:SENSe]:PVTime :CONFigure :FETCh :MEASure :READ
BURST	TRIGger [:SENSe]:TXPower [:SENSe]:SYNC [:SENSe]:CHANnel [:SENSe]:PFERror
CABLE FAULTS	[:SENSe]:CFLocation :CONFigure :FETCh :MEASure :READ
CORRECTED MEASUREMENTS	[:SENSe]:CORRection
DEMODULATION	[:SENSe]:TXPower
DETECTOR	[:SENSe]:MONitor
DISPLAY	[:SENSe]:MONitor
FREQUENCY	[:SENSe]:OOBSpur [:SENSe]:FREQuency [:SENSe]:CHANnel [:SENSe]:PFERror [:SENSe]:CFLocation :CONFigure :FETCh :MEASure :READ
FREQUENCY SPAN	[:SENSe]:CFLocation [:SENSe]:OOBSpur :CONFigure :FETCh :MEASure :READ
LIMIT MASK	[:SENSe]:EPVTime [:SENSe]:PVTime

Function Category	SCPI Subsection or Subsystem
LIMITS	:CALCulate:ORFSpectrum :CALCulate:OOBSpur :CALCulate:PFERror :CALCulate:PSTeps :CALCulate:RSPur :CALCulate:TSPur
MARKER	:CALCulate:CFLocation
MEASURE	:CONFigure :FETCh :MEASure :READ [:SENSe]:MONitor [:SENSe]:OOBSpur
MIXER	[:SENSe]:OOBSpur
POWER VERSUS TIME	[:SENSe]:PVTime
REFERENCE OSCILLATOR	[:SENSe]:ROSCillator
SPECTRUM/ MODULATION	MEASure :CALCulate:EORFspectr :CALCulate:ORFSpectrum
SPURIOUS	:CALCulate:OOBSpur
SWEEP	[:SENSe]:OOBSpur [:SENSe]:PSTeps
TIME SLOT	[:SENSe]:TXPower [:SENSe]:CHANnel
TIMING SEQUENCE CODE	[:SENSe]:CHANnel
TRIGGER	TRIGger [:SENSe]:TXPower [:SENSe]:PSTeps [:SENSe]:PFERror [:SENSe]:EORFspectr [:SENSe]:ORFSpectrum :CONFigure :FETCh :MEASure :READ

CALCulate Subsystem

This subsystem is used to perform post-acquisition data processing. In effect, the collection of new data triggers the CALCulate subsystem. In this instrument, the primary functions in this subsystem are markers and limits.

The SCPI default for data output format is ASCII. The format can be changed to binary with FORMat:DATA which transports faster over the bus.

Test Current Results Against all Limits

:CALCulate:CLIMits:FAIL?

Queries the status of the current measurement limit testing. It returns a 0 if the measured results pass when compared with the current limits. It returns a 1 if the measured results fail any limit tests.

Programming Commands

EDGE Error Vector Magnitude (EEVM) - Limits

EDGE RMS EVM Limit

:CALCulate:EEVM:LIMit:BS|BTS|MS:REVM[:UPPer][:DATA] <percent>

:CALCulate:EEVM:LIMit:BS|BTS|MS:REVM[:UPPer][:DATA]?

Set or query the device RMS EVM limit.

Factory Preset: 7.00 % for BTS|BS device
9.00 % for MS device

Range: 0 to 100 %

Default Unit: percent

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Peak EVM Limit

:CALCulate:EEVM:LIMit:BS|BTS|MS:PEVM[:UPPer][:DATA] <percent>

:CALCulate:EEVM:LIMit:BS|BTS|MS:PEVM[:UPPer][:DATA]?

Set or query the device peak EVM limit.

Factory Preset: 22.00 % for BTS|BS device
30.00 % for MS device

Range: 0 to 100 %

Default Unit: percent

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE 95th Percentile EVM Limit

:CALCulate:EEVM:LIMit:BS|BTS|MS:EVMP95[:UPPer][:DATA] <percent>

:CALCulate:EEVM:LIMit:BS|BTS|MS:EVMP95[:UPPer][:DATA]?

Set or query the device 95th percentile EVM limit.

Factory Preset:	11.00 % for BTS|BS device 15.00 % for MS device
Range:	0 to 100 %
Default Unit:	percent
Remarks:	You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE I/Q Origin Offset Suppression Limit

:CALCulate:EEVM:LIMit:BS|BTS|MS:IQOOffset[:UPPer][:DATA] <rel_ampl>

:CALCulate:EEVM:LIMit:BS|BTS|MS:IQOOffset[:UPPer][:DATA]?

Set or query the device I/Q origin offset suppression limit.

Factory Preset:	–35 dB for BTS|BS device –30 dB for MS device
Range:	–200 to 200 dB
Default Unit:	dB
Remarks:	You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE EVM Frequency Error Limits—BTS

:CALCulate:EEVM:LIMit:<standard>:BS|BTS:FERRor:UPPer[:DATA] <real number>

:CALCulate:EEVM:LIMit:<standard>:BTS:FERRor:UPPer[:DATA]?

Set or query any of the BTS related frequency error limits for the EDGE EVM measurement. Replace <standard> in the above command strings with the appropriate keyword or abbreviated keyword from the table below.

Table 4-1 Valid GSM Standards Used in the SCPI Command

Frequency Band Standard	SCPI Keyword	Abbreviated SCPI Keyword
GSM 450	GSM450	none
GSM 480	GSM480	none
GSM 850	GSM850	none
P-GSM 900	PGSM900	PGSM
E-GSM 900	EGSM900	EGSM
R-GSM 900	RGSM900	RGSM
DCS 1800	DCS1800	DCS
PCS 1900	PCS1900	PCS

Factory Preset: 0.05

Range: 0 to 100

Default Unit: ppm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE EVM Frequency Error Limits—MS

:CALCulate:EEVM:LIMit:<standard>:MS:FERRor:UPPer:[DATA] <real number>

:CALCulate:EEVM:LIMit:<standard>:MS:FERRor:UPPer:[DATA]?

Set or query any of the MS related frequency error limits for the EDGE EVM measurement. Replace <standard> in the above command strings with the appropriate keyword or abbreviated keyword from the table below.

Table 4-2 Valid GSM Standards Used in the SCPI Command

Frequency Band Standard	SCPI Keyword	Abbreviated SCPI Keyword
GSM 450	GSM450	none
GSM 480	GSM480	none

Table 4-2 Valid GSM Standards Used in the SCPI Command

Frequency Band Standard	SCPI Keyword	Abbreviated SCPI Keyword
GSM 850	GSM850	none
P-GSM 900	PGSM900	PGSM
E-GSM 900	EGSM900	EGSM
R-GSM 900	RGSM900	RGSM
DCS 1800	DCS1800	DCS
PCS 1900	PCS1900	PCS

Factory Preset: 0.1 for all standards except GSM450 and GSM480
0.2 for GSM450 and GSM480

Range: 0 to 100

Default Unit: ppm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE EVM Frequency Error Limits—pBTS

:CALCulate:EEVM:LIMit:<standard>:PBTS:FERRor:UPPer:[DATA] <real number>

:CALCulate:EEVM:LIMit:<standard>:PBTS:FERRor:UPPer:[DATA]?

Set or query any of the pBTS related frequency error limits for the EDGE EVM measurement. Replace <standard> in the above command strings with the appropriate keyword or abbreviated keyword from the table below.

Table 4-3 Valid GSM Standards Used in the SCPI Command

Frequency Band Standard	SCPI Keyword	Abbreviated SCPI Keyword
GSM 450	GSM450	none
GSM 480	GSM480	none
GSM 850	GSM850	none
P-GSM 900	PGSM900	PGSM

Programming Commands

Table 4-3 Valid GSM Standards Used in the SCPI Command

Frequency Band Standard	SCPI Keyword	Abbreviated SCPI Keyword
E-GSM 900	EGSM900	EGSM
R-GSM 900	RGSM900	RGSM
DCS 1800	DCS1800	DCS
PCS 1900	PCS1900	PCS

Factory Preset: 0.1

Range: 0 to 100

Default Unit: ppm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE EVM Frequency Error Limits—uBTS

:CALCulate:EEVM:LIMit:<standard>:UBTS:FERRor:UPPer:[DATA] <real number>

:CALCulate:EEVM:LIMit:<standard>:UBTS:FERRor:UPPer:[DATA]?

Set or query any of the uBTS related frequency error limits for the EDGE EVM measurement. Replace <standard> in the above command strings with the appropriate keyword or abbreviated keyword from the table below.

Table 4-4 Valid GSM Standards Used in the SCPI Command

Frequency Band Standard	SCPI Keyword	Abbreviated SCPI Keyword
GSM 450	GSM450	none
GSM 480	GSM480	none
GSM 850	GSM850	none
P-GSM 900	PGSM900	PGSM
E-GSM 900	EGSM900	EGSM
R-GSM 900	RGSM900	RGSM
DCS 1800	DCS1800	DCS

Table 4-4 Valid GSM Standards Used in the SCPI Command

Frequency Band Standard	SCPI Keyword	Abbreviated SCPI Keyword
PCS 1900	PCS1900	PCS

Factory Preset: 0.05

Range: 0 to 100

Default Unit: ppm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Output RF Spectrum (EORFS) - Limits

EDGE ORFS Due To Modulation Absolute Limits Commands

Use the commands in this section to change the EDGE Output RF Spectrum absolute limits to your own custom limits values.

ORFS limits are generally specified in dB relative to the reference power (ref power). This equates to the absolute power which the result must not exceed. Standards documents also supply an absolute power level—below which the calculated relative limit (ref power – relative limit) will not be applied—for each ORFS type, radio standard, device type and offset frequency.

Therefore the relative limit applies if the calculated limit (ref power – relative limit) is greater than the absolute limit. Otherwise the absolute limit applies.

Example:

If relative limit = –75 dB and absolute limit = –65 dBm.

1.	If the ref power is measured at 43 dBm, then: Upper result limit due to relative limit = 43 – 75 = –32 dBm Upper result limit due to absolute limit = –65 dBm A relative limit of –32 dBm therefore applies.
2.	If the ref power is measured at 0 dBm, then: Upper result limit due to relative limit = 0 – 75 = –75 dBm Upper result limit due to absolute limit = –65 dBm An absolute limit of –65 dBm therefore applies.

The commands are presented according to the following devices: MS, BTS, UBTS1, UBTS2, UBTS3 and PBTS1.

EDGE ORFS Due To Modulation Absolute Limits—BTS

:CALCulate:EORFspectr:MODulation:LIMit:<standard>:BTS :ABSolute[:UPPer]:DATA[n] <amplitude>

:CALCulate:EORFspectr:MODulation:LIMit:<standard>:BTS :ABSolute[:UPPer]:DATA[n]?

Set or query any of the absolute BTS related limits for the EDGE ORFS due to modulation measurement. Replace <standard> in the above command strings with the appropriate keyword or abbreviated keyword from the table below.

Table 4-5 Valid GSM Standards Used in the SCPI Command

Frequency Band Standard	SCPI Keyword	Abbreviated SCPI Keyword
GSM 450	GSM900	GSM
GSM 480		
GSM 850		
P-GSM 900		
E-GSM 900		
R-GSM 900		
DCS 1800	DCS1800	DCS
PCS 1900	PCS1900	PCS

Table 4-6 below shows how each <standard> is associated with a value that must be referenced using numeric 1 or 2. Replace n in the above command strings with the appropriate numeric to set or query the desired limit. For further information, refer to the example provided in this section (page 142) for the EDGE ORFS Due To Modulation Absolute Limits—MS command.

Factory Preset: Refer to Table 4-6.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-6 EDGE ORFS Due To Modulation Absolute Limits—BTS: Default Values

	Standard		
Offset	**GSM/ GSM900**	**DCS/ DCS1800**	**PCS/ PCS1900**
< 1800 kHz (n=1)	–65.0	–57.0	–57.0
≥ 1800 kHz (n=2)	–65.0	–57.0	–57.0

EDGE ORFS Due To Modulation Absolute Limits—MS

```
:CALCulate:EORFspectr:MODulation:LIMit:<standard>:MS
:ABSolute[:UPPer]:DATA[n] <amplitude>
```

```
:CALCulate:EORFspectr:MODulation:LIMit:<standard>:MS
:ABSolute[:UPPer]:DATA[n]?
```

Set or query any of the absolute MS related limits for the EDGE ORFS due to modulation measurement. Replace <standard> in the above command strings with the appropriate keyword or abbreviated keyword from the table below.

Table 4-7 Valid GSM Standards Used in the SCPI Command

<table>
<tr><th>Frequency Band Standard</th><th>SCPI Keyword</th><th>Abbreviated SCPI Keyword</th></tr>
<tr><td>GSM 450</td><td rowspan="6">GSM900</td><td rowspan="6">GSM</td></tr>
<tr><td>GSM 480</td></tr>
<tr><td>GSM 850</td></tr>
<tr><td>P-GSM 900</td></tr>
<tr><td>E-GSM 900</td></tr>
<tr><td>R-GSM 900</td></tr>
<tr><td>DCS 1800</td><td>DCS1800</td><td>DCS</td></tr>
<tr><td>PCS 1900</td><td>PCS1900</td><td>PCS</td></tr>
</table>

Table 4-8 below shows how each <standard> is associated with a value that must be referenced using a numeric from 1 to 3. Replace n in the above command strings with the appropriate numeric to set or query the desired limit.

Example:

The following command sets the absolute result limit to –40 dBm when testing a PGSM MS device at 1800 kHz offset (the default value is –46.0 dBm):

```
:CALCulate:EORFspectr:MODulation:LIMit:GSM:MS
  :ABSolute:UPPer:DATA3 –40.0
```

Factory Preset: Refer to Table 4-8.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-8 EDGE ORFS Due To Modulation Absolute Limits—MS: Default Values

	Standard		
Offset	**GSM/ GSM900**	**DCS/ DCS1800**	**PCS/ PCS1900**
< 600 kHz (n=1)	–36.0	–36.0	–36.0
≥ 600 kHz, < 1800 kHz (n=2)	–51.0	–56.0	–56.0
≥ 1800 kHz (n=3)	–46.0	–51.0	–51.0

EDGE ORFS Due To Modulation Absolute Limits—PBTS1

```
:CALCulate:EORFspectr:MODulation:LIMit:<standard>:PBTS1
:ABSolute[:UPPer]:DATA[n] <amplitude>
```

```
:CALCulate:EORFspectr:MODulation:LIMit:<standard>:PBTS1
:ABSolute[:UPPer]:DATA[n]?
```

Set or query any of the absolute PBTS1 related limits for the EDGE ORFS due to modulation measurement. Replace <standard> in the above command strings with the appropriate keyword or abbreviated keyword from the table below.

Table 4-9 Valid GSM Standards Used in the SCPI Command

Frequency Band Standard	SCPI Keyword	Abbreviated SCPI Keyword
GSM 450	GSM900	GSM
GSM 480		
GSM 850		
P-GSM 900		
E-GSM 900		
R-GSM 900		

Programming Commands

Table 4-9 Valid GSM Standards Used in the SCPI Command

Frequency Band Standard	SCPI Keyword	Abbreviated SCPI Keyword
DCS 1800	DCS1800	DCS
PCS 1900	PCS1900	PCS

Table 4-10 below shows how each <standard> is associated with a value that must be referenced using numeric 1 or 2. Replace n in the above command strings with the appropriate numeric to set or query the desired limit. For further information, refer to the example provided in this section (page 142) for the EDGE ORFS Due To Modulation Absolute Limits—MS command.

Factory Preset: Refer to Table 4-10.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-10 EDGE ORFS Due To Modulation Absolute Limits—PBTS1: Default Values

	Standard		
Offset	GSM/ GSM900	DCS/ DCS1800	PCS/ PCS1900
< 1800 kHz (n=1)	–68.0	–65.0	–65.0
≥ 1800 kHz (n=2)	–68.0	–65.0	–65.0

EDGE ORFS Due To Modulation Absolute Limits—UBTS1

```
:CALCulate:EORFspectr:MODulation:LIMit:<standard>:UBTS1
:ABSolute[:UPPer]:DATA[n] <amplitude>
```

```
:CALCulate:EORFspectr:MODulation:LIMit:<standard>:UBTS1
:ABSolute[:UPPer]:DATA[n]?
```

Set or query any of the absolute UBTS1 related limits for the EDGE ORFS due to modulation measurement. Replace <standard> in the above command strings with the appropriate keyword or abbreviated keyword from the table below.

Table 4-11 Valid GSM Standards Used in the SCPI Command

Frequency Band Standard	SCPI Keyword	Abbreviated SCPI Keyword
GSM 450	GSM900	GSM
GSM 480		
GSM 850		
P-GSM 900		
E-GSM 900		
R-GSM 900		
DCS 1800	DCS1800	DCS
PCS 1900	PCS1900	PCS

Table 4-12 below shows how each <standard> is associated with a value that must be referenced using numeric 1 or 2. Replace n in the above command strings with the appropriate numeric to set or query the desired limit. For further information, refer to the example provided in this section (page 142) for the EDGE ORFS Due To Modulation Absolute Limits—MS command.

Factory Preset: Refer to Table 4-12.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-12 EDGE ORFS Due To Modulation Absolute Limits—UBTS1: Default Values

	Standard		
Offset	**GSM/ GSM900**	**DCS/ DCS1800**	**PCS/ PCS1900**
< 1800 kHz (n=1)	–59.0	–57.0	–57.0

Programming Commands

Table 4-12 EDGE ORFS Due To Modulation Absolute Limits—UBTS1: Default Values

	Standard		
Offset	**GSM/ GSM900**	**DCS/ DCS1800**	**PCS/ PCS1900**
≥ 1800 kHz (n=2)	–59.0	–57.0	–57.0

EDGE ORFS Due To Modulation Absolute Limits—UBTS2

:CALCulate:EORFspectr:MODulation:LIMit:<standard>:UBTS2 :ABSolute[:UPPer]:DATA[n] <amplitide>

:CALCulate:EORFspectr:MODulation:LIMit:<standard>:UBTS2 :ABSolute[:UPPer]:DATA[n]?

Set or query any of the absolute UBTS2 related limits for the EDGE ORFS due to modulation measurement. Replace <standard> in the above command strings with the appropriate keyword or abbreviated keyword from the table below.

Table 4-13 Valid GSM Standards Used in the SCPI Command

Frequency Band Standard	SCPI Keyword	Abbreviated SCPI Keyword
GSM 450	GSM900	GSM
GSM 480		
GSM 850		
P-GSM 900		
E-GSM 900		
R-GSM 900		
DCS 1800	DCS1800	DCS
PCS 1900	PCS1900	PCS

Table 4-14 below shows how each <standard> is associated with a value that must be referenced using numeric 1 or 2. Replace n in the above command strings with the appropriate numeric to set or query the desired limit. For further information, refer to the example provided in this section (page 142) for the EDGE ORFS Due To Modulation Absolute Limits—MS command.

Factory Preset: Refer to Table 4-14.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-14 EDGE ORFS Due To Modulation Absolute Limits—UBTS2: Default Values

	Standard		
Offset	**GSM/ GSM900**	**DCS/ DCS1800**	**PCS/ PCS1900**
< 1800 kHz (n=1)	–64.0	–62.0	–62.0
≥ 1800 kHz (n=2)	–64.0	–62.0	–62.0

EDGE ORFS Due To Modulation Absolute Limits—UBTS3

:CALCulate:EORFspectr:MODulation:LIMit:<standard>:UBTS3 :ABSolute[:UPPer]:DATA[n] <amplitude>

:CALCulate:EORFspectr:MODulation:LIMit:<standard>:UBTS3 :ABSolute[:UPPer]:DATA[n]?

Set or query any of the absolute UBTS3 related limits for the EDGE ORFS due to modulation measurement. Replace <standard> in the above command strings with the appropriate keyword or abbreviated keyword from the table below.

Table 4-15 Valid GSM Standards Used in the SCPI Command

Frequency Band Standard	SCPI Keyword	Abbreviated SCPI Keyword
GSM 450	GSM900	GSM
GSM 480		
GSM 850		
P-GSM 900		
E-GSM 900		
R-GSM 900		

Table 4-15 Valid GSM Standards Used in the SCPI Command

Frequency Band Standard	SCPI Keyword	Abbreviated SCPI Keyword
DCS 1800	DCS1800	DCS
PCS 1900	PCS1900	PCS

Table 4-16 below shows how each <standard> is associated with a value that must be referenced using numeric 1 or 2. Replace n in the above command strings with the appropriate numeric to set or query the desired limit. For further information, refer to the example provided in this section (page 142) for the EDGE ORFS Due To Modulation Absolute Limits—MS command.

Factory Preset: Refer to Table 4-16.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-16 EDGE ORFS Due To Modulation Absolute Limits—UBTS3: Default Values

	Standard		
Offset	**GSM/ GSM900**	**DCS/ DCS1800**	**PCS/ PCS1900**
< 1800 kHz (n=1)	–69.0	–67.0	–67.0
≥ 1800 kHz (n=2)	–69.0	–67.0	–67.0

EDGE ORFS Due To Modulation Relative Limits Commands

Use the commands in this section to change the EDGE Output RF Spectrum relative limits to your own custom limits values.

ORFS limits are generally specified in dB relative to the reference power (ref power). This equates to the absolute power which the result must not exceed. Standards documents also supply an absolute power level—below which the calculated relative limit (ref power – relative limit) will not be applied—for each ORFS type, radio standard, device type and offset frequency.

Therefore the relative limit applies if the calculated limit (ref power – relative limit) is greater than the absolute limit. Otherwise the absolute limit applies.

Example:

If relative limit = –75 dB and absolute limit = –65 dBm.

1.	If the ref power is measured at 43 dBm, then: Upper result limit due to relative limit = 43 – 75 = –32 dBm Upper result limit due to absolute limit = –65 dBm A relative limit of –32 dBm therefore applies.
2.	If the ref power is measured at 0 dBm, then: Upper result limit due to relative limit = 0 – 75 = –75 dBm Upper result limit due to absolute limit = –65 dBm An absolute limit of –65 dBm therefore applies.

The commands are presented according to standards DCS 1800, GSM 900 and PCS 1900 for devices MS, BTS and UBTS.

EDGE ORFS Due To Modulation DCS Relative Limits—BTS

:CALCulate:EORFspectr:MODulation:LIMit:DCS|DCS1800:BTS:<Pnn>[:UPPer]:DATA[n] <amplitude>

:CALCulate:EORFspectr:MODulation:LIMit:DCS|DCS1800:BTS:<Pnn>[:UPPer]:DATA[n]?

Set or query any of the DCS 1800 BTS relative limits for the EDGE ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate BS TX Level.

Table 4-17 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 9. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. For further information, refer to the example provided in this section (page 151) for the EDGE ORFS Due To Modulation DCS Relative Limits—MS command.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Factory Preset: Refer to Table 4-17.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-17 EDGE ORFS Due To Modulation DCS Relative Limits—BTS: Default Values

BS TX Level (Pnn)	Power Level (dBm)	Power (dBm) (n=1 or not stated)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. DCS1800 BTS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P43	>43	43.0	+0.5	–30.0	–33.0	–56.0	–70.0	–73.0	–75.0	–80.0
P41	41	41.0	+0.5	–30.0	–33.0	–56.0	–68.0	–71.0	–73.0	–80.0
P39	39	39.0	+0.5	–30.0	–33.0	–56.0	–66.0	–69.0	–71.0	–80.0
P37	37	37.0	+0.5	–30.0	–33.0	–56.0	–64.0	–67.0	–69.0	–80.0
P35	35	35.0	+0.5	–30.0	–33.0	–56.0	–62.0	–65.0	–67.0	–80.0
P33	<33	33.0	+0.5	–30.0	–33.0	–56.0	–60.0	–63.0	–65.0	–80.0

EDGE ORFS Due To Modulation DCS Relative Limits—MS

```
:CALCulate:EORFspectr:MODulation:LIMit:DCS|DCS1800:MS:<Pnn>
[:UPPer]:DATA[n] <amplitude>
```

```
:CALCulate:EORFspectr:MODulation:LIMit:DCS|DCS1800:MS:<Pnn>
[:UPPer]:DATA[n]?
```

Set or query any of the DCS 1800 MS relative limits for the EDGE ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate MS TX Level.

Table 4-18 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 9. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Example:

The following command sets the relative result limit to –65.0 dB (the default value is –60.0 dB) when testing a DCS MS device at 400 kHz offset and total carrier power = 34 dBm:

```
:CALCulate:EORFspectr:MODulation:LIMit:DCS|DCS1800:MS
  :P34:UPPer:DATA5 –65.0
```

Factory Preset: Refer to Table 4-18.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-18 EDGE ORFS Due To Modulation DCS Relative Limits—MS: Default Values

MS TX Level (Pnn)	Power Level (dBm)	Power (dBm) (n=1 or not stated)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. DCS1800 MS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P36	>36	36.0	+0.5	–30.0	–33.0	–60.0	–60.0	–60.0	–71.0	–79.0
P34	34	34.0	+0.5	–30.0	–33.0	–60.0	–60.0	–60.0	–69.0	–77.0
P32	32	32.0	+0.5	–30.0	–33.0	–60.0	–60.0	–60.0	–67.0	–75.0
P30	30	30.0	+0.5	–30.0	–33.0	–54.0	–60.0	–60.0	–65.0	–73.0
P28	28	28.0	+0.5	–30.0	–33.0	–54.0	–60.0	–60.0	–63.0	–71.0

Table 4-18 EDGE ORFS Due To Modulation DCS Relative Limits—MS: Default Values

MS TX Level (Pnn)	Power Level (dBm)	Power (dBm) (n=1 or not stated)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. DCS1800 MS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P26	26	26.0	+0.5	–30.0	–33.0	–54.0	–60.0	–60.0	–61.0	–69.0
P24	<24	24.0	+0.5	–30.0	–33.0	–54.0	–60.0	–60.0	–59.0	–67.0

Programming Commands

EDGE ORFS Due To Modulation DCS Relative Limits—PBTS

:CALCulate:EORFspectr:MODulation:LIMit:DCS|DCS1800:PBTS:<Pnn>[:UPPer]:DATA[n] <amplitude>

:CALCulate:EORFspectr:MODulation:LIMit:DCS|DCS1800:PBTS:<Pnn>[:UPPer]:DATA[n]?

Set or query any of the DCS 1800 PBTS relative limits for the EDGE ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate BS TX Level.

Table 4-19 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 9. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. For further information, refer to the example provided in this section (page 151) for the EDGE ORFS Due To Modulation DCS Relative Limits—MS command.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Factory Preset: Refer to Table 4-19.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-19 EDGE ORFS Due To Modulation DCS Relative Limits—PBTS: Default Values

BS TX Level (Pnn)	Power Level (dBm)	Power (dBm) (n=1 or not stated)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. DCS1800 PBTS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P23	<=23	23.0	+0.5	–30.0	–33.0	–56.0	–60.0	–63.0	–76.0	–80.0

Programming Commands

EDGE ORFS Due To Modulation DCS Relative Limits—UBTS

:CALCulate:EORFspectr:MODulation:LIMit:DCS|DCS1800:UBTS:<Pnn>[:UPPer]:DATA[n] <amplitude>

:CALCulate:EORFspectr:MODulation:LIMit:DCS|DCS1800:UBTS:<Pnn>[:UPPer]:DATA[n]?

Set or query any of the DCS 1800 UBTS relative limits for the EDGE ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate BS TX Level.

Table 4-20 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 9. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. For further information, refer to the example provided in this section (page 151) for the EDGE ORFS Due To Modulation DCS Relative Limits—MS command.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Factory Preset: Refer to Table 4-20.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-20 EDGE ORFS Due To Modulation DCS Relative Limits—UBTS: Default Values

BS TX Level (Pnn)	Power Level (dBm)	Power (dBm) (n=1 or not stated)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. DCS1800 UBTS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P35	>35	35.0	+0.5	–30.0	–33.0	–56.0	–62.0	–65.0	–76.0	–76.0
P33	<33	33.0	+0.5	–30.0	–33.0	–56.0	–60.0	–63.0	–76.0	–76.0

EDGE ORFS Due To Modulation GSM Relative Limits—BTS

:CALCulate:EORFspectr:MODulation:LIMit:GSM|GSM900:BTS:<Pnn>[:UPPer]:DATA[n] <amplitude>

:CALCulate:EORFspectr:MODulation:LIMit:GSM|GSM900:BTS:<Pnn>[:UPPer]:DATA[n]?

Set or query any of the DCS 1800 BTS relative limits for the EDGE ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate BS TX Level.

Table 4-21 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 9. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. For further information, refer to the example provided in this section (page 151) for the EDGE ORFS Due To Modulation DCS Relative Limits—MS command.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Factory Preset: Refer to Table 4-21.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-21 EDGE ORFS Due To Modulation GSM Relative Limits—BTS: Default Values

BS TX Level (Pnn)	Power Level (dBm)	Power (dBm) (n=1 or not stated)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. GSM900 BTS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P43	>43	43.0	+0.5	–30.0	–33.0	–56.0	–70.0	–73.0	–75.0	–80.0
P41	41	41.0	+0.5	–30.0	–33.0	–56.0	–68.0	–71.0	–73.0	–80.0
P39	39	39.0	+0.5	–30.0	–33.0	–56.0	–66.0	–69.0	–71.0	–80.0

Programming Commands

Programming Commands

Table 4-21 EDGE ORFS Due To Modulation GSM Relative Limits—BTS: Default Values

BS TX Level (Pnn)	Power Level (dBm)	Power (dBm) (n=1 or not stated)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. GSM900 BTS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P37	37	37.0	+0.5	–30.0	–33.0	–56.0	–64.0	–67.0	–69.0	–80.0
P35	35	35.0	+0.5	–30.0	–33.0	–56.0	–62.0	–65.0	–67.0	–80.0
P33	<33	33.0	+0.5	–30.0	–33.0	–56.0	–60.0	–63.0	–65.0	–80.0

EDGE ORFS Due To Modulation GSM Relative Limits—MS

:CALCulate:EORFspectr:MODulation:LIMit:GSM|GSM900:MS:<Pnn>[:UPPer]:DATA[n] <amplitude>

:CALCulate:EORFspectr:MODulation:LIMit:GSM|GSM900:MS:<Pnn>[:UPPer]:DATA[n]?

Set or query any of the GSM 900 MS relative limits for the EDGE ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate MS TX Level.

Table 4-22 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 10. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. For further information, refer to the example provided in this section (page 151) for the EDGE ORFS Due To Modulation DCS Relative Limits—MS command.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Factory Preset: Refer to Table 4-22.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-22 EDGE ORFS Due To Modulation GSM Relative Limits—MS: Default Values

MS TX Level (Pnn)	Power Level (dBm)	Power (dBm) (n=1 or not stated)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. GSM900 MS								
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)	100 (n=10)
			30 kHz RBW						100 kHz RBW		
P39	>39	39.0	+0.5	–30.0	–33.0	–60.0	–66.0	–66.0	–69.0	–71.0	–77.0
P37	37	37.0	+0.5	–30.0	–33.0	–60.0	–64.0	–64.0	–67.0	–69.0	–75.0
P35	35	35.0	+0.5	–30.0	–33.0	–60.0	–62.0	–62.0	–65.0	–67.0	–73.0
P33	<33	33.0	+0.5	–30.0	–33.0	–54.0	–60.0	–60.0	–63.0	–65.0	–71.0

EDGE ORFS Due To Modulation GSM Relative Limits—PBTS

```
:CALCulate:EORFspectr:MODulation:LIMit:GSM|GSM900:PBTS:
<Pnn>[:UPPer]:DATA[n] <amplitude>
```

```
:CALCulate:EORFspectr:MODulation:LIMit:GSM|GSM900:PBTS:
<Pnn>[:UPPer]:DATA[n]?
```

Set or query any of the GSM 900 PBTS relative limits for the EDGE ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate BS TX Level.

Table 4-23 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 9. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. For further information, refer to the example provided in this section (page 151) for the EDGE ORFS Due To Modulation DCS Relative Limits—MS command.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Factory Preset: Refer to Table 4-23.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-23 EDGE ORFS Due To Modulation GSM Relative Limits—PBTS: Default Values

BS TX Level (Pnn)	Power Level (dBm)	Power (dBm) (n=1 or not stated)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. GSM900 PBTS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P20	<=20	20.0	+0.5	–30.0	–33.0	–56.0	–60.0	–63.0	–70.0	–80.0

EDGE ORFS Due To Modulation GSM Relative Limits—UBTS

:CALCulate:EORFspectr:MODulation:LIMit:GSM|GSM900:UBTS:<Pnn>[:UPPer]:DATA[n] <amplitude>

:CALCulate:EORFspectr:MODulation:LIMit:GSM|GSM900:UBTS:<Pnn>[:UPPer]:DATA[n]?

Set or query any of the GSM 900 UBTS relative limits for the EDGE ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate BS TX Level.

Table 4-24 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 9. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. For further information, refer to the example provided in this section (page 151) for the EDGE ORFS Due To Modulation DCS Relative Limits—MS command.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Factory Preset: Refer to Table 4-24.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-24 EDGE ORFS Due To Modulation GSM Relative Limits—UBTS: Default Values

BS TX Level (Pnn)	Power Level (dBm)	Power (dBm) (n=1 or not stated)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. GSM900 UBTS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P33	<33	33.0	+0.5	–30.0	–33.0	–56.0	–60.0	–63.0	–70.0	–70.0

Programming Commands

EDGE ORFS Due To Modulation PCS Relative Limits—BTS

:CALCulate:EORFspectr:MODulation:LIMit:PCS|PCS1900:BTS:<Pnn>[:UPPer]:DATA[n] <amplitude>

:CALCulate:EORFspectr:MODulation:LIMit:PCS|PCS1900:BTS:<Pnn>[:UPPer]:DATA[n]?

Set or query any of the GSM 900 BTS relative limits for the EDGE ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate BS TX Level.

Table 4-25 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 9. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. For further information, refer to the example provided in this section (page 151) for the EDGE ORFS Due To Modulation DCS Relative Limits—MS command.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Factory Preset: Refer to Table 4-25.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-25 EDGE ORFS Due To Modulation PCS Relative Limits—BTS: Default Values

BS TX Level (Pnn)	Power Level (dBm)	Power (dBm) (n=1 or not stated)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. PCS1900 BTS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P43	>43	43.0	+0.5	–30.0	–33.0	–56.0	–70.0	–73.0	–75.0	–80.0
P41	41	41.0	+0.5	–30.0	–33.0	–56.0	–68.0	–71.0	–73.0	–80.0
P39	39	39.0	+0.5	–30.0	–33.0	–56.0	–66.0	–69.0	–71.0	–80.0

Table 4-25 EDGE ORFS Due To Modulation PCS Relative Limits—BTS: Default Values

BS TX Level (Pnn)	Power Level (dBm)	Power (dBm) (n=1 or not stated)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. PCS1900 BTS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P37	37	37.0	+0.5	–30.0	–33.0	–56.0	–64.0	–67.0	–69.0	–80.0
P35	35	35.0	+0.5	–30.0	–33.0	–56.0	–62.0	–65.0	–67.0	–80.0
P33	<33	33.0	+0.5	–30.0	–33.0	–56.0	–60.0	–63.0	–65.0	–80.0

EDGE ORFS Due To Modulation PCS Relative Limits—MS

:CALCulate:EORFspectr:MODulation:LIMit:PCS|PCS1900:MS:<Pnn>[:UPPer]:DATA[n] <amplitude>

:CALCulate:EORFspectr:MODulation:LIMit:PCS|PCS1900:MS:<Pnn>[:UPPer]:DATA[n]?

Set or query any of the PCS 1900 MS relative limits for the EDGE ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate BS TX Level.

Table 4-26 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 9. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. For further information, refer to the example provided in this section (page 151) for the EDGE ORFS Due To Modulation DCS Relative Limits—MS command.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Factory Preset: Refer to Table 4-26.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-26 EDGE ORFS Due To Modulation PCS Relative Limits—MS: Default Values

MS TX Level (Pnn)	Power Level (dBm)	Power (dBm) (n=1 or not stated)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. PCS1900 MS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P36	>36	36.0	+0.5	–30.0	–33.0	–60.0	–60.0	–60.0	–71.0	–79.0
P34	34	34 .0	+0.5	–30.0	–33.0	–60.0	–60.0	–60.0	–69.0	–77.0
P32	32	32.0	+0.5	–30.0	–33.0	–60.0	–60.0	–60.0	–67.0	–75.0
P30	30	30.0	+0.5	–30.0	–33.0	–54.0	–60.0	–60.0	–65.0	–73.0
P28	28	28.0	+0.5	–30.0	–33.0	–54.0	–60.0	–60.0	–63.0	–71.0
P26	26	26.0	+0.5	–30.0	–33.0	–54.0	–60.0	–60.0	–61.0	–69.0
P24	<24	24.0	+0.5	–30.0	–33.0	–54.0	–60.0	–60.0	–59.0	–67.0

EDGE ORFS Due To Modulation PCS Relative Limits—PBTS

:CALCulate:EORFspectr:MODulation:LIMit:PCS|PCS1900:PBTS:<Pnn>[:UPPer]:DATA[n] <amplitude>

:CALCulate:EORFspectr:MODulation:LIMit:PCS|PCS1900:PBTS:<Pnn>[:UPPer]:DATA[n]?

Set or query any of the PCS 1900 PBTS relative limits for the EDGE ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate BS TX Level.

Table 4-27 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 9. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. For further information, refer to the example provided in this section (page 151) for the EDGE ORFS Due To Modulation DCS Relative Limits—MS command.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Factory Preset: Refer to Table 4-27.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-27 EDGE ORFS Due To Modulation PCS Relative Limits—PBTS: Default Values

BS TX Level (Pnn)	Power Level (dBm)	Power (dBm) (n=1 or not stated)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. PCS1900 PBTS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P23	>23	23.0	+0.5	–30.0	–33.0	–56.0	–60.0	–63.0	–76.0	–76.0

EDGE ORFS Due To Modulation PCS Relative Limits—UBTS

:CALCulate:EORFspectr:MODulation:LIMit:PCS|PCS1900:UBTS:<Pnn>[:UPPer]:DATA[n] <amplitude>

:CALCulate:EORFspectr:MODulation:LIMit:PCS|PCS1900:UBTS:<Pnn>[:UPPer]:DATA[n]?

Set or query any of the PCS 1900 UBTS relative limits for the EDGE ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate BS TX Level.

Table 4-28 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 9. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. For further information, refer to the example provided in this section (page 151) for the EDGE ORFS Due To Modulation DCS Relative Limits—MS command.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Factory Preset: Refer to Table 4-28.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-28 EDGE ORFS Due To Modulation PCS Relative Limits—UBTS: Default Values

BS TX Level (Pnn)	Power Level (dBm)	Power (dBm) (n=1 or not stated)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. PCS1900 UBTS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P35	35	35.0	+0.5	–30.0	–33.0	–56.0	–62.0	–65.0	–76.0	–76.0
P33	<33	33.0	+0.5	–30.0	–33.0	–56.0	–60.0	–63.0	–76.0	–76.0

EDGE ORFS Due To Switching Transients Absolute Limits Commands—BTS, PBTS, and UBTS

Use the commands in this section to change the EDGE output RF spectrum due to switching transients absolute limits to your own custom limits values.

ORFS limits are generally specified in dB relative to the reference power (ref power). This equates to the absolute power which the result must not exceed. Standards documents also supply an absolute power level—below which the calculated relative limit (ref power – relative limit) will not be applied—for each ORFS type, radio standard, device type and offset frequency.

Therefore the relative limit applies if the calculated limit (ref power – relative limit) is greater than the absolute limit. Otherwise the absolute limit applies.

Example:

If relative limit = –75 dB and absolute limit = –65 dBm.

1.	If the ref power is measured at 43 dBm, then: Upper result limit due to relative limit = 43 – 75 = –32 dBm Upper result limit due to absolute limit = –65 dBm A relative limit of –32 dBm therefore applies.
2.	If the ref power is measured at 0 dBm, then: Upper result limit due to relative limit = 0 – 75 = –75 dBm Upper result limit due to absolute limit = –65 dBm An absolute limit of –65 dBm therefore applies.

Note that for ORFS due to switching transients the above only applies to BTS, UBTS and PBTS devices as MS limits are specified in absolute terms (dBm) only.

The commands are presented according to devices BTS, UBTS1, UBTS2, UBTS3 and PBTS1.

EDGE ORFS Due To Switching Transients Absolute Limits—BTS

:CALCulate:EORFspectr:SWITching:LIMit:<standard>:BTS:ABSolute[:UPPer]:DATA[n] <amplitude>

:CALCulate:EORFspectr:SWITching:LIMit:<standard>:BTS:ABSolute[:UPPer]:DATA[n]?

Set or query any of the absolute BTS related limits for the EDGE ORFS due to switching transients measurement. Replace <standard> in the above command strings with GSM, GSM900, DCS, DCS1800, PCS or PCS1900.

Table 4-29 shows how each <standard> is associated with a value that must be referenced using numeric 1 or 2. Replace n in the above command strings with the appropriate numeric to set or query the desired limit.

Example:

The following command sets the absolute result limit to –40 dBm when testing an E-GSM BTS device for offsets ≥ 1800 kHz (the default value is -36.0 dBm):

:CALCulate:EORFspectr:SWITching:LIMit:GSM:BTS:ABSolute:UPPer:DATA2 -40.0

Factory Preset: Refer to Table 4-29.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-29 EDGE ORFS Due To Switching Transients Absolute Limits Commands—BTS: Default Values

	Standard		
Offset	**GSM/ GSM900**	**DCS/ DCS1800**	**PCS/ PCS1900**
< 1800 kHz (n=1)	–36.0	–36.0	–36.0
≥ 1800 kHz (n=2)	–36.0	–36.0	–36.0

EDGE ORFS Due To Switching Transients Absolute Limits—PBTS1

:CALCulate:EORFspectr:SWITching:LIMit:<standard>:PBTS1:ABSolute[:UPPer]:DATA[n] <amplitude>

:CALCulate:EORFspectr:SWITching:LIMit:<standard>:PBTS1:ABSolute[:UPPer]:DATA[n]?

Set or query any of the absolute PBTS1 related limits for the EDGE ORFS due to switching transients measurement. Replace <standard> in the above command strings with GSM, GSM900, DCS, DCS1800, PCS or PCS1900.

Table 4-30 shows how each <standard> is associated with a value that must be referenced using numeric 1 or 2. Replace n in the above command strings with 1 to set or query the desired limit. For further information, refer to the example provided in this section (page 167) for the EDGE ORFS Due To Switching Transients Absolute Limits—BTS command.

Factory Preset: Refer to Table 4-30.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-30 EDGE ORFS Due To Switching Transients Absolute Limits Commands—PBTS1: Default Values

	Standard		
Offset	**GSM/ GSM900**	**DCS/ DCS1800**	**PCS/ PCS1900**
< 1800 kHz (n=1)	–36.0	–36.0	–36.0
≥ 1800 kHz (n=2)	–36.0	–36.0	–36.0

EDGE ORFS Due To Switching Transients Absolute Limits—UBTS1

:CALCulate:EORFspectr:SWITching:LIMit:<standard>:UBTS1:ABSolute[:UPPer]:DATA[n] <amplitude>

:CALCulate:EORFspectr:SWITching:LIMit:<standard>:UBTS1:ABSolute[:UPPer]:DATA[n]?

Set or query any of the absolute UBTS1 related limits for the EDGE ORFS due to switching transients measurement. Replace <standard> in the above command strings with GSM, GSM900, DCS, DCS1800, PCS or PCS1900.

Table 4-31 shows how each <standard> is associated with a value that must be referenced using numeric 1 or 2. Replace n in the above command strings with 1 to set or query the desired limit. For further information, refer to the example provided in this section (page 167) for the EDGE ORFS Due To Switching Transients Absolute Limits—BTS command.

Factory Preset: Refer to Table 4-31.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-31 EDGE ORFS Due To Switching Transients Absolute Limits Commands—UBTS1: Default Values

	Standard		
Offset	**GSM/ GSM900**	**DCS/ DCS1800**	**PCS/ PCS1900**
< 1800 kHz (n=1)	–36.0	–36.0	–36.0
≥ 1800 kHz (n=2)	–36.0	–36.0	–36.0

EDGE ORFS Due To Switching Transients Absolute Limits—UBTS2

:CALCulate:EORFspectr:SWITching:LIMit:<standard>:UBTS2:ABSolute[:UPPer]:DATA[n] <amplitude>

:CALCulate:EORFspectr:SWITching:LIMit:<standard>:UBTS2:ABSolute[:UPPer]:DATA[n]?

Set or query any of the absolute UBTS2 related limits for the EDGE ORFS due to switching transients measurement. Replace <standard> in the above command strings with GSM, GSM900, DCS, DCS1800, PCS or PCS1900.

Table 4-32 shows how each <standard> is associated with a value that must be referenced using numeric 1 or 2. Replace n in the above command strings with 1 to set or query the desired limit. For further information, refer to the example provided in this section (page 167) for the EDGE ORFS Due To Switching Transients Absolute Limits—BTS command.

Factory Preset: Refer to Table 4-32.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-32 EDGE ORFS Due To Switching Transients Absolute Limits Commands—UBTS2: Default Values

	Standard		
Offset	**GSM/ GSM900**	**DCS/ DCS1800**	**PCS/ PCS1900**
< 1800 kHz (n=1)	–36.0	–36.0	–36.0
≥ 1800 kHz (n=2)	–36.0	–36.0	–36.0

EDGE ORFS Due To Switching Transients Absolute Limits—UBTS3

:CALCulate:EORFspectr:SWITching:LIMit:<standard>:UBTS3:ABSolute[:UPPer]:DATA[n] <amplitude>

:CALCulate:EORFspectr:SWITching:LIMit:<standard>:UBTS3:ABSolute[:UPPer]:DATA[n]?

Set or query any of the absolute UBTS3 related limits for the EDGE ORFS due to switching transients measurement. Replace <standard> in the above command strings with GSM, GSM900, DCS, DCS1800, PCS or PCS1900.

Table 4-33 shows how each <standard> is associated with a value that must be referenced using numeric 1 or 2. Replace n in the above command strings with 1 to set or query the desired limit. For further information, refer to the example provided in this section (page 167) for the EDGE ORFS Due To Switching Transients Absolute Limits—BTS command.

Factory Preset: Refer to Table 4-33.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-33 EDGE ORFS Due To Switching Transients Absolute Limits Commands—UBTS3: Default Values

	Standard		
Offset	**GSM/ GSM900**	**DCS/ DCS1800**	**PCS/ PCS1900**
< 1800 kHz (n=1)	–36.0	–36.0	–36.0
≥ 1800 kHz (n=2)	–36.0	–36.0	–36.0

EDGE ORFS Due To Switching Transients Relative Limits Commands—BTS, PBTS and UBTS

Use the commands in this section to change the EDGE output RF spectrum due to switching transients relative limits to your own custom limits values.

ORFS limits are generally specified in dB relative to the reference power (ref power). This equates to the absolute power which the result must not exceed. Standards documents also supply an absolute power level—below which the calculated relative limit (ref power – relative limit) will not be applied—for each ORFS type, radio standard, device type and offset frequency.

Therefore the relative limit applies if the calculated limit (ref power – relative limit) is greater than the absolute limit. Otherwise the absolute limit applies.

Example:

If relative limit = –75 dB and absolute limit = –65 dBm.

1.	If the ref power is measured at 43 dBm, then: Upper result limit due to relative limit = 43 – 75 = –32 dBm Upper result limit due to absolute limit = –65 dBm A relative limit of –32 dBm therefore applies.
2.	If the ref power is measured at 0 dBm, then: Upper result limit due to relative limit = 0 – 75 = –75 dBm Upper result limit due to absolute limit = –65 dBm An absolute limit of –65 dBm therefore applies.

Note that for ORFS due to switching transients the above only applies to BTS, PBTS and UBTS devices as MS limits are specified in absolute terms (dBm) only.

EDGE ORFS Due To Switching Transients Relative Limits—DCS

:CALCulate:EORFspectr:SWITching:LIMit:DCS|DCS1800 :BTS|PBTS|UBTS[:UPPer]:DATA[n] <amplitude>

:CALCulate:EORFspectr:SWITching:LIMit:DCS|DCS1800 :BTS|PBTS|UBTS[:UPPer]:DATA[n]?

Set or query any of the relative DCS related limits for the EDGE ORFS due to switching transients measurement.

Programming Commands

Table 4-34 shows how each <device> is associated with a value that must be referenced using a numeric from 1 to 5. Replace n in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. Note that entries in the Power column (n=1) are currently not used. For further information, refer to the example provided in this section (page 173) for the EDGE ORFS Due To Switching Transients Relative Limits—GSM command.

Factory Preset: Refer to Table 4-34.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-34 EDGE ORFS Due To Switching Transients Relative Limits—DCS: Default Values

		Offset Frequency (kHz)			
Device	**Power (n=1)**	**400 (n=2)**	**600 (n=3)**	**1200 (n=4)**	**1800 (n=5)**
BTS	0.0 dB	–50.0 dB	–58.0 dB	–66.0 dB	–66.0 dB
UBTS	0.0 dB	–50.0 dB	–58.0 dB	–66.0 dB	–66.0 dB
PBTS	0.0 dB	–50.0 dB	–58.0 dB	–66.0 dB	–66.0 dB

EDGE ORFS Due To Switching Transients Relative Limits—GSM

:CALCulate:EORFspectr:SWITching:LIMit:GSM|GSM900 :BTS|PBTS|UBTS[:UPPer]:DATA[n] <amplitude>

:CALCulate:EORFspectr:SWITching:LIMit:GSM|GSM900 :BTS|PBTS|UBTS[:UPPer]:DATA[n]?

Set or query any of the relative GSM related limits for the EDGE ORFS due to switching transients measurement.

Table 4-35 shows how each <device> is associated with a value that must be referenced using a numeric from 1 to 5. Replace n in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. Note that entries in the Power column (n=1) are currently not used.

Example:

The following command sets the relative result limit to –70 dB (the default value is –74.0 dB) when testing a GSM BTS device at 1200 kHz offset:

:CALCulate:EORFspectr:SWITching:LIMit:GSM:BTS:UPPer :DATA4 –70.0

Factory Preset: Refer to Table 4-35.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-35 EDGE ORFS Due To Switching Transients Relative Limits—GSM: Default Values

		Offset Frequency (kHz)			
Device	**Power (n=1)**	**400 (n=2)**	**600 (n=3)**	**1200 (n=4)**	**1800 (n=5)**
BTS	0.0 dB	–52.0 dB	–62.0 dB	–74.0 dB	–74.0 dB
UBTS	0.0 dB	–52.0 dB	–62.0 dB	–74.0 dB	–74.0 dB
PBTS	0.0 dB	–52.0 dB	–62.0 dB	–74.0 dB	–74.0 dB

EDGE ORFS Due To Switching Transients Relative Limits—PCS

:CALCulate:EORFspectr:SWITching:LIMit:PCS|PCS1900 :BTS|PBTS|UBTS[:UPPer]:DATA[n] <amplitude>

:CALCulate:EORFspectr:SWITching:LIMit:PCS|PCS1900 :BTS|PBTS|UBTS[:UPPer]:DATA[n]?

Set or query any of the relative PCS related limits for the EDGE ORFS due to switching transients measurement.

Table 4-36 shows how each <device> is associated with a value that must be referenced using a numeric from 1 to 5. Replace n in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. Note that entries in the Power column (n=1) are currently not used. For further information, refer to the example provided in this section (page 173) for the EDGE ORFS Due To Switching Transients Relative Limits—GSM command.

Factory Preset: Refer to Table 4-36.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-36 EDGE ORFS Due To Switching Transients Relative Limits—PCS: Default Values

		Offset Frequency (kHz)			
Device	**Power (n=1)**	**400 (n=2)**	**600 (n=3)**	**1200 (n=4)**	**1800 (n=5)**
BTS	0.0 dB	–50.0 dB	–58.0 dB	–66.0 dB	–66.0 dB
UBTS	0.0 dB	–50.0 dB	–58.0 dB	–66.0 dB	–66.0 dB
PBTS	0.0 dB	–50.0 dB	–58.0 dB	–66.0 dB	–66.0 dB

EDGE ORFS Due To Switching Transients Absolute Limits Commands—MS

Use the commands in this section to change the EDGE output RF spectrum due to switching transients limits for MS devices, to your own custom limits values. The output RF spectrum due to switching transients test for MS devices, uses limits that are specified in absolute units—that is, dBm.

Note that the limit applied—as shown in the table that accompanies each command—depends on the total carrier power. If the measured carrier power lies between these discrete power values, the limit value is linearly interpolated. If it lies above or below the range specified, the upper or lower limit set are used respectively.

EDGE ORFS Due To Switching Transients DCS MS Limits

:CALCulate:EORFspectr:SWITching:LIMit:DCS|DCS1800:MS:<Pnn> [:ABSolute][:UPPer]:DATA[n] <amplitude>

:CALCulate:EORFspectr:SWITching:LIMit:DCS|DCS1800:MS:<Pnn> [:ABSolute][:UPPer]:DATA[n]?

Set or query any of the DCS MS absolute limit related commands for the EDGE ORFS due to switching transients measurement. Replace <Pnn> in the above command strings with the appropriate MS TX Level. The measured total carrier power will determine which row of limits will be applied.

Table 4-37 shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 5. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. You can also change the values in the Power column (n=1) to alter the carrier power required for each set of limits. For further information, refer to the example provided earlier in this section for the ORFS Due To Modulation Absolute Limits—MS command.

Factory Preset: Refer to Table 4-37.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-37 EDGE ORFS Due To Switching Transients DCS MS Limits: Default Values

			Offset Frequency (kHz)			
Pnn	**Power Level (dBm)**	**Power (dBm) (n=1)**	**400 (n=2)**	**600 (n=3)**	**1200 (n=4)**	**1800 (n=5)**
36	36	36.0 dBm	–16.0 dBm	–21.0 dBm	–21.0 dBm	–24.0 dBm
34	34	34.0 dBm	–18.0 dBm	–21.0 dBm	–21.0 dBm	–24.0 dBm
32	32	32.0 dBm	–20.0 dBm	–22.0 dBm	–22.0 dBm	–25.0 dBm
30	30	30.0 dBm	–22.0 dBm	–24.0 dBm	–24.0 dBm	–27.0 dBm
28	28	28.0 dBm	–23.0 dBm	–25.0 dBm	–26.0 dBm	–29.0 dBm
26	26	26.0 dBm	–23.0 dBm	–26.0 dBm	–28.0 dBm	–31.0 dBm
24	24	24.0 dBm	–23.0 dBm	–26.0 dBm	–30.0 dBm	–33.0 dBm
22	22	22.0 dBm	–23.0 dBm	–26.0 dBm	–31.0 dBm	–35.0 dBm
20	20	20.0 dBm	–23.0 dBm	–26.0 dBm	–32.0 dBm	–36.0 dBm

EDGE ORFS Due To Switching Transients GSM MS Limits

:CALCulate:EORFspectr:SWITching:LIMit:GSM|GSM900:MS:<Pnn>[:ABSolute][:UPPer]:DATA[n] <amplitude>

:CALCulate:EORFspectr:SWITching:LIMit:GSM|GSM900:MS:<Pnn>[:ABSolute][:UPPer]:DATA[n]?

Set or query any of the GSM MS related absolute limits for the EDGE ORFS due to switching transients measurement. Replace <Pnn> in the above command strings with the appropriate MS TX Level. The measured total carrier power will determine which row of limits will be applied.

Table 4-38 shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 5. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. You can also change the values in the Power column (n=1) to alter the carrier power required for each set of limits.

Example 1:

The following command sets the result limit to –10.0 dBm (the default value is –13.0 dBm) when testing a GSM MS device, total carrier power 39 dBm, at 400 kHz offset:

```
:CALCulate:EORFspectr:SWITching:LIMit:GSM:MS:P39:ABSolute
:UPPer:DATA2 –10.0
```

Example 2:

The following command configures the limits to use the P39 limits when the total carrier power level is +38dBm (instead of the default +39.0 dBm) when testing a GSM MS device:

```
:CALCulate:EORFspectr:SWITching:LIMit:GSM:MS:P39:ABSolute
:UPPer:DATA1 38.0
```

Factory Preset: Refer to Table 4-38.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-38 EDGE ORFS Due To Switching Transients GSM MS Limits: Default Values

			Offset Frequency (kHz)			
Pnn	**Power Level (dBm)**	**Power (dBm) (n=1)**	**400 (n=2)**	**600 (n=3)**	**1200 (n=4)**	**1800 (n=5)**
39	39	39.0 dBm	–13.0 dBm	–21.0 dBm	–21.0 dBm	–24.0 dBm
37	37	37.0 dBm	–15.0 dBm	–21.0 dBm	–21.0 dBm	–24.0 dBm
35	35	35.0 dBm	–17.0 dBm	–21.0 dBm	–21.0 dBm	–24.0 dBm
33	33	33.0 dBm	–19.0 dBm	–21.0 dBm	–21.0 dBm	–24.0 dBm
31	31	31.0 dBm	–21.0 dBm	–23.0 dBm	–23.0 dBm	–26.0 dBm
29	29	29.0 dBm	–23.0 dBm	–25.0 dBm	–25.0 dBm	–28.0 dBm
27	27	27.0 dBm	–23.0 dBm	–26.0 dBm	–27.0 dBm	–30.0 dBm
25	25	25.0 dBm	–23.0 dBm	–26.0 dBm	–29.0 dBm	–32.0 dBm
23	23	23.0 dBm	–23.0 dBm	–26.0 dBm	–31.0 dBm	–34.0 dBm
21	21	21.0 dBm	–23.0 dBm	–26.0 dBm	–32.0 dBm	–36.0 dBm

EDGE ORFS Due To Switching Transients PCS MS Limits

:CALCulate:EORFspectr:SWITching:LIMit:PCS|PCS1900:MS:<Pnn>[:ABSolute][:UPPer]:DATA[n] <amplitude>

:CALCulate:EORFspectr:SWITching:LIMit:PCS|PCS1900:MS:<Pnn>[:ABSolute][:UPPer]:DATA[n]?

Set or query any of the PCS MS absolute limit related commands for the EDGE ORFS due to switching transients measurement. Replace <Pnn> in the above command strings with the appropriate MS TX Level. The measured total carrier power will determine which row of limits will be applied.

Table 4-39 shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 5. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. You can also change the values in the Power column (n=1) to alter the carrier power required for each set of limits. For further information, refer to the example provided earlier in this section for the ORFS Due To Modulation Absolute Limits—MS command.

Factory Preset: Refer to Table 4-39.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-39 EDGE ORFS Due To Switching Transients PCS MS Limits: Default Values

			Offset Frequency (kHz)			
Pnn	**Power Level (dBm)**	**Power (dBm) (n=1)**	**400 (n=2)**	**600 (n=3)**	**1200 (n=4)**	**1800 (n=5)**
36	36	36.0 dBm	–16.0 dBm	–21.0 dBm	–21.0 dBm	–24.0 dBm
34	34	34.0 dBm	–18.0 dBm	–21.0 dBm	–21.0 dBm	–24.0 dBm
32	32	32.0 dBm	–20.0 dBm	–22.0 dBm	–22.0 dBm	–25.0 dBm
30	30	30.0 dBm	–22.0 dBm	–24.0 dBm	–24.0 dBm	–27.0 dBm
28	28	28.0 dBm	–23.0 dBm	–25.0 dBm	–26.0 dBm	–29.0 dBm
26	26	26.0 dBm	–23.0 dBm	–26.0 dBm	–28.0 dBm	–31.0 dBm

Table 4-39 EDGE ORFS Due To Switching Transients PCS MS Limits: Default Values

			Offset Frequency (kHz)			
Pnn	**Power Level (dBm)**	**Power (dBm) (n=1)**	**400 (n=2)**	**600 (n=3)**	**1200 (n=4)**	**1800 (n=5)**
24	24	24.0 dBm	–23.0 dBm	–26.0 dBm	–30.0 dBm	–33.0 dBm
22	22	22.0 dBm	–23.0 dBm	–26.0 dBm	–31.0 dBm	–35.0 dBm
20	20	20.0 dBm	–23.0 dBm	–26.0 dBm	–32.0 dBm	–36.0 dBm

CALCulate:MARKers Subsystem

This subsystem is documented in the ESA User's and Programmer's Reference. The GMSK phase and frequency, GMSK and EDGE output RF spectrum, and EDGE error vector magnitude measurements do not support the use of markers.

Markers can be put on your displayed measurement data to supply information about specific points on the data. Some of the things that markers can be used to measure include: precise frequency at a point, minimum or maximum amplitude, and the difference in amplitude or frequency between two points.

When using the marker commands you must specify the measurement in the SCPI command. We recommend that you use the marker commands only on the current measurement. Many marker commands will return invalid results, when used on a measurement that is not current. (This is true for commands that do more than simply setting or querying an instrument parameter.) No error is reported for these invalid results.

You must make sure that the measurement is completed before trying to query the marker value. Using the MEASure or READ command, before the marker command, forces the measurement to complete before allowing the next command to be executed.

Each measurement has its own instrument state for marker parameters. Therefore, if you exit the measurement, the marker settings in each measurement are saved and are then recalled when you change back to that measurement.

GSM (with EDGE) Mode - <measurement> key words

- CFLocation - markers available
- EEVM - no markers
- EORFspectr - no markers
- EPVTime - markers available
- MONitor - markers available
- OOBSpur - markers available
- ORFSpectrum - no markers
- PFERror - no markers
- PSTeps - markers available
- PVTime - markers available
- RSPur - markers available
- TSPur - markers available
- TXPower - no markers

Example:

Suppose you are using the Spectrum measurement in your measurement personality. To position marker 2 at the maximum peak value of the trace that marker 2 is currently on, the command is:

:CALCulate:SPECtrum:MARKer2:MAXimum

You must make sure that the measurement is completed before trying to query the marker value. Use the MEASure or READ command before using the marker command. This forces the measurement to complete before allowing the next command to be executed.

Markers All Off on All Traces

:CALCulate:<measurement>:MARKer:AOFF

Turns off all markers on all the traces in the specified measurement.

Example: **CALC:SPEC:MARK:AOFF**

Remarks: The keyword for the current measurement must be specified in the command. (Some examples include: SPECtrum, WAVeform)

Front Panel Access: **Marker, More, Marker All Off**

Marker Mode

:CALCulate:<measurement>:MARKer[1]|2|3|4:MODE POSition|DELTa|OFF

:CALCulate:<measurement>:MARKer[1]|2|3|4:MODE?

Selects the type of markers that you want to activate.

Position – selects a normal marker that can be positioned on a trace and from which trace information will be generated.

Delta – When a Marker is set to Delta, the next marker is used as the Reference Marker and its Mode is set to Normal (POSition). The value of the Delta Marker is the relative value from the Reference Marker. When Marker4 is set to Delta, Marker1 is used as the Reference Marker.

Front Panel Access: **Marker, Off**

Marker, Normal

Marker, Delta

Marker State

:CALCulate:<measurement>:MARKer[1]|2|3|4[:STATe] OFF|ON|0|1

:CALCulate:<measurement>:MARKer[1]|2|3|4[:STATe]?

Turns the selected marker on or off.

The marker must have already been assigned to a trace. Use **:CALCulate:<measurement>:MARKer[1]|2|3|4:TRACe** to assign a marker to a particular trace.

Example: **CALC:CFL:MARK2: on**

Remarks: The keyword for the current measurement must be specified in the command. (Some examples include: SPECtrum, AREFerence, CFLocation, WAVeform)

You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Marker, Select** then **Marker Normal**

Marker X Value

:CALCulate:<measurement>:MARKer[1]|2|3|4:X <param>

:CALCulate:<measurement>:MARKer[1]|2|3|4:X?

Position the designated marker on its assigned trace at the specified X value. The parameter value is in X-axis units (which is often frequency or time).

The query returns the current X value of the designated marker. The measurement must be completed before querying the marker.

Example: **CALC:CFL:MARK2:X 10.00 m**

Default Unit: Matches the units of the trace on which the marker is positioned

Remarks: The keyword for the current measurement must be specified in the command. (Some examples include: LPLot, ACP, CFLocation,WAVeform)

You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Marker, <active marker>, RPG**

Marker Readout Y Value

:CALCulate:<measurement>:MARKer[1]|2|3|4:Y?

Readout the current Y value for the designated marker on its assigned trace. The value is in the Y-axis units for the trace (which is often dBm).

The measurement must be completed before querying the marker.

Example: **CALC:CFL:MARK1:Y?**

Default Unit: Matches the units of the trace on which the marker is positioned

Remarks: The keyword for the current measurement must be specified in the command. (Some examples include: LPLot, ACP, CFLocation, WAVeform)

You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Out Of Band Spurious Emissions (OOBS) Absolute Limits Commands

The commands in this section are presented according to the following devices: MS, BTS, UBTS1, UBTS2, UBTS3 and PBTS1.

OOBS Absolute Limits Commands—BTS

:CALCulate:OOBSpur:LIMit:<standard>:BS|BTS[:UPPer]:DATA[n] <amplitude>

:CALCulate:OOBSpur:LIMit:<standard>:BS|BTS[:UPPer]:DATA[n]?

Set or query any of the MS related limits for the out of band spurious measurement. Replace <standard> in the above command strings with the appropriate keyword or abbreviated keyword from the table below.

Table 4-40 Valid GSM Standards Used in the SCPI Command

Frequency Band Standard	SCPI Keyword	Abbreviated SCPI Keyword
GSM 450	GSM450	none
GSM 480	GSM480	none
GSM 850	GSM850	none
P-GSM 900	PGSM900	PGSM
E-GSM 900	EGSM900	EGSM
R-GSM 900	RGSM900	RGSM
DCS 1800	DCS1800	DCS
PCS 1900	PCS1900	PCS

Table 4-41 shows how each <standard> is associated with a value that must be referenced using a numeric from 1 to 6. Replace n in the above command strings with the appropriate numeric to set or query the desired limit.

Factory Preset: Limit values default to the GSM450 / GSM480 / GSM850 / PGSM900 / EGSM900 / RGSM900 / DCS1800 / PCS1900 standards as shown in Table 4-41.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel

Access: None

Table 4-41 Out Of Band Spurious Absolute Limits Commands—BTS: Default Values

	Standard							
Frequency	**GSM 450**	**GSM 480**	**GSM 850**	**PGSM 900**	**EGSM 900**	**RGSM 900**	**DCS 1800**	**PCS 1900**
≤ 1 GHz absolute frequency	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)
> 1 GHz absolute frequency	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)
GSM850 Tx band limit (869 - 894 MHz)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	–57.0 (N=3)
DCS Tx band limit (1805 - 1880 MHz)	–47.0 (n=3)	–47.0 (n=3)	N/A	–47.0 (n=3)	–47.0 (n=3)	–47.0 (n=3)	N/A	N/A
PCS Tx band limit (1930 - 1990 MHz)	N/A	N/A	–47.0 (n=3)	N/A	N/A	N/A	N/A	N/A
R-GSM Tx band limit (921 - 960 MHz)	–57.0 (n=4)	–57.0 (n=4)	N/A	N/A	N/A	N/A	–57.0 (n=3)	N/A
GSM750 Tx band limit (747 - 762 MHz)	N/A	N/A	–57.0 (n=4)	N/A	N/A	N/A	N/A	–57.0 (n=4)
GSM450 Tx band limit (460.4 - 467.6 MHz)	N/A	N/A	N/A	–36.0 (n=4)	–36.0 (n=4)	–36.0 (n=4)	–36.0 (n=4)	N/A
GSM480 Tx band limit (488.8 - 496.0 MHz)	N/A	N/A	N/A	–36.0 (n=5)	–36.0 (n=5)	–36.0 (n=5)	–36.0 (n=5)	N/A
UTRA Tx and Rx limits	–62.0 (n=5)	–62.0 (n=5)	N/A	–62.0 (n=6)	–62.0 (n=6)	–62.0 (n=6)	–62.0 (n=6)	N/A
	Standard							
Frequency	GSM 450	GSM 480	GSM 850	PGSM 900	EGSM 900	RGSM 900	DCS 1800	PCS 1900

OOBS Emissions Absolute Limits Commands—MS

:CALCulate:OOBSpur:LIMit:<standard>:MS[:UPPer]:DATA[n] <amplitude>

:CALCulate:OOBSpur:LIMit:<standard>:MS[:UPPer]:DATA[n]?

Set or query any of the MS related limits for the out of band spurious measurement. Replace <standard> in the above command strings with the appropriate keyword or abbreviated keyword from the table below.

Table 4-42 Valid GSM Standards Used in the SCPI Command

Frequency Band Standard	SCPI Keyword	Abbreviated SCPI Keyword
GSM 450	GSM450	none
GSM 480	GSM480	none
GSM 850	GSM850	none
P-GSM 900	PGSM900	PGSM
E-GSM 900	EGSM900	EGSM
R-GSM 900	RGSM900	RGSM
DCS 1800	DCS1800	DCS
PCS 1900	PCS1900	PCS

Table 4-43 shows how each <standard> is associated with a value that must be referenced using a numeric from 1 to 5. Replace n in the above command strings with the appropriate numeric to set or query the desired limit.

Factory Preset: Limit values default to the GSM450 / GSM480 / GSM850 / PGSM900 / EGSM900 / RGSM900 / DCS1800 / PCS1900 standards as shown in Table 4-43.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-43 Out Of Band Spurious Absolute Limits Commands—MS: Default Values

	Standard							
Frequency	**GSM 450**	**GSM 480**	**GSM 850**	**PGSM 900**	**EGSM 900**	**RGSM 900**	**DCS 1800**	**PCS 1900**
For MS allocated: ≤ 1 GHz absolute frequency	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)
For MS allocated: > 1 GHz absolute frequency	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)
For MS idle: ≤ 1 GHz absolute frequency	–57.0 (n=3)	–57.0 (n=3)	–57.0 (n=3)	–57.0 (n=3)	–57.0 (n=3)	–57.0 (n=3)	–57.0 (n=3)	–57.0 (n=3)
For MS idle: > 1 GHz absolute frequency	–47.0 (n=4)	–47.0 (n=4)	–47.0 (n=4)	–47.0 (n=4)	–47.0 (n=4)	–47.0 (n=4)	–47.0 (n=4)	–47.0 (n=4)
For MS idle: GSM450 Tx band limit (450.4 - 457.6)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For MS idle: GSM480 Tx band limit (478.8 - 486.0)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For MS idle: GSM850 Tx band limit (824 - 849)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For MS idle: E-GSM Tx band limit (880 - 915 MHz)	–59.0 (n=5)	–59.0 (n=5)	N/A	–59.0 (n=5)	–59.0 (n=5)	–59.0 (n=5)	–59.0 (n=5)	N/A
For MS idle: DCS Tx band limit (1710 - 1785 MHz)	–53.0 (n=6)	–53.0 (n=6)	N/A	–53.0 (n=6)	–53.0 (n=6)	–53.0 (n=6)	–53.0 (n=6)	N/A
For MS idle: PCS Tx Band Limit (1850 - 1910 MHz)	N/A	N/A	–53.0 (n=5)	N/A	N/A	N/A	N/A	–53.0 (n=5)

OOBS Emissions Absolute Limits Commands—PBTS1

:CALCulate:OOBSpur:LIMit:<standard>:PBTS1[:UPPer]:DATA[n] <amplitude>

:CALCulate:OOBSpur:LIMit:<standard>:PBTS1[:UPPer]:DATA[n]?

Set or query any of the PBTS1 related limits for the out of band spurious measurement. Replace <standard> in the above command strings with the appropriate keyword or abbreviated keyword from the table below.

Table 4-44 Valid GSM Standards Used in the SCPI Command

Frequency Band Standard	SCPI Keyword	Abbreviated SCPI Keyword
GSM 450	GSM450	none
GSM 480	GSM480	none
GSM 850	GSM850	none
P-GSM 900	PGSM900	PGSM
E-GSM 900	EGSM900	EGSM
R-GSM 900	RGSM900	RGSM
DCS 1800	DCS1800	DCS
PCS 1900	PCS1900	PCS

Table 4-45 shows how each <standard> is associated with a value that must be referenced using a numeric from 1 to 6. Replace n in the above command strings with the appropriate numeric to set or query the desired limit.

Factory Preset: Limit values default to the GSM450 / GSM480 / GSM850 / PGSM900 / EGSM900 / RGSM900 / DCS1800 / PCS1900 standards as shown in Table 4-45.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-45 Out Of Band Spurious Absolute Limits Commands—PBTS1: Default Values

	Standard							
Frequency	**GSM 450**	**GSM 480**	**GSM 850**	**PGSM 900**	**EGSM 900**	**RGSM 900**	**DCS 1800**	**PCS 1900**
≤ 1 GHz absolute frequency	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)
> 1 GHz absolute frequency	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)
GSM850 Tx band limit (869 - 894 MHz)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	–57.0 (N=3)
DCS Tx band limit (1805 - 1880 MHz)	–47.0 (n=3)	–47.0 (n=3)	N/A	–47.0 (n=3)	–47.0 (n=3)	–47.0 (n=3)	N/A	N/A
PCS Tx band limit (1930 - 1990 MHz)	N/A	N/A	–47.0 (n=3)	N/A	N/A	N/A	N/A	N/A
R-GSM Tx band limit (921 - 960 MHz)	–57.0 (n=4)	–57.0 (n=4)	N/A	N/A	N/A	N/A	–57.0 (n=3)	N/A
GSM750 Tx band limit (747 - 762 MHz)	N/A	N/A	–57.0 (n=4)	N/A	N/A	N/A	N/A	–57.0 (n=4)
GSM450 Tx band limit (460.4 - 467.6 MHz)	N/A	N/A	N/A	–36.0 (n=4)	–36.0 (n=4)	–36.0 (n=4)	–36.0 (n=4)	N/A
GSM480 Tx band limit (488.8 - 496.0 MHz)	N/A	N/A	N/A	–36.0 (n=5)	–36.0 (n=5)	–36.0 (n=5)	–36.0 (n=5)	N/A
UTRA Tx and Rx limits	–62.0 (n=5)	–62.0 (n=5)	N/A	–62.0 (n=6)	–62.0 (n=6)	–62.0 (n=6)	–62.0 (n=6)	N/A

OOBS Absolute Limits Commands—UBTS1

:CALCulate:OOBSpur:LIMit:<standard>:UBTS1[:UPPer]:DATA[n] <amplitude>

:CALCulate:OOBSpur:LIMit:<standard>:UBTS1[:UPPer]:DATA[n]?

Set or query any of the UBTS1 related limits for the out of band spurious measurement. Replace <standard> in the above command

Programming Commands

strings with the appropriate keyword or abbreviated keyword from the table below.

Table 4-46 Valid GSM Standards Used in the SCPI Command

Frequency Band Standard	SCPI Keyword	Abbreviated SCPI Keyword
GSM 450	GSM450	none
GSM 480	GSM480	none
GSM 850	GSM850	none
P-GSM 900	PGSM900	PGSM
E-GSM 900	EGSM900	EGSM
R-GSM 900	RGSM900	RGSM
DCS 1800	DCS1800	DCS
PCS 1900	PCS1900	PCS

Table 4-47 shows how each <standard> is associated with a value that must be referenced using a numeric from 1 to 6. Replace n in the above command strings with the appropriate numeric to set or query the desired limit.

Factory Preset: Limit values default to the GSM450 / GSM480 / GSM850 / PGSM900 / EGSM900 / RGSM900 / DCS1800 / PCS1900 standards as shown in Table 4-47.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-47 Out Of Band Spurious Absolute Limits Commands—UBTS1: Default Values

	Standard							
Frequency	**GSM 450**	**GSM 480**	**GSM 850**	**PGSM 900**	**EGSM 900**	**RGSM 900**	**DCS 1800**	**PCS 1900**
≤ 1 GHz absolute frequency	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)

Table 4-47 **Out Of Band Spurious Absolute Limits Commands—UBTS1: Default Values**

	Standard							
Frequency	**GSM 450**	**GSM 480**	**GSM 850**	**PGSM 900**	**EGSM 900**	**RGSM 900**	**DCS 1800**	**PCS 1900**
> 1 GHz absolute frequency	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)
GSM850 Tx band limit (869 - 894 MHz)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	–57.0 (N=3)
DCS Tx band limit (1805 - 1880 MHz)	–47.0 (n=3)	–47.0 (n=3)	N/A	–47.0 (n=3)	–47.0 (n=3)	–47.0 (n=3)	N/A	N/A
PCS Tx band limit (1930 - 1990 MHz)	N/A	N/A	–47.0 (n=3)	N/A	N/A	N/A	N/A	N/A
R-GSM Tx band limit (921 - 960 MHz)	–57.0 (n=4)	–57.0 (n=4)	N/A	N/A	N/A	N/A	–57.0 (n=3)	N/A
GSM750 Tx band limit (747 - 762 MHz)	N/A	N/A	–57.0 (n=4)	N/A	N/A	N/A	N/A	–57.0 (n=4)
GSM450 Tx band limit (460.4 - 467.6 MHz)	N/A	N/A	N/A	–36.0 (n=4)	–36.0 (n=4)	–36.0 (n=4)	–36.0 (n=4)	N/A
GSM480 Tx band limit (488.8 - 496.0 MHz)	N/A	N/A	N/A	–36.0 (n=5)	–36.0 (n=5)	–36.0 (n=5)	–36.0 (n=5)	N/A
UTRA Tx and Rx limits	–62.0 (n=5)	–62.0 (n=5)	N/A	–62.0 (n=6)	–62.0 (n=6)	–62.0 (n=6)	–62.0 (n=6)	N/A

OOBS Emissions Absolute Limits Commands—UBTS2

:CALCulate:OOBSpur:LIMit:<standard>:UBTS2[:UPPer]:DATA[n] <amplitude>

:CALCulate:OOBSpur:LIMit:<standard>:UBTS2[:UPPer]:DATA[n]?

Set or query any of the UBTS2 related limits for the out of band spurious measurement. Replace <standard> in the above command strings with the appropriate keyword or abbreviated keyword from the table below.

Table 4-48 Valid GSM Standards Used in the SCPI Command

Frequency Band Standard	SCPI Keyword	Abbreviated SCPI Keyword
GSM 450	GSM450	none
GSM 480	GSM480	none
GSM 850	GSM850	none
P-GSM 900	PGSM900	PGSM
E-GSM 900	EGSM900	EGSM
R-GSM 900	RGSM900	RGSM
DCS 1800	DCS1800	DCS
PCS 1900	PCS1900	PCS

Table 4-49 shows how each <standard> is associated with a value that must be referenced using a numeric from 1 to 6. Replace n in the above command strings with the appropriate numeric to set or query the desired limit.

Factory Preset: Limit values default to the GSM450 / GSM480 / GSM850 / PGSM900 / EGSM900 / RGSM900 / DCS1800 / PCS1900 standards as shown in Table 4-49.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-49 Out Of Band Spurious Absolute Limits Commands—UBTS2: Default Values

	Standard							
Frequency	**GSM 450**	**GSM 480**	**GSM 850**	**PGSM 900**	**EGSM 900**	**RGSM 900**	**DCS 1800**	**PCS 1900**
≤ 1 GHz absolute frequency	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)

Table 4-49 Out Of Band Spurious Absolute Limits Commands—UBTS2: Default Values

	Standard							
Frequency	**GSM 450**	**GSM 480**	**GSM 850**	**PGSM 900**	**EGSM 900**	**RGSM 900**	**DCS 1800**	**PCS 1900**
> 1 GHz absolute frequency	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)
GSM850 Tx band limit (869 - 894 MHz)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	–57.0 (N=3)
DCS Tx band limit (1805 - 1880 MHz)	–47.0 (n=3)	–47.0 (n=3)	N/A	–47.0 (n=3)	–47.0 (n=3)	–47.0 (n=3)	N/A	N/A
PCS Tx band limit (1930 - 1990 MHz)	N/A	N/A	–47.0 (n=3)	N/A	N/A	N/A	N/A	N/A
R-GSM Tx band limit (921 - 960 MHz)	–57.0 (n=4)	–57.0 (n=4)	N/A	N/A	N/A	N/A	–57.0 (n=3)	N/A
GSM750 Tx band limit (747 - 762 MHz)	N/A	N/A	–57.0 (n=4)	N/A	N/A	N/A	N/A	–57.0 (n=4)
GSM450 Tx band limit (460.4 - 467.6 MHz)	N/A	N/A	N/A	–36.0 (n=4)	–36.0 (n=4)	–36.0 (n=4)	–36.0 (n=4)	N/A
GSM480 Tx band limit (488.8 - 496.0 MHz)	N/A	N/A	N/A	–36.0 (n=5)	–36.0 (n=5)	–36.0 (n=5)	–36.0 (n=5)	N/A
UTRA Tx and Rx limits	–62.0 (n=5)	–62.0 (n=5)	N/A	–62.0 (n=6)	–62.0 (n=6)	–62.0 (n=6)	–62.0 (n=6)	N/A

OOBS Emissions Absolute Limits Commands—UBTS3

:CALCulate:OOBSpur:LIMit:<standard>:UBTS3[:UPPer]:DATA[n] <amplitude>

:CALCulate:OOBSpur:LIMit:<standard>:UBTS3[:UPPer]:DATA[n]?

Set or query any of the UBTS3 related limits for the out of band spurious measurement. Replace <standard> in the above command strings with the appropriate keyword or abbreviated keyword from the table below.

Table 4-50 Valid GSM Standards Used in the SCPI Command

Frequency Band Standard	SCPI Keyword	Abbreviated SCPI Keyword
GSM 450	GSM450	none
GSM 480	GSM480	none
GSM 850	GSM850	none
P-GSM 900	PGSM900	PGSM
E-GSM 900	EGSM900	EGSM
R-GSM 900	RGSM900	RGSM
DCS 1800	DCS1800	DCS
PCS 1900	PCS1900	PCS

Table 4-51 shows how each <standard> is associated with a value that must be referenced using a numeric from 1 to 6. Replace n in the above command strings with the appropriate numeric to set or query the desired limit.

Factory Preset: Limit values default to the GSM450 / GSM480 / GSM850 / PGSM900 / EGSM900 / RGSM900 / DCS1800 / PCS1900 standards as shown in Table 4-51.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-51 Out Of Band Spurious Absolute Limits Commands—UBTS3: Default Values

	Standard							
Frequency	**GSM 450**	**GSM 480**	**GSM 850**	**PGSM 900**	**EGSM 900**	**RGSM 900**	**DCS 1800**	**PCS 1900**
≤ 1 GHz absolute frequency	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)	–36.0 (n=1)

Programming Commands

Table 4-51 Out Of Band Spurious Absolute Limits Commands—UBTS3: Default Values

	Standard							
Frequency	**GSM 450**	**GSM 480**	**GSM 850**	**PGSM 900**	**EGSM 900**	**RGSM 900**	**DCS 1800**	**PCS 1900**
> 1 GHz absolute frequency	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)	–30.0 (n=2)
GSM850 Tx band limit (869 - 894 MHz)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	–57.0 (N=3)
DCS Tx band limit (1805 - 1880 MHz)	–47.0 (n=3)	–47.0 (n=3)	N/A	–47.0 (n=3)	–47.0 (n=3)	–47.0 (n=3)	N/A	N/A
PCS Tx band limit (1930 - 1990 MHz)	N/A	N/A	–47.0 (n=3)	N/A	N/A	N/A	N/A	N/A
R-GSM Tx band limit (921 - 960 MHz)	–57.0 (n=4)	–57.0 (n=4)	N/A	N/A	N/A	N/A	–57.0 (n=3)	N/A
GSM750 Tx band limit (747 - 762 MHz)	N/A	N/A	–57.0 (n=4)	N/A	N/A	N/A	N/A	–57.0 (n=4)
GSM450 Tx band limit (460.4 - 467.6 MHz)	N/A	N/A	N/A	–36.0 (n=4)	–36.0 (n=4)	–36.0 (n=4)	–36.0 (n=4)	N/A
GSM480 Tx band limit (488.8 - 496.0 MHz)	N/A	N/A	N/A	–36.0 (n=5)	–36.0 (n=5)	–36.0 (n=5)	–36.0 (n=5)	N/A
UTRA Tx and Rx limits	–62.0 (n=5)	–62.0 (n=5)	N/A	–62.0 (n=6)	–62.0 (n=6)	–62.0 (n=6)	–62.0 (n=6)	N/A

Output RF Spectrum - Limits

Output RF Spectrum (ORFS) Due To Modulation Absolute Limits Commands

Use the commands in this section to change the output RF spectrum absolute limits to your own custom limits values.

ORFS limits are generally specified in dB relative to the reference power (ref power). This equates to the absolute power which the result must not exceed. Standards documents also supply an absolute power level—below which the calculated relative limit (ref power – relative limit) will not be applied—for each ORFS type, radio standard, device type and offset frequency.

Therefore the relative limit applies if the calculated limit (ref power – relative limit) is greater than the absolute limit. Otherwise the absolute limit applies.

Example:

If relative limit = –75 dB and absolute limit = –65 dBm.

1.	If the ref power is measured at 43 dBm, then: Upper result limit due to relative limit = 43 – 75 = –32 dBm Upper result limit due to absolute limit = –65 dBm A relative limit of –32 dBm therefore applies.
2.	If the ref power is measured at 0 dBm, then: Upper result limit due to relative limit = 0 – 75 = –75 dBm Upper result limit due to absolute limit = –65 dBm An absolute limit of –65 dBm therefore applies.

The commands are presented according to the following devices: MS, BTS, UBTS1, UBTS2, UBTS3 and PBTS1.

ORFS Due To Modulation Absolute Limits—BTS

:CALCulate:ORFSpectrum:MODulation:LIMit:<standard>:BTS:ABSolute[:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:MODulation:LIMit:<standard>:BTS:ABSolute[:UPPer]:DATA[n]?

Set or query any of the absolute BTS related limits for the ORFS due to modulation measurement. Replace <standard> in the above command strings with GSM or GSM900, DCS or DCS1800, or PCS or PCS1900.

Note that GSM applies to all of GSM450, GSM480, GSM850, PGSM900, EGSM900 and RGSM900.

Table 4-52 below shows how each <standard> is associated with a value that must be referenced using numeric 1 or 2. Replace n in the above command strings with the appropriate numeric to set or query the desired limit. For further information, refer to the example provided earlier in this section (page 198) for the ORFS Due To Modulation Absolute Limits—MS command.

Factory Preset: Refer to Table 4-52.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-52 ORFS Due To Modulation Absolute Limits—BTS: Default Values

	Standard		
Offset	**GSM/ GSM900**	**DCS/ DCS1800**	**PCS/ PCS1900**
< 1800 kHz (n=1)	–65.0	–57.0	–57.0
≥ 1800 kHz (n=2)	–65.0	–57.0	–57.0

ORFS Due To Modulation Absolute Limits—MS

:CALCulate:ORFSpectrum:MODulation:LIMit:<standard>:MS:ABSolute[:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:MODulation:LIMit:<standard>:MS:ABSolute[:UPPer]:DATA[n]?

Set or query any of the absolute MS related limits for the ORFS due to modulation measurement. Replace <standard> in the above command strings with GSM or GSM900, DCS or DCS1800, or PCS or PCS1900. Note that GSM applies to all of GSM450, GSM480, GSM850, PGSM900, EGSM900 and RGSM900.

Table 4-53 below shows how each <standard> is associated with a value that must be referenced using a numeric from 1 to 3. Replace n in the above command strings with the appropriate numeric to set or query the desired limit.

Example:

The following command sets the absolute result limit to –40 dBm when testing a PGSM MS device at 1800 kHz offset (the default value is –46.0 dBm):

:CALCulate:ORFSpectrum:MODulation:LIMit:GSM:MS:ABSolute:UPPer:DATA3 –40.0

Factory Preset: Refer to Table 4-53.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-53 ORFS Due To Modulation Absolute Limits—MS: Default Values

	Standard		
Offset	**GSM/ GSM900**	**DCS/ DCS1800**	**PCS/ PCS1900**
< 600 kHz (n=1)	–36.0	–36.0	–36.0
≥ 600 kHz, < 1800 kHz (n=2)	–51.0	–56.0	–56.0
≥ 1800 kHz (n=3)	–46.0	–51.0	–51.0

ORFS Due To Modulation Absolute Limits—PBTS1

:CALCulate:ORFSpectrum:MODulation:LIMit:<standard>:PBTS1:ABSolute[:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:MODulation:LIMit:<standard>:PBTS1:ABSolute[:UPPer]:DATA[n]?

Set or query any of the absolute PBTS1 related limits for the ORFS due to modulation measurement. Replace <standard> in the above command strings with GSM or GSM900, DCS or DCS1800, or PCS or PCS1900. Note that GSM applies to all of GSM450, GSM480, GSM850, PGSM900, EGSM900 and RGSM900.

Table 4-54 below shows how each <standard> is associated with a value that must be referenced using the numeric 1 or 2. Replace n in the above command strings with 1 or 2 to set or query the desired limit. For further information, refer to the example provided earlier in this section (page 198) for the ORFS Due To Modulation Absolute Limits—MS command.

Factory Preset: Refer to Table 4-54.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-54 ORFS Due To Modulation Absolute Limits—PBTS1: Default Values

	Standard		
Offset	**GSM/ GSM900**	**DCS/ DCS1800**	**PCS/ PCS1900**
< 1800 kHz (n=1)	–68.0	–65.0	–65.0
≥ 1800 kHz (n=2)	–68.0	–65.0	–65.0

ORFS Due To Modulation Absolute Limits—UBTS1

:CALCulate:ORFSpectrum:MODulation:LIMit:<standard>:UBTS1:ABSolute[:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:MODulation:LIMit:<standard>:UBTS1:ABSolute[:UPPer]:DATA[n]?

Set or query any of the absolute UBTS1 related limits for the ORFS due to modulation measurement. Replace <standard> in the above command strings with GSM or GSM900, DCS or DCS1800, or PCS or PCS1900. Note that GSM applies to all of GSM450, GSM480, GSM850, PGSM900, EGSM900 and RGSM900.

Table 4-55 below shows how each <standard> is associated with a value that must be referenced using the numeric 1 or 2. Replace n in the above command strings with 1 or 2 to set or query the desired limit. For further information, refer to the example provided earlier in this section (page 198) for the ORFS Due To Modulation Absolute Limits—MS command.

Factory Preset: Refer to Table 4-55.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Programming Commands

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-55 ORFS Due To Modulation Absolute Limits—UBTS1: Default Values

	Standard		
Offset	**GSM/ GSM900**	**DCS/ DCS1800**	**PCS/ PCS1900**
< 1800 kHz (n=1)	–59.0	–57.0	–57.0
≥ 1800 kHz (n=2)	–59.0	–57.0	–57.0

ORFS Due To Modulation Absolute Limits—UBTS2

:CALCulate:ORFSpectrum:MODulation:LIMit:<standard>:UBTS2:ABSolute[:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:MODulation:LIMit:<standard>:UBTS2:ABSolute[:UPPer]:DATA[n]?

Set or query any of the absolute UBTS2 related limits for the ORFS due to modulation measurement. Replace <standard> in the above command strings with GSM or GSM900, DCS or DCS1800, or PCS or PCS1900. Note that GSM applies to all of GSM450, GSM480, GSM850, PGSM900, EGSM900 and RGSM900.

Table 4-56 below shows how each <standard> is associated with a value that must be referenced using the numeric 1 or 2. Replace n in the above command strings with 1 or 2 to set or query the desired limit. For further information, refer to the example provided earlier in this section (page 198) for the ORFS Due To Modulation Absolute Limits—MS command.

Factory Preset: Refer to Table 4-56.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-56 ORFS Due To Modulation Absolute Limits—UBTS2: Default Values

	Standard		
Offset	**GSM/ GSM900**	**DCS/ DCS1800**	**PCS/ PCS1900**
< 1800 kHz (n=1)	–64.0	–62.0	–62.0
≥ 1800 kHz (n=2)	–64.0	–62.0	–62.0

ORFS Due To Modulation Absolute Limits—UBTS3

:CALCulate:ORFSpectrum:MODulation:LIMit:<standard>:UBTS3:ABSolute[:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:MODulation:LIMit:<standard>:UBTS3:ABSolute[:UPPer]:DATA[n]?

Set or query any of the absolute UBTS3 related limits for the ORFS due to modulation measurement. Replace <standard> in the above command strings with GSM or GSM900, DCS or DCS1800, or PCS or PCS1900. Note that GSM applies to all of GSM450, GSM480, GSM850, PGSM900, EGSM900 and RGSM900.

Table 4-57 below shows how each <standard> is associated with a value that must be referenced using the numeric 1 or 2. Replace n in the above command strings with 1 or 2 to set or query the desired limit. For further information, refer to the example provided earlier in this section (page 198) for the ORFS Due To Modulation Absolute Limits—MS command.

Factory Preset: Refer to Table 4-57.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-57 ORFS Due To Modulation Absolute Limits—UBTS3: Default Values

	Standard		
Offset	**GSM/ GSM900**	**DCS/ DCS1800**	**PCS/ PCS1900**
< 1800 kHz (n=1)	–69.0	–67.0	–67.0
≥ 1800 kHz (n=2)	–69.0	–67.0	–67.0

Output RF Spectrum (ORFS) Due To Modulation Relative Limits Commands

Use the commands in this section to change the output RF spectrum relative limits to your own custom limits values.

ORFS limits are generally specified in dB relative to the reference power (ref power). This equates to the absolute power which the result must not exceed. Standards documents also supply an absolute power level— below which the calculated relative limit (ref power – relative limit) will not be applied—for each ORFS type, radio standard, device type and offset frequency.

Therefore the relative limit applies if the calculated limit (ref power – relative limit) is greater than the absolute limit. Otherwise the absolute limit applies.

Example:

If relative limit = –75 dB and absolute limit = –65 dBm.

1.	If the ref power is measured at 43 dBm, then: Upper result limit due to relative limit = 43 – 75 = –32 dBm Upper result limit due to absolute limit = –65 dBm A relative limit of –32 dBm therefore applies.
2.	If the ref power is measured at 0 dBm, then: Upper result limit due to relative limit = 0 – 75 = –75 dBm Upper result limit due to absolute limit = –65 dBm An absolute limit of –65 dBm therefore applies.

The commands are presented according to standards DCS, GSM and

PCS for devices MS, BTS and UBTS.

ORFS Due To Modulation DCS Relative Limits—BTS

:CALCulate:ORFSpectrum:MODulation:LIMit:DCS|DCS1800 :BTS:<Pnn>[:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:MODulation:LIMit:DCS|DCS1800 :BTS:<Pnn>[:UPPer]:DATA[n]?

Set or query any of the DCS 1800 BTS relative limits for the ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate BS TX Level.

Table 4-58 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 9. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. For further information, refer to the example provided earlier in this section (page 204) for the ORFS Due To Modulation DCS Relative Limits—MS command.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Factory Preset: Refer to Table 4-58.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Programming Commands

Table 4-58 ORFS Due To Modulation DCS Relative Limits—BTS: Default Values

Pnn	Power Level (dBm)	Power (dBm) (n=1)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. DCS1800 BTS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P43	>43	43.0	+0.5	–30.0	–33.0	–60.0	–70.0	–73.0	–75.0	–80.0
P41	41	41.0	+0.5	–30.0	–33.0	–60.0	–68.0	–71.0	–73.0	–80.0
P39	39	39.0	+0.5	–30.0	–33.0	–60.0	–66.0	–69.0	–71.0	–80.0
P37	37	37.0	+0.5	–30.0	–33.0	–60.0	–64.0	–67.0	–69.0	–80.0
P35	35	35.0	+0.5	–30.0	–33.0	–60.0	–62.0	–65.0	–67.0	–80.0
P33	<33	33.0	+0.5	–30.0	–33.0	–60.0	–60.0	–63.0	–65.0	–80.0

ORFS Due To Modulation DCS Relative Limits—MS

```
:CALCulate:ORFSpectrum:MODulation:LIMit:DCS|DCS1800
:MS:<Pnn>[:UPPer]:DATA[n] <amplitude>
```

```
:CALCulate:ORFSpectrum:MODulation:LIMit:DCS|DCS1800
:MS:<Pnn>[:UPPer]:DATA[n]?
```

Table 4-59 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 9. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency.

Set or query any of the DCS 1800 MS relative limits for the ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate MS TX Level.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Example:

The following command sets the relative result limit to –65.0 dB (the default value is –60.0 dB) when testing a DCS MS device at 400 kHz offset and total carrier power = 36 dBm:

:CALCulate:ORFSpectrum:MODulation:LIMit:DCS:MS:P36:UPPer:DATA5 –65.0

Factory Preset: Refer to Table 4-59.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-59 ORFS Due To Modulation DCS Relative Limits—MS: Default Values

Pnn	Power Level (dBm)	Power (dBm) (n=1)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. DCS1800 MS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P36	>36	36.0	+0.5	–30.0	–33.0	–60.0	–60.0	–60.0	–71.0	–79.0
P34	34	34.0	+0.5	–30.0	–33.0	–60.0	–60.0	–60.0	–69.0	–77.0
P32	32	32.0	+0.5	–30.0	–33.0	–60.0	–60.0	–60.0	–67.0	–75.0
P30	30	30.0	+0.5	–30.0	–33.0	–60.0	–60.0	–60.0	–65.0	–73.0
P28	28	28.0	+0.5	–30.0	–33.0	–60.0	–60.0	–60.0	–63.0	–71.0
P26	26	26.0	+0.5	–30.0	–33.0	–60.0	–60.0	–60.0	–61.0	–69.0
P24	<24	24.0	+0.5	–30.0	–33.0	–60.0	–60.0	–60.0	–59.0	–67.0

ORFS Due To Modulation DCS Relative Limits—PBTS

:CALCulate:ORFSpectrum:MODulation:LIMit:DCS|DCS1800:PBTS:<Pnn>[:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:MODulation:LIMit:DCS|DCS1800:PBTS:<Pnn>[:UPPer]:DATA[n]?

Set or query any of the DCS 1800 PBTS relative limits for the ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate BS TX Level.

Table 4-60 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 9. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. For further information, refer to the example provided earlier in this section (page 204) for the ORFS Due To Modulation DCS Relative Limits—MS command.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Factory Preset: Refer to Table 4-60.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-60 ORFS Due To Modulation DCS Relative Limits—PBTS: Default Values

Pnn	Power Level (dBm)	Power (dBm) (n=1)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. DCS1800 PBTS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P23	≤ 23	23.0	+0.5	–30.0	–33.0	–60.0	–60.0	–63.0	–76.0	–80.0

ORFS Due To Modulation DCS Relative Limits—UBTS

```
:CALCulate:ORFSpectrum:MODulation:LIMit:DCS|DCS1800:UBTS
:<Pnn>[:UPPer]:DATA[n] <amplitude>
```

```
:CALCulate:ORFSpectrum:MODulation:LIMit:DCS|DCS1800:UBTS
:<Pnn>[:UPPer]:DATA[n]?
```

Set or query any of the DCS 1800 UBTS relative limits for the ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate BS TX Level.

Table 4-61 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 9. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. For further information, refer to the example provided earlier in this section (page 204) for the ORFS Due To Modulation DCS Relative Limits—MS command.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Factory Preset: Refer to Table 4-61.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-61 ORFS Due To Modulation DCS Relative Limits—UBTS: Default Values

Pnn	Power Level (dBm)	Power (dBm) (n=1)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. DCS1800 UBTS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P35	>35	35.0	+0.5	–30.0	–33.0	–60.0	–62.0	–65.0	–76.0	–76.0
P33	<33	33.0	+0.5	–30.0	–33.0	–60.0	–60.0	–63.0	–76.0	–76.0

ORFS Due To Modulation GSM Relative Limits—BTS

:CALCulate:ORFSpectrum:MODulation:LIMit:GSM|GSM900:BTS :<Pnn>[:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:MODulation:LIMit:GSM|GSM900:BTS :<Pnn>[:UPPer]:DATA[n]?

Set or query any of the GSM 900 BTS relative limits for the ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate BS TX Level.

Table 4-62 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 9. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. For further information, refer to the example provided earlier in this section (page 204) for the ORFS Due To Modulation DCS Relative Limits—MS command.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Factory Preset: Refer to Table 4-62.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-62 ORFS Due To Modulation GSM Relative Limits—BTS: Default Values

Pnn	Power Level (dBm)	Power (dBm) (n=1)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. GSM900 BTS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P43	>43	43.0	+0.5	–30.0	–33.0	–60.0	–70.0	–73.0	–75.0	–80.0
P41	41	41.0	+0.5	–30.0	–33.0	–60.0	–68.0	–71.0	–73.0	–80.0
P39	39	39.0	+0.5	–30.0	–33.0	–60.0	–66.0	–69.0	–71.0	–80.0
P37	37	37.0	+0.5	–30.0	–33.0	–60.0	–64.0	–67.0	–69.0	–80.0
P35	35	35.0	+0.5	–30.0	–33.0	–60.0	–62.0	–65.0	–67.0	–80.0
P33	<33	33.0	+0.5	–30.0	–33.0	–60.0	–60.0	–63.0	–65.0	–80.0

ORFS Due To Modulation GSM Relative Limits—MS

```
:CALCulate:ORFSpectrum:MODulation:LIMit:GSM|GSM900:MS
:<Pnn>[:UPPer]:DATA[n] <amplitude>
```

:CALCulate:ORFSpectrum:MODulation:LIMit:GSM|GSM900:MS :<Pnn>[:UPPer]:DATA[n]?

Set or query any of the GSM 900 MS relative limits for the ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate MS TX Level.

Table 4-63 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 9. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. For further information, refer to the example provided earlier in this section (page 204) for the ORFS Due To Modulation DCS Relative Limits—MS command.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Factory Preset: Refer to Table 4-63.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None+

Table 4-63 ORFS Due To Modulation GSM Relative Limits—MS: Default Values

Pnn	Power Level (dBm)	Power (dBm) (n=1)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. GSM900 MS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P39	>39	39.0	+0.5	–30.0	–33.0	–60.0	–66.0	–69.0	–71.0	–77.0
P37	37	37.0	+0.5	–30.0	–33.0	–60.0	–64.0	–67.0	–69.0	–75.0
P35	35	35.0	+0.5	–30.0	–33.0	–60.0	–62.0	–65.0	–67.0	–73.0
P33	<33	33.0	+0.5	–30.0	–33.0	–60.0	–60.0	–63.0	–65.0	–71.0

ORFS Due To Modulation GSM Relative Limits—PBTS

:CALCulate:ORFSpectrum:MODulation:LIMit:GSM|GSM900:PBTS :<Pnn>[:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:MODulation:LIMit:GSM|GSM900:PBTS :<Pnn>[:UPPer]:DATA[n]?

Set or query any of the GSM 900 PBTS relative limits for the ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate BS TX Level.

Table 4-64 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 9. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. For further information, refer to the example provided earlier in this section (page 204) for the ORFS Due To Modulation DCS Relative Limits—MS command.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Factory Preset: Refer to Table 4-64.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-64 ORFS Due To Modulation GSM Relative Limits—PBTS: Default Values

Pnn	Power Level (dBm)	Power (dBm) (n=1)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. GSM900 PBTS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P20	<=20	20.0	+0.5	–30.0	–33.0	–60.0	–60.0	–63.0	–70.0	–80.0

ORFS Due To Modulation GSM Relative Limits—UBTS

:CALCulate:ORFSpectrum:MODulation:LIMit:GSM|GSM900:UBTS :<Pnn>[:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:MODulation:LIMit:GSM|GSM900:UBTS :<Pnn>[:UPPer]:DATA[n]?

Set or query any of the GSM 900 UBTS relative limits for the ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate BS TX Level.

Table 4-65 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 9. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. For further information, refer to the example provided earlier in this section (page 204) for the ORFS Due To Modulation DCS Relative Limits—MS command.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Factory Preset: Refer to Table 4-65.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-65 ORFS Due To Modulation GSM Relative Limits—UBTS: Default Values

Pnn	Power Level (dBm)	Power (dBm) (n=1)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. GSM900 MS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P33	<33	33.0	+0.5	–30.0	–33.0	–60.0	–60.0	–63.0	–70.0	–70.0

ORFS Due To Modulation PCS Relative Limits—BTS

:CALCulate:ORFSpectrum:MODulation:LIMit:PCS|PCS1900:BTS:<Pnn>[:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:MODulation:LIMit:PCS|PCS1900:BTS:<Pnn>[:UPPer]:DATA[n]?

Set or query any of the PCS 1900 BTS relative limits for the ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate BS TX Level.

Table 4-66 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 9. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. For further information, refer to the example provided earlier in this section (page 204) for the ORFS Due To Modulation DCS Relative Limits—MS command.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Factory Preset: Refer to Table 4-66.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-66 ORFS Due To Modulation PCS Relative Limits—BTS: Default Values

Pnn	Power Level (dBm)	Power (dBm) (n=1)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. PCS1900 BTS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P43	>43	43.0	+0.5	–30.0	–33.0	–60.0	–70.0	–73.0	–75.0	–80.0
P41	41	41.0	+0.5	–30.0	–33.0	–60.0	–68.0	–71.0	–73.0	–80.0

Table 4-66 ORFS Due To Modulation PCS Relative Limits—BTS: Default Values

Pnn	Power Level (dBm)	Power (dBm) (n=1)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. PCS1900 BTS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P39	39	39.0	+0.5	–30.0	–33.0	–60.0	–66.0	–69.0	–71.0	–80.0
P37	37	37.0	+0.5	–30.0	–33.0	–60.0	–64.0	–67.0	–69.0	–80.0
P35	35	35.0	+0.5	–30.0	–33.0	–60.0	–62.0	–65.0	–67.0	–80.0
P33	<33	33.0	+0.5	–30.0	–33.0	–60.0	–60.0	–63.0	–65.0	–80.0

ORFS Due To Modulation PCS Relative Limits—MS

:CALCulate:ORFSpectrum:MODulation:LIMit:PCS|PCS1900:MS:<Pnn>[:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:MODulation:LIMit:PCS|PCS1900:MS:<Pnn>[:UPPer]:DATA[n]?

Set or query any of the PCS 1900 MS relative limits for the ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate MS TX Level.

Table 4-67 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 9. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. For further information, refer to the example provided earlier in this section (page 204) for the ORFS Due To Modulation DCS Relative Limits—MS command.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Factory Preset: Refer to Table 4-67.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command.

Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-67 ORFS Due To Modulation PCS Relative Limits—MS: Default Values

Pnn	Power Level (dBm)	Power (dBm) (n=1)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. PCS1900 MS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P33	>33	33 .0	+0.5	–30.0	–33.0	–60.0	–60.0	–60.0	–68.0	–76.0
P32	32	32.0	+0.5	–30.0	–33.0	–60.0	–60.0	–60.0	–67.0	–75.0
P30	30	30.0	+0.5	–30.0	–33.0	–60.0	–60.0	–60.0	–65.0	–73.0
P28	28	28.0	+0.5	–30.0	–33.0	–60.0	–60.0	–60.0	–63.0	–71.0
P26	26	26.0	+0.5	–30.0	–33.0	–60.0	–60.0	–60.0	–61.0	–69.0
P24	<24	24.0	+0.5	–30.0	–33.0	–60.0	–60.0	–60.0	–59.0	–67.0

ORFS Due To Modulation PCS Relative Limits—PBTS

:CALCulate:ORFSpectrum:MODulation:LIMit:PCS|PCS1900:PBTS:<Pnn>[:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:MODulation:LIMit:PCS|PCS1900:PBTS:<Pnn>[:UPPer]:DATA[n]?

Set or query any of the PCS 1900 PBTS relative limits for the ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate BS TX Level.

Table 4-68 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 9. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. For further information, refer to the example provided earlier in this section (page 204) for the ORFS Due To Modulation DCS Relative Limits—MS command.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Factory Preset: Refer to Table 4-68.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-68 ORFS Due To Modulation PCS Relative Limits—PBTS: Default Values

Pnn	Power Level (dBm)	Power (dBm) (n=1)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. PCS1900 PBTS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P23	>23	23.0	+0.5	–30.0	–33.0	–60.0	–60.0	–63.0	–76.0	–76.0

ORFS Due To Modulation PCS Relative Limits—UBTS

```
:CALCulate:ORFSpectrum:MODulation:LIMit:PCS|PCS1900:UBTS
:<Pnn>[:UPPer]:DATA[n] <amplitude>
```

```
:CALCulate:ORFSpectrum:MODulation:LIMit:PCS|PCS1900:UBTS
:<Pnn>[:UPPer]:DATA[n]?
```

Set or query any of the PCS 1900 UBTS relative limits for the ORFS due to modulation measurement. Replace <Pnn> in the above command strings with the appropriate BS TX Level.

Table 4-69 below shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 9. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. For further information, refer to the example provided earlier in this section (page 204) for the ORFS Due To Modulation DCS Relative Limits—MS command.

NOTE The relative limit applied depends on the measured total carrier power. If the measured total carrier power lies between these discrete power values noted in the table the limit value is linearly interpolated.

Factory Preset: Refer to Table 4-69.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-69 ORFS Due To Modulation PCS Relative Limits—UBTS: Default Values

Pnn	Power Level (dBm)	Power (dBm) (n=1)	Maximum relative level (dB) at specific carrier offsets (kHz), using specified measurement resolution bandwidths. PCS1900 UBTS							
			100 (n=2)	200 (n=3)	250 (n=4)	400 (n=5)	600 to <1200 (n=6)	1200 to <1800 (n=7)	1800 to <6000 (n=8)	≥6000 (n=9)
			30 kHz RBW						100 kHz RBW	
P43	>43	43.0	+0.5	–30.0	–33.0	–60.0	–70.0	–73.0	–76.0	–76.0
P41	41	41.0	+0.5	–30.0	–33.0	–60.0	–68.0	–71.0	–76.0	–76.0
P39	39	39.0	+0.5	–30.0	–33.0	–60.0	–66.0	–69.0	–76.0	–76.0
P37	37	37.0	+0.5	–30.0	–33.0	–60.0	–64.0	–67.0	–76.0	–76.0
P35	35	35.0	+0.5	–30.0	–33.0	–60.0	–62.0	–65.0	–76.0	–76.0
P33	<33	33.0	+0.5	–30.0	–33.0	–60.0	–60.0	–63.0	–76.0	–76.0

Output RF Spectrum (ORFS) Due To Switching Transients Absolute Limits Commands—BTS, PBTS and UBTS

Use the commands in this section to change the output RF spectrum due to switching transients absolute limits to your own custom limits values.

ORFS limits are generally specified in dB relative to the reference power (ref power). This equates to the absolute power which the result must not exceed. Standards documents also supply an absolute power level—below which the calculated relative limit (ref power – relative limit) will not be applied—for each ORFS type, radio standard, device type and offset frequency.

Therefore the relative limit applies if the calculated limit (ref power – relative limit) is greater than the absolute limit. Otherwise the absolute limit applies.

Example:

If relative limit = –75 dB and absolute limit = –65 dBm.

1.	If the ref power is measured at 43 dBm, then: Upper result limit due to relative limit = 43 – 75 = –32 dBm Upper result limit due to absolute limit = –65 dBm A relative limit of –32 dBm therefore applies.
2.	If the ref power is measured at 0 dBm, then: Upper result limit due to relative limit = 0 – 75 = –75 dBm Upper result limit due to absolute limit = –65 dBm An absolute limit of –65 dBm therefore applies.

Note that for ORFS due to switching transients the above only applies to BTS, UBTS and PBTS devices as MS limits are specified in absolute terms (dBm) only.

The commands are presented according to devices BTS, UBTS1, UBTS2, UBTS3 and PBTS1.

ORFS Due To Switching Transients Absolute Limits—BTS

:CALCulate:ORFSpectrum:SWITching:LIMit:<standard>:BTS:ABSolute[:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:SWITching:LIMit:<standard>:BTS:ABSolute[:UPPer]:DATA[n]?

Set or query any of the absolute BTS related limits for the ORFS due to switching transients measurement. Replace <standard> in the above command strings with GSM, DCS or PCS. Note that GSM applies to all of GSM450, GSM480, GSM850,PGSM900, EGSM900 and RGSM900.

Table 4-70 shows how each <standard> is associated with a value that must be referenced using the numerics 1 or 2. Replace n in the above command strings with the appropriate numeric to set or query the desired limit.

Example:

The following command sets the absolute result limit to –40 dBm when testing an E-GSM BTS device for offsets ≥ 1800 kHz (the default value is –36.0 dBm):

:CALCulate:ORFSpectrum:SWITching:LIMit:GSM:BTS:ABSolute :UPPer:DATA2 –40.0

Factory Preset: Refer to Table 4-70.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-70 ORFS Due To Switching Transients Absolute Limits Commands—BTS: Default Values

	Standard		
Offset	**GSM/ GSM900**	**DCS/ DCS1800**	**PCS/ PCS1900**
< 1800 kHz (n=1)	–36.0	–36.0	–36.0
≥ 1800 kHz (n=2)	–36.0	–36.0	–36.0

ORFS Due To Switching Transients Absolute Limits—PBTS1

:CALCulate:ORFSpectrum:SWITching:LIMit:<standard>:PBTS1: ABSolute[:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:SWITching:LIMit:<standard>:PBTS1: ABSolute[:UPPer]:DATA[n]?

Set or query any of the absolute PBTS1 related limits for the ORFS due to switching transients measurement. Replace <standard> in the above command strings with GSM, DCS or PCS. Note that GSM applies to all of GSM450, GSM480, GSM850, PGSM900, EGSM900 and RGSM900.

Table 4-71 shows how each <standard> is associated with a value that must be referenced using the numeric 1. Replace n in the above command strings with 1 to set or query the desired limit. For further information, refer to the example provided earlier in this section (page 219) for the ORFS Due To Switching Transients Absolute Limits—BTS command.

Factory Preset: Refer to Table 4-71.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-71 ORFS Due To Switching Transients Absolute Limits Commands—PBTS1: Default Values

	Standard		
Offset	**GSM/ GSM900**	**DCS/ DCS1800**	**PCS/ PCS1900**
≥ 1800 kHz (n=1)	–36.0	–36.0	–36.0

ORFS Due To Switching Transients Absolute Limits—UBTS1

:CALCulate:ORFSpectrum:SWITching:LIMit:<standard>:UBTS1:ABSolute[:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:SWITching:LIMit:<standard>:UBTS1:ABSolute[:UPPer]:DATA[n]?

Set or query any of the absolute UBTS1 related limits for the ORFS due to switching transients measurement. Replace <standard> in the above command strings with GSM, DCS or PCS. Note that GSM applies to all of GSM450, GSM480, GSM850, PGSM900, EGSM900 and RGSM900.

Table 4-72 shows how each <standard> is associated with a value that must be referenced using the numeric 1. Replace n in the above command strings with 1 to set or query the desired limit. For further information, refer to the example provided earlier in this section (page 219) for the ORFS Due To Switching Transients Absolute Limits—BTS command.

Factory Preset: Refer to Table 4-72.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-72 ORFS Due To Switching Transients Absolute Limits Commands—UBTS1: Default Values

	Standard		
Offset	**GSM/ GSM900**	**DCS/ DCS1800**	**PCS/ PCS1900**
≥ 1800 kHz (n=1)	–36.0	–36.0	–36.0

ORFS Due To Switching Transients Absolute Limits—UBTS2

:CALCulate:ORFSpectrum:SWITching:LIMit:<standard>:UBTS2:ABSolute[:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:SWITching:LIMit:<standard>:UBTS2:ABSolute[:UPPer]:DATA[n]?

Set or query any of the absolute UBTS2 related limits for the ORFS due to switching transients measurement. Replace <standard> in the above command strings with GSM, DCS or PCS. Note that GSM applies to all of GSM450, GSM480, GSM850, PGSM900, EGSM900 and RGSM900.

Table 4-73 shows how each <standard> is associated with a value that must be referenced using the numeric 1. Replace n in the above command strings with 1 to set or query the desired limit. For further information, refer to the example provided earlier in this section (page 219) for the ORFS Due To Switching Transients Absolute Limits—BTS command.

Factory Preset: Refer to Table 4-73.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-73 ORFS Due To Switching Transients Absolute Limits Commands—UBTS2: Default Values

	Standard		
Offset	**GSM/ GSM900**	**DCS/ DCS1800**	**PCS/ PCS1900**
≥ 1800 kHz (n=1)	–36.0	–36.0	–36.0

ORFS Due To Switching Transients Absolute Limits—UBTS3

:CALCulate:ORFSpectrum:SWITching:LIMit:<standard>:UBTS3:ABSolute[:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:SWITching:LIMit:<standard>:UBTS3:ABSolute[:UPPer]:DATA[n]?

Set or query any of the absolute UBTS3 related limits for the ORFS due to switching transients measurement. Replace <standard> in the above command strings with GSM, DCS or PCS. Note that GSM applies to all of GSM450, GSM480, GSM850, PGSM900, EGSM900 and RGSM900.

Table 4-74 shows how each <standard> is associated with a value that must be referenced using the numeric 1. Replace n in the above command strings with 1 to set or query the desired limit. For further information, refer to the example provided earlier in this section (page 219) for the ORFS Due To Switching Transients Absolute Limits—BTS command.

Factory Preset: Refer to Table 4-74.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-74 ORFS Due To Switching Transients Absolute Limits Commands—UBTS3: Default Values

	Standard		
Offset	**GSM/ GSM900**	**DCS/ DCS1800**	**PCS/ PCS1900**
≥ 1800 kHz (n=1)	–36.0	–36.0	–36.0

Output RF Spectrum (ORFS) Due To Switching Transients Relative Limits Commands—BTS, PBTS and UBTS

Use the commands in this section to change the output RF spectrum due to switching transients relative limits to your own custom limits values.

ORFS limits are generally specified in dB relative to the reference power (ref power). This equates to the absolute power which the result must not exceed. Standards documents also supply an absolute power level—below which the calculated relative limit (ref power – relative limit) will not be applied—for each ORFS type, radio standard, device type and offset frequency.

Therefore the relative limit applies if the calculated limit (ref power – relative limit) is greater than the absolute limit. Otherwise the absolute limit applies.

Example:

If relative limit = –75 dB and absolute limit = –65 dBm.

1.	If the ref power is measured at 43 dBm, then: Upper result limit due to relative limit = 43 – 75 = –32 dBm Upper result limit due to absolute limit = –65 dBm A relative limit of –32 dBm therefore applies.
2.	If the ref power is measured at 0 dBm, then: Upper result limit due to relative limit = 0 – 75 = –75 dBm Upper result limit due to absolute limit = –65 dBm An absolute limit of –65 dBm therefore applies.

Note that for ORFS due to switching transients the above only applies to BTS and UBTS devices as MS limits are specified in absolute terms (dBm) only.

ORFS Due To Switching Transients Relative Limits—DCS

:CALCulate:ORFSpectrum:SWITching:LIMit:DCS|DCS1800:<device>[:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:SWITching:LIMit:DCS|DCS1800:<device>[:UPPer]:DATA[n]?

Set or query any of the relative DCS related limits for the ORFS due to switching transients measurement. Replace <device> in the above command strings with the appropriate entry.

Table 4-75 shows how each <device> is associated with a value that must be referenced using a numeric from 2 to 5. Replace n in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. Note that entries in the Power column (n=1) are currently not used. For further information, refer to the example provided earlier in this section (page 224) for the ORFS Due To Switching Transients Relative Limits—GSM command.

Factory Preset: Refer to Table 4-75.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-75 ORFS Due To Switching Transients Relative Limits—DCS: Default Values

		Offset Frequency (kHz)			
Device	**Power (n=1)**	**400 (n=2)**	**600 (n=3)**	**1200 (n=4)**	**1800 (n=5)**
BTS	0.0 dB	–50.0 dB	–58.0 dB	–66.0 dB	–66.0 dB
UBTS	0.0 dB	–50.0 dB	–58.0 dB	–66.0 dB	–66.0 dB
PBTS	0.0 dB	–50.0 dB	–58.0 dB	–66.0 dB	–66.0 dB

Programming Commands

ORFS Due To Switching Transients Relative Limits—GSM

:CALCulate:ORFSpectrum:SWITching:LIMit:GSM|GSM900:<device>[:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:SWITching:LIMit:GSM|GSM900:<device>[:UPPer]:DATA[n]?

Set or query any of the relative GSM related limits for the ORFS due to switching transients measurement. Replace <device> in the above command strings with the appropriate entry.

Table 4-76 shows how each <device> is associated with a value that must be referenced using a numeric from 2 to 5. Replace n in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. Note that entries in the Power column (n=1) are currently not used.

Example:

The following command sets the relative result limit to –70 dB (the default value is –74.0 dB) when testing a GSM BTS device at 1200 kHz offset:

:CALCulate:ORFSpectrum:SWITching:LIMit:GSM:BTS:UPPer:DATA4 –70.0

Factory Preset: Refer to Table 4-76.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-76 ORFS Due To Switching Transients Relative Limits—GSM: Default Values

		Offset Frequency (kHz)			
Device	**Power (n=1)**	**400 (n=2)**	**600 (n=3)**	**1200 (n=4)**	**180 (n=5)**
BTS	0.0 dB	–57.0 dB	–67.0 dB	–74.0 dB	–74.0 dB
UBTS	0.0 dB	–57.0 dB	–67.0 dB	–74.0 dB	–74.0 dB
PBTS	0.0 dB	–57.0 dB	–67.0 dB	–74.0 dB	–74.0 dB

ORFS Due To Switching Transients Relative Limits—PCS

:CALCulate:ORFSpectrum:SWITching:LIMit:PCS|PCS1900:<device>[:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:SWITching:LIMit:PCS|PCS1900:<device>[:UPPer]:DATA[n]?

Set or query any of the relative PCS related limits for the ORFS due to switching transients measurement. Replace <device> in the above command strings with the appropriate entry.

Table 4-77 shows how each <device> is associated with a value that must be referenced using a numeric from 2 to 5. Replace n in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. Note that entries in the Power column (n=1) are currently not used. For further information, refer to the example provided earlier in this section (page 224) for the ORFS Due To Switching Transients Relative Limits—GSM command.

Factory Preset: Refer to Table 4-77.

Range: –150 dB to 150 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-77 ORFS Due To Switching Transients Relative Limits—PCS: Default Values

		Offset Frequency (kHz)			
Device	**Power (n=1)**	**400 (n=2)**	**600 (n=3)**	**1200 (n=4)**	**1800 (n=5)**
BTS	0.0 dB	–50.0 dB	–58.0 dB	–66.0 dB	–66.0 dB
UBTS	0.0 dB	–50.0 dB	–58.0 dB	–66.0 dB	–66.0 dB
PBTS	0.0 dB	–50.0 dB	–58.0 dB	–66.0 dB	–66.0 dB

Output RF Spectrum (ORFS) Due To Switching Transients Absolute Limit Commands—MS

Use the commands in this section to change the output RF spectrum due to switching transients limits for MS devices, to your own custom limits values. The output RF spectrum due to switching transients test for MS devices, uses limits that are specified in absolute units—that is, dBm.

Note that the limit applied—as shown in the table that accompanies each command—depends on the total carrier power. If the measured carrier power lies between these discrete power values, the limit value is linearly interpolated. If it lies above or below the range specified, the upper or lower limit set are used respectively.

NOTE Due to changes in 3GPP specifications for ORFS due to switching transients, the commands listed below are no longer supported:

```
:CALCulate:ORFSpectrum:SWITching:LIMit:DCS:MS:P37|P39:[:UPPer]:DATA[n] <amplitude>
:CALCulate:ORFSpectrum:SWITching:LIMit:DCS:MS:P37|P39:[:UPPer]:DATA[n] <amplitude>
:CALCulate:ORFSpectrum:SWITching:LIMit:GSM:MS:P37|P39:[:UPPer]:DATA[n] <amplitude>
```

ORFS Due To Switching Transients DCS MS Limits

:CALCulate:ORFSpectrum:SWITching:LIMit:DCS|DCS1800:MS:<Pnn>:[ABSolute][:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:SWITching:LIMit:DCS|DCS1800:MS:<Pnn>:[ABSolute][:UPPer]:DATA[n]?

Set or query any of the DCS MS related commands for the ORFS due to switching transients measurement. Replace <Pnn> in the above command strings with the appropriate MS TX Level. The measured total carrier power will determine which row of limits will be applied.

Table 4-78 shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 5. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. You can also change the values in the Power column (n=1) to alter the carrier power required for each set of limits. For further information, refer to the examples provided in this section for the ORFS Due To Switching Transients GSM MS Limits command.

Factory Preset: Refer to Table 4-78.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-78 ORFS Due To Switching Transients DCS MS Limits: Default Values

			Offset Frequency (kHz)			
Pnn	**Power Level (dBm)**	**Power (dBm) (n=1)**	**400 (n=2)**	**600 (n=3)**	**1200 (n=4)**	**1800 (n=5)**
36	36	36.0 dBm	–16.0 dBm	–21.0 dBm	–21.0 dBm	–24.0 dBm
34	34	34.0 dBm	–18.0 dBm	–21.0 dBm	–21.0 dBm	–24.0 dBm
32	32	32.0 dBm	–20.0 dBm	–22.0 dBm	–22.0 dBm	–25.0 dBm
30	30	30.0 dBm	–22.0 dBm	–24.0 dBm	–24.0 dBm	–27.0 dBm
28	28	28.0 dBm	–23.0 dBm	–25.0 dBm	–26.0 dBm	–29.0 dBm
26	26	26.0 dBm	–23.0 dBm	–26.0 dBm	–28.0 dBm	–31.0 dBm
24	24	24.0 dBm	–23.0 dBm	–26.0 dBm	–30.0 dBm	–33.0 dBm
22	22	22.0 dBm	–23.0 dBm	–26.0 dBm	–31.0 dBm	–35.0 dBm
20	20	20.0 dBm	–23.0 dBm	–26.0 dBm	–32.0 dBm	–36.0 dBm

ORFS Due To Switching Transients GSM MS Limits

:CALCulate:ORFSpectrum:SWITching:LIMit:GSM|GSM900:MS:<Pnn>:[ABSolute][:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:SWITching:LIMit:GSM|GSM900:MS:<Pnn>:[ABSolute][:UPPer]:DATA[n]?

Set or query any of the GSM MS related absolute limits for the ORFS due to switching transients measurement. Replace <Pnn> in the above command strings with the appropriate MS TX Level. The measured total carrier power will determine which row of limits will be applied.

Table 4-79 shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 5. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. You can also change the values in the Power column (n=1) to alter the carrier power required for each set of limits.

Example 1:

The following command sets the result limit to –30.0 dBm (the default value is –13.0 dBm) when testing a GSM MS device, total carrier power 39 dBm, at 400 kHz offset:

:CALCulate:ORFSpectrum:SWITching:LIMit:GSM:MS:P39:ABSolute:UPPer:DATA2 –30.0

Example 2:

The following command configures the limits to use the P39 limits when the total carrier power level is less than or equal to +38dBm (instead of the default +39.0 dBm) when testing a GSM MS device:

:CALCulate:ORFSpectrum:SWITching:LIMit:GSM:MS:P39:ABSolute:UPPer:DATA1 38.0

Factory Preset: Refer to Table 4-79.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-79 ORFS Due To Switching Transients GSM MS Limits: Default Values

			Offset Frequency (kHz)			
Pnn	**Power Level (dBm)**	**Power (dBm) (n=1)**	**400 (n=2)**	**600 (n=3)**	**1200 (n=4)**	**1800 (n=5)**
39	39.0 dBm	39.0 dBm	–13.0 dBm	–21.0 dBm	–21.0 dBm	–24.0 dBm
37	37.0 dBm	37.0 dBm	–15.0 dBm	–21.0 dBm	–21.0 dBm	–24.0 dBm
35	35.0 dBm	35.0 dBm	–17.0 dBm	–21.0 dBm	–21.0 dBm	–24.0 dBm
33	33.0 dBm	33.0 dBm	–19.0 dBm	–21.0 dBm	–21.0 dBm	–24.0 dBm
31	31.0 dBm	31.0 dBm	–21.0 dBm	–23.0 dBm	–23.0 dBm	–26.0 dBm
29	29.0 dBm	29.0 dBm	–23.0 dBm	–25.0 dBm	–25.0 dBm	–28.0 dBm
27	27.0 dBm	27.0 dBm	–23.0 dBm	–26.0 dBm	–27.0 dBm	–30.0 dBm
25	25.0 dBm	25.0 dBm	–23.0 dBm	–26.0 dBm	–29.0 dBm	–32.0 dBm
23	23.0 dBm	23.0 dBm	–23.0 dBm	–26.0 dBm	–31.0 dBm	–34.0 dBm
21	21.0 dBm	21.0 dBm	–23.0 dBm	–26.0 dBm	–32.0 dBm	–36.0 dBm

ORFS Due To Switching Transients PCS MS Limits

:CALCulate:ORFSpectrum:SWITching:LIMit:PCS|PCS1900:MS:<Pnn>:[ABSolute][:UPPer]:DATA[n] <amplitude>

:CALCulate:ORFSpectrum:SWITching:LIMit:PCS|PCS1900:MS:<Pnn>:[ABSolute][:UPPer]:DATA[n]?

Set or query any of the PCS MS related commands for the ORFS due to switching transients measurement. Replace <Pnn> in the above command strings with the appropriate MS TX Level. The measured total carrier power will determine which row of limits will be applied.

Table 4-80 shows how each <Pnn> is associated with a value that must be referenced using a numeric from 1 to 5. Replace nn in the above command strings with the appropriate numeric to set or query the desired relative limit for the required offset frequency. You can also change the values in the Power column (n=1) to alter the carrier power required for each set of limits. For further information, refer to the examples provided earlier in this section for the ORFS Due To Switching Transients GSM MS Limits command.

Factory Preset: Refer to Table 4-80.

Range: –150 dBm to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: None

Table 4-80 ORFS Due To Switching Transients PCS MS Limits: Default Values

			Offset Frequency (kHz)			
Pnn	**Power Level (dBm)**	**Power (dBm) (n=1)**	**400 (n=2)**	**600 (n=3)**	**1200 (n=4)**	**1800 (n=5)**
33	33	33.0 dBm	–19.0 dBm	–22.0 dBm	–22.0 dBm	–25.0 dBm
32	32	32.0 dBm	–20.0 dBm	–22.0 dBm	–22.0 dBm	–25.0 dBm
30	30	30.0 dBm	–22.0 dBm	–24.0 dBm	–24.0 dBm	–27.0 dBm
28	28	28.0 dBm	–23.0 dBm	–25.0 dBm	–26.0 dBm	–29.0 dBm
26	26	26.0 dBm	–23.0 dBm	–26.0 dBm	–28.0 dBm	–31.0 dBm
24	24	24.0 dBm	–23.0 dBm	–26.0 dBm	–30.0 dBm	–33.0 dBm

Table 4-80 ORFS Due To Switching Transients PCS MS Limits: Default Values

			Offset Frequency (kHz)			
Pnn	**Power Level (dBm)**	**Power (dBm) (n=1)**	**400 (n=2)**	**600 (n=3)**	**1200 (n=4)**	**1800 (n=5)**
22	22	22.0 dBm	–23.0 dBm	–26.0 dBm	–31.0 dBm	–35.0 dBm
20	20	20.0 dBm	–23.0 dBm	–26.0 dBm	–32.0 dBm	–36.0 dBm

Programming Commands

Phase and Frequency Error Measurement Limits Commands

Phase and Frequency Error—Frequency Error Limit

:CALCulate:PFERror:LIMit:<standard>:<device>:MFERror[:UPPer][:DATA] <ppm>

:CALCulate:PFERror:LIMit:<standard>:<device>:MFERror[:UPPer][:DATA]?

Set the absolute maximum value for frequency limit.

<standard> = GSM450 | GSM480 | GSM850 | PGSM900 | EGSM900 | RGSM900 | DCS1800 | PCS1900

<device> = MS | BTS | UBTS1 | UBTS2 | UBTS3 | PBTS1

MS – Mobile station transmitter

BTS – Base station transmitter

UBTS1 – Micro base station class M1 transmitter

UBTS2 – Micro base station class M2 transmitter

UBTS3 – Micro base station class M3 transmitter

PBTS1 – Pico base station class P1 transmitter

Factory Preset: Values default to the GSM/DCS/PCS standards as shown in Table 4-81.

Range: 0 to 100

Default Unit: parts per million (ppm)

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Limits**

Table 4-81 Phase And Frequency Error Commands: Default Values

Standard	RMS Phase Limit (deg) RPERror	Peak Phase Limit (deg) PPERror	Mean Frequency Limit (ppm) MFERror
GSM450 BTS	5	20	0.10 for PBTS1 devices 0.05 for all other BTS devices

Table 4-81 Phase And Frequency Error Commands: Default Values

Standard	RMS Phase Limit (deg) RPERror	Peak Phase Limit (deg) PPERror	Mean Frequency Limit (ppm) MFERror
GSM480 BTS	5	20	0.10 for PBTS1 devices 0.05 for all other BTS devices
GSM850 BTS	5	20	0.10 for PBTS1 devices 0.05 for all other BTS devices
PGSM900 BTS	5	20	0.10 for PBTS1 devices 0.05 for all other BTS devices
EGSM900 BTS	5	20	0.10 for PBTS1 devices 0.05 for all other BTS devices
RGSM900 BTS	5	20	0.10 for PBTS1 devices 0.05 for all other BTS devices
DCS1800 BTS	5	20	0.10 for PBTS1 devices 0.05 for all other BTS devices
PCS1900 BTS	5	20	0.10 for PBTS1 devices 0.05 for all other BTS devices
GSM450 MS	5	20	0.1
GSM480 MS	5	20	0.1
GSM850 MS	5	20	0.1
PGSM900 MS	5	20	0.1
EGSM900 MS	5	20	0.1
RGSM900 MS	5	20	0.1

Table 4-81 Phase And Frequency Error Commands: Default Values

Standard	RMS Phase Limit (deg) RPERror	Peak Phase Limit (deg) PPERror	Mean Frequency Limit (ppm) MFERror
DCS1800 MS	5	20	0.1
PCS1900 MS	5	20	0.1

Phase and Frequency Error—Peak Phase Error Limit

:CALCulate:PFERror:LIMit:<standard>:<device>:PPERror[:UPPer][:DATA] <degrees>

:CALCulate:PFERror:LIMit:<standard>:<device>:PPERror[:UPPer][:DATA]?

Set the maximum value for peak phase limit.

<standard> = GSM450|GSM480|GSM850|PGSM900|EGSM900|RGSM900|DCS1800|PCS1900

<device> = MS|BTS|UBTS1|UBTS2|UBTS3|PBTS1

MS – Mobile station transmitter

BTS – Base station transmitter

UBTS1 – Micro base station class M1 transmitter

UBTS2 – Micro base station class M2 transmitter

UBTS3 – Micro base station class M3 transmitter

PBTS1 – Pico base station class P1 transmitter

Factory Preset: Values default to the GSM/DCS/PCS standards as shown in Table 4-81.

Range: 0 to 180

Default Unit: degrees peak

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Limits....**

Phase and Frequency Error—RMS Phase Error Limit

:CALCulate:PFERror:LIMit:<standard>:<device>:RPERror[:UPPer][:DATA] <degrees>

:CALCulate:PFERror:LIMit:<standard>:<device>:RPERror[:UPPer][:DATA]?

Set the maximum value for RMS phase limit.

<standard> = GSM450 | GSM480 | GSM850 | PGSM900 | EGSM900 | RGSM900 | DCS1800 | PCS1900

<device> = MS | BTS | UBTS1 | UBTS2 | UBTS3 | PBTS1

MS – Mobile station transmitter

BTS – Base station transmitter

UBTS1 – Micro base station class M1 transmitter

UBTS2 – Micro base station class M2 transmitter

UBTS3 – Micro base station class M3 transmitter

PBTS1 – Pico base station class P1 transmitter

Factory Preset: Values default to the GSM/DCS/PCS standards as shown in Table 4-81.

Range: 0 to 180

Default Unit: degrees RMS

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Limits....**

Phase and Frequency Error—Limits State

:CALCulate:PFERror:LIMit[:STATe] OFF|ON|0|1

:CALCulate:PFERror:LIMit[:STATe]?

Turn limit checking on or off.

Factory Preset: On

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Limit Test**

Power Steps Measurement Limits Commands

Power Steps—Power Step Lower Limit

:CALCulate:PSTeps:LIMit:<standard>:<device>:PDELta:LOWer [:DATA] <dB>

:CALCulate:PSTeps:LIMit:<standard>:<device>:PDELta:LOWer [:DATA]?

Set the delta power step lower limit.

<standard> = GSM450 | GSM480 | GSM850 | PGSM900 | EGSM900 | RGSM900 | DCS1800 | PCS1900

<device> = MS | BTS | UBTS1 | UBTS2 | UBTS3 | PBTS1

MS – Mobile station transmitter

BTS – Base station transmitter

UBTS1 – Micro base station class M1 transmitter

UBTS2 – Micro base station class M2 transmitter

UBTS3 – Micro base station class M3 transmitter

PBTS1 – Pico base station class P1 transmitter

Factory Preset: Values default to the GSM/DCS/PCS standards as shown in Table 4-82.

Range: 0 to 200

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Limit...**

Table 4-82 Power Steps Commands: Default Values

	Power Step Upper Limit (dB) PDEL:UPP	Power Step Lower Limit (dB) PDEL:LOW
GSM450 BTS	3.5	0.5
GSM480 BTS	3.5	0.5
GSM850 BTS	3.5	0.5
PGSM900 BTS	3.5	0.5
EGSM900 BTS	3.5	0.5
RGSM900 BTS	3.5	0.5

Programming Commands

Table 4-82 Power Steps Commands: Default Values

	Power Step Upper Limit (dB) PDEL:UPP	Power Step Lower Limit (dB) PDEL:LOW
DCS1800 BTS	3.5	0.5
PCS1900 BTS	3.5	0.5
GSM450 MS	3.5	0.5
GSM480 MS	3.5	0.5
GSM850 MS	3.5	0.5
PGSM900 MS	3.5	0.5
EGSM900 MS	3.5	0.5
RGSM900 MS	3.5	0.5
DCS1800 MS	3.5	0.5
PCS1900 MS	3.5	0.5

Power Steps—Power Step Upper Limit

:CALCulate:PSTeps:LIMit:<standard>:<device>:PDELta[:UPPer][:DATA] <dB>

:CALCulate:PSTeps:LIMit:<standard>:<device>:PDELta[:UPPer][:DATA]?

Set the delta power step upper limit.

<standard> = GSM450 | GSM480 | GSM850 | PGSM900 | EGSM900 | RGSM900 | DCS1800 | PCS1900

<device> = MS | BTS | UBTS1 | UBTS2 | UBTS3 | PBTS1

MS – Mobile station transmitter

BTS – Base station transmitter

UBTS1 – Micro base station class M1 transmitter

UBTS2 – Micro base station class M2 transmitter

UBTS3 – Micro base station class M3 transmitter

PBTS1 – Pico base station class P1 transmitter

Factory Preset: Values default to the GSM/DCS/PCS standards as shown in Table 4-82.

Range: 0 to 200

Default Unit: dB

Remarks:	You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**Meas Setup, Limit...**

Power Steps—Limits State

:CALCulate:PSTeps:LIMit[:STATe] OFF|ON|0|1

:CALCulate:PSTeps:LIMit[:STATe]?

Turn limits state on or off.

Factory Preset: On

Remarks:	You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**Meas Setup, Limit Test**

Receive Band Spurious - Limits

Receive Band Spurious Limit

:CALCulate:RSPur:LIMit:<standard>:<device>[:IDLE][:UPPer][:DATA] <dBm>

:CALCulate:RSPur:LIMit:<standard>:<device>[:IDLE][:UPPer][:DATA]?

Set the maximum limit value for the current measurement.

<standard> = GSM450 | GSM480 | GSM850 | PGSM900 | EGSM900 | RGSM900 | DCS1800 | PCS1900

<device> = MS | BTS | UBTS1 | UBTS2 | UBTS3 | PBTS1

MS – Mobile station transmitter

BTS – Base station transmitter

UBTS1 – Micro base station class M1 transmitter

UBTS2 – Micro base station class M2 transmitter

UBTS3 – Micro base station class M3 transmitter

PBTS1 – Pico base station class P1 transmitter

Factory Preset: Limit values default to the GSM/DCS/PCS standards as shown in Table 4-83.

Range: –200 to 100

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Limit....**

Table 4-83 Receive Band Spurious Command: Default Limit Values

Standard	MS	BTS	UBTS1	UBTS2	UBTS3	PBTS1
GSM450	–67.0	–98.0	–91.0	–86.0	–81.0	–70.0
GSM480	–67.0	–98.0	–91.0	–86.0	–81.0	–70.0
GSM850	–79.0	–98.0	–91.0	–86.0	–81.0	–70.0
PGSM900	–79.0	–98.0	–91.0	–86.0	–81.0	–70.0
EGSM900	–67.0	–98.0	–91.0	–86.0	–81.0	–70.0
RGSM900	–60.0	–98.0	–91.0	–86.0	–81.0	–70.0
DCS1800	–71.0	–98.0	–96.0	–91.0	–86.0	–80.0

Table 4-83 Receive Band Spurious Command: Default Limit Values

Standard	MS	BTS	UBTS1	UBTS2	UBTS3	PBTS1
PCS1900	–71.0	–98.0	–96.0	–91.0	–86.0	–80.0

Transmit Band Spurious - Limits

Transmit Band Spurious Limit

:CALCulate:TSPur:LIMit:<standard>:<device>:<idle mode>[:UPPer][:DATA] <dBm>

:CALCulate:TSPur:LIMit:<standard>:<device>:<idle mode>[:UPPer][:DATA]?

Set the maximum limit value for the current measurement.

<standard> = GSM450 | GSM480 | GSM850 | PGSM900 | EGSM900 | RGSM900 | DCS1800 | PCS1900

<device> = MS | BTS | UBTS1 | UBTS2 | UBTS3 | PBTS1

MS – Mobile station transmitter

BTS – Base station transmitter

UBTS1 – Micro base station class M1 transmitter

UBTS2 – Micro base station class M2 transmitter

UBTS3 – Micro base station class M3 transmitter

PBTS1 – Pico base station class P1 transmitter

<idle mode> = :IDLE | [ACTIVE]

Factory Preset: Limit values default to the GSM/DCS/PCS standards as shown in Table 4-84.

Range: –200 to 100 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Limit....**

Table 4-84 Transmit Band Spurious Command: Default Limit Values

Standard	Active Mode	Idle Mode
GSM450 BTS	–36.0	–36.0
GSM480 BTS	–36.0	–36.0
GSM850 BTS	–36.0	–36.0
PGSM900 BTS	–36.0	–36.0
EGSM900 BTS	–36.0	–36.0

Table 4-84 Transmit Band Spurious Command: Default Limit Values

Standard	Active Mode	Idle Mode
RGSM900 BTS	–36.0	–36.0
DCS1800 BTS	–36.0	–36.0
PCS1900 BTS	–36.0	–36.0
GSM450 MS	–36.0	–57.0
GSM480 MS	–36.0	–57.0
GSM850 MS	–36.0	–57.0
PGSM900 MS	–36.0	–59.0
EGSM900 MS	–36.0	–59.0
RGSM900 MS	–42.0	–59.0
DCS1800 MS	–36.0	–53.0
PCS1900 MS	–30.0	–53.0

CONFigure Subsystem

The CONFigure commands are used with several other commands to control the measurement process. The full set of commands are described in the section "MEASure Group of Commands" on page 254.

Selecting measurements with the CONFigure/FETCh/MEASure/READ commands sets the instrument state to the defaults for that measurement and to make a single measurement. Other commands are available for each measurement to allow you to change: settings, view, limits, etc. Refer to:

SENSe:<measurement>, SENSe:CHANnel, SENSe:CORRection,
SENSe:DEFaults, SENSe:DEViation, SENSe:FREQuency,
SENSe:PACKet, SENSe:POWer, SENSe:RADio, SENSe:SYNC
CALCulate:<measurement>, CALCulate:CLIMits
DISPlay:<measurement>
TRIGger

The INITiate[:IMMediate] or INITiate:RESTart commands will initiate the taking of measurement data without resetting any of the measurement settings that you have changed from their defaults.

Configure the Selected Measurement

:CONFigure:<measurement>

A CONFigure command must specify the desired measurement. It will set the instrument settings for that measurement's standard defaults, but should not initiate the taking of data. The available measurements are described in the MEASure subsystem.

NOTE This command sets Averaging to On and sets the number of averages to 10.

DISPlay Subsystem

The DISPlay controls the selection and presentation of textual, graphical, and TRACe information. Within a DISPlay, information may be separated into individual WINDows.

Display Annotation Title Data

:DISPlay:ANNotation:TITLe:DATA <string>

:DISPlay:ANNotation:TITLe:DATA?

Enters the text that will be displayed in the user title area of the display.

Front Panel Access: **Display, Title**

Display, Title, Change Title

Display, Title, Clear Title

Display EDGE Output RF Spectrum Measurement Results

:DISPlay:EORFSpectr:TABLe RESults|LIMits|MARGins

:DISPlay:EORFSpectr:TABLe?

Displays the EDGE Output RF Spectrum Measurement results in tabular form, allowing the user to switch between displaying results, applied limits and margins of error for six offset frequencies

Factory Preset: Results

Front Panel Access: **Display**

Display Output RF Spectrum Measurement Results

:DISPlay:ORFSpectrum:TABLe RESults|LIMits|MARGins

Displays the Output RF Spectrum Measurement results in tabular form, allowing the user to switch between displaying results, applied limits and margins of error for six offset frequencies

Factory Preset: Results

Programming Commands

Front Panel
Access: **Display**

Set the Display Line

:DISPlay:WINDow:TRACe:Y:DLINe <ampl>

:DISPlay:WINDow:TRACe:Y:DLINe?

Defines the level of the display line, in the active amplitude units if no units are specified.

Factory Preset: 2.5 divisions below the reference level

Range: 10 display divisions below the reference level to the reference level

Default Unit: Current active units

Front Panel
Access: **Display, Display Line**

Control the Display Line

:DISPlay:WINDow:TRACe:Y:DLINe:STATe OFF|ON|0|1

:DISPlay:WINDow:TRACe:Y:DLINe:STATe?

Turns the display line on or off.

Factory Preset: Off

Front Panel
Access: **Display, Display Line**

FETCh Subsystem

The FETCh? queries are used with several other commands to control the measurement process. These commands are described in the section on the "MEASure Group of Commands" on page 254. These commands apply only to measurements found in the MEASURE menu.

This command puts selected data from the most recent measurement into the output buffer (new data is initiated/measured). Use FETCh if you have already made a good measurement and you want to look at several types of data (different [n] values) from the single measurement. FETCh saves you the time of re-making the measurement. You can only fetch results from the measurement that is currently active.

If you need to make a new measurement, use the READ command, which is equivalent to an INITiate[:IMMediate] followed by a FETCh.

:FETCh <meas>? will return valid data only when the measurement is in one of the following states:

idle
initiated
paused

Fetch the Current Measurement Results

:FETCh:<measurement>[n]?

A FETCh? command must specify the desired measurement. It will return the valid results that are currently available, but will not initiate the taking of any new data. You can only fetch results from the measurement that is currently selected. The code number n selects the kind of results that will be returned. The available measurements and data results are described in the "MEASure Group of Commands" on page 254.

INITiate Subsystem

The INITiate subsystem is used to initiate a trigger for a sweep or measurement. “Measurement” refers to the functions found under the MEASURE front panel key or in the “MEASure Group of Commands” on page 254. Refer also to the TRIGger and ABORt subsystems for related commands.

Continuous or Single Measurements

:INITiate:CONTinuous OFF|ON|0|1

:INITiate:CONTinuous?

Selects whether the trigger system is continuously initiated, or not.

This command affects the sweep in Spectrum Analysis mode, and affects measurement triggering when in a measurement. A “measurement” refers to any of the functions under the MEASURE key.

NOTE This command operates in the same manner whether you are triggering a sweep cycle, or triggering a measurement cycle.

- When ON, at the completion of each sweep/measurement cycle the sweep/measurement system immediately initiates another sweep/measurement cycle.
- When OFF, the sweep/measurement system remains in the “idle” state until INITiate:CONTinuous is set to ON or an :INITiate[:IMMediate] command is received. On receiving the :INITiate[:IMMediate] command, a single sweep/measurement occurs followed by a return to the “idle” state.
- The query returns 1 or 0 into the output buffer. 1 is returned when there is continuous sweeping/measurement triggering. 0 is returned when there is single sweeping/measurement triggering.

Example: INIT:CONT ON

Factory Preset: On (Off is usually recommended for remote operation.)

Front Panel Access: **Meas Control**

Take New Data Acquisitions

:INITiate[:IMMediate]

The command causes the system to exit the “idle” state and go to the “initiated” state. Once the trigger conditions are met, the sweep/measurement will start.

The instrument must be in the single sweep/measurement mode. The command is ignored if:

- INIT:CONT is ON
- a measurement is selected (any function under the MEASURE key), but it is not waiting in the “idle” state.

It then completes one full trigger cycle and returns to the “idle” state on completion of the sweep/measurement. (If you have selected averaging, or are in a measurement, it may average several sweeps/measurements. So there can be multiple data acquisitions, with multiple trigger events, for one full trigger cycle.)

Use the TRIGer[:SEQuence]:SOURce EXT command to select the external trigger source. If you are making a measurement (using a function from the MEASure subsystem), you may need to use a [:SENSe]:<meas>:TRIGger:SOURce command to select the desired trigger.

Use :FETCh:<meas>? to transfer a measurement result from memory to the output buffer. Refer to individual commands in the FETCh subsystem for more information.

While the system is in the “initiated” state, additional :INIT command(s) will restart the sweep/measurement. If averaging is on, the averaging will be reset.

Example:	INIT:IMM
Remarks:	See also the *TRG command and the TRIGger subsystem.
Front Panel Access:	**Meas Control, Restart**

Pause the Measurement

:INITiate:PAUSe

Pauses the current measurement by changing the current measurement state from the “wait for trigger” state to the “paused” state. If the measurement is not in the “wait for trigger” state, when the command is issued, the transition will be made the next time that state is entered as part of the trigger cycle. When in the paused state, the spectrum analyzer auto-align process stops. If the analyzer is paused for a long period of time, measurement accuracy may degrade.

Example: INIT:PAUS

Front Panel Access: **Meas Control, Pause**

Restart the Measurement

:INITiate:RESTart

This command applies to measurements found in the MEASURE menu. It restarts the current measurement from the “idle” state regardless of its current operating state. It is equivalent to:

INITiate[:IMMediate]

ABORt (for continuous measurement mode)

Example: INIT:REST

Front Panel Access: **Restart**

or

Meas Control, Restart

Resume the Measurement

:INITiate:RESume

Resumes the current measurement by changing the current measurement state from the “paused state” back to the “wait for trigger” state. If the measurement is not in the “paused” state, when the command is issued, an error is reported.

Example: INIT:RES

Front Panel Access: **Meas Control, Resume**

INSTrument Subsystem

This subsystem includes commands for querying and selecting instrument measurement (personality option) modes.

Catalog Query

:INSTrument:CATalog?

Returns a comma separated list of strings which contains the names of all the installed applications. These names can only be used with the **INST:SELECT** command.

Example:
(PSA and ESA) INST:CAT?

Query response: ”CDMA,PNOISE”

Select Application by Number

:INSTrument:NSELect <integer>

:INSTrument:NSELect?

Select the measurement mode by its instrument number. The actual available choices depends upon which applications are installed in the instrument.

1 = SA (PSA/ESA)
3 = GSM (GSM on E4406A, and GSM or GSM w/EDGE on ESA)
4 = CDMA (cdmaOne) (E4406/ESA/PSA)
5 = NADC (E4406/PSA)
6 = PDC (E4406/PSA)
8 = BASIC (E4406/PSA)
9 = WCDMA (3GPP W-CDMA with HSDPA) (E4406/PSA)
10 = CDMA2K (cdma2000 with 1xEV-DV) (E4406/PSA)
13 = EDGEGSM (E4406/PSA)
14 = PNOISE (phase noise) (ESA/PSA)
15 = CMDA1XEV (1xEV-D0) (E4406/PSA)
219 = NOISEFIGURE (ESA/PSA)
228 = BLUETOOTH (ESA)
227 = CATV (Cable TV) (ESA)
229 = MAN (Modulation Analysis) (ESA)
231 = LINK (89600 VSA Link Software) (ESA)
266 = 8566/68 Programming Compatibility (ESA/PSA)
290 = 8590 Series Programming Compatibility (ESA/PSA)

NOTE If you are using the SCPI status registers and the analyzer mode is changed, the status bits should be read, and any errors resolved, prior to switching modes. Error conditions that exist prior to switching modes cannot be detected using the condition registers after the mode change. This is true unless they recur after the mode change, although transitions of these conditions can be detected using the event registers.

Changing modes resets all SCPI status registers and mask registers to their power-on defaults. Hence, any event or condition register masks must be re-established after a mode change. Also note that the power up status bit is set by any mode change, since that is the default state after power up.

Example:	INST:NSEL 4
Factory Preset:	Persistent state with factory default of 1 (PSA/ESA)
Range:	1 to x, where x depends upon which applications are installed.
Front Panel Access:	**MODE**

Select Application

ESA Series:

:INSTrument[:SELect] 'SA'|'GSM'|'CDMA'|'PNOISE'|'BLUETOOTH'|'EDGE'|'MAN'|'LINK'|'CATV'|'NFIGURE'

:INSTrument[:SELect]?

Select the measurement mode. The actual available choices depend upon which modes (measurement applications) are installed in the instrument. A list of the valid choices is returned with the INST:CAT? query.

Once an instrument mode is selected, only the commands that are valid for that mode can be executed.

1 = SA (PSA/ESA)
3 = GSM (GSM on E4406A, and GSM or GSM w/EDGE on ESA)
4 = CDMA (cdmaOne) (E4406/ESA/PSA)
5 = NADC (E4406/PSA)
6 = PDC (E4406/PSA)
8 = BASIC (E4406/PSA)
9 = WCDMA (3GPP W-CDMA with HSDPA) (E4406/PSA)
10 = CDMA2K (cdma2000 with 1xEV-DV) (E4406/PSA)
13 = EDGEGSM (E4406/PSA)
14 = PNOISE (phase noise) (ESA/PSA)
15 = CMDA1XEV (1xEV-D0) (E4406/PSA)

219 = NOISEFIGURE (ESA/PSA)
228 = BLUETOOTH (ESA)
227 = CATV (Cable TV) (ESA)
229 = MAN (Modulation Analysis) (ESA)
231 = LINK (89600 VSA Link Software) (ESA)
266 = 8566/68 Programming Compatibility (ESA/PSA)
290 = 8590 Series Programming Compatibility (ESA/PSA)

NOTE If you are using the status bits and the analyzer mode is changed, the status bits should be read, and any errors resolved, prior to switching modes. Error conditions that exist prior to switching modes cannot be detected using the condition registers after the mode change. This is true unless they recur after the mode change, although transitions of these conditions can be detected using the event registers.

Changing modes resets all SCPI status registers and mask registers to their power-on defaults. Hence, any event or condition register masks must be re-established after a mode change. Also note that the power up status bit is set by any mode change, since that is the default state after power up.

Example: ESA Series instruments: INST:SEL ‘CDMA’

Example: PSA Series instruments: INST:SEL CDMA

Factory Preset:
(PSA/ESA) Persistent state with factory default of Spectrum Analyzer mode

Front Panel
Access: **MODE**

MEASure Group of Commands

This group includes the CONFigure, FETCh, MEASure, and READ commands that are used to make measurements and return results. The different commands can be used to provide fine control of the overall measurement process, like changing measurement parameters from their default settings. Most measurements should be done in single measurement mode, rather than measuring continuously.

Cable Fault Location Measurement

Displays the reflected signal of a transmission line as a function of the distance down the line. This complements the return loss measurement. If a cable under test fails a return loss measurement, the cable fault location measurement can be used to identify the location of the fault. The measurement is particularly useful when a base station and antenna are connected by a long length of cable

The general functionality of CONFigure, FETCh, MEASure, and READ are described at the beginning of this section. See the SENSe:CFLocation commands for more measurement related commands.

:CONFigure:CFLocation

:FETCh:CFLocation[n]?

:READ:CFLocation[n]?

:MEASure:CFLocation[n]?

Front Panel Access:	**Measure, Cable Fault Location**
	After the measurement is selected, press **Restore Meas Defaults** to restore factory defaults.

Measurement Results Available

n	Results Returned
n=1 (or not specified)	Returns scalar values: 1. **Max Range** 2. **Marker Distance** 3. **Marker Amplitude** 4. **Marker Amplitude Coeff (rho)** 5. **Accuracy** 6. **Velocity Factor** 7. **Cable Loss**
2	Returns the RF Envelope Trace (data array). The number of data points in the array depends on the settings in use. The default number of data points is 512.
3	Returns the FFT Trace (data array). The number of data points in the array depends on the settings in use. The default number of data points is 512.

EDGE Error Vector Magnitude Measurement

This measures the vector error of the magnitude of each symbol. You must be in GSM, EDGE mode to use these commands. Use INSTrument:SELect to set the mode.

The general functionality of CONFigure, FETCh, MEASure, and READ are described at the beginning of this section. See the SENSe:EEVM commands for more measurement related commands.

:CONFigure:EEVM

:FETCh:EEVM[n]?

:READ:EEVM[n]?

:MEASure:EEVM[n]?

Front Panel Access: **Measure, EDGE EVM**

After the measurement is selected, press **Restore Meas Defaults** to restore factory defaults.

Measurement Results Available

n	Results Returned
0	Returns unprocessed I/Q trace data, as a data array of trace point values, in volts.

n	Results Returned
1 (default)	Returns the following scalar results, in order. 1. RMS 95th percentile EVM – a floating point number (in percent) of EVM over 95% of the entire measurement area. 2. RMS EVM – a floating point number (in percent) of EVM over the entire measurement area. 3. Maximum RMS EVM – a floating point number (in percent) of highest EVM over the entire measurement area. 4. Peak EVM – a floating point number (in percent) of the average of the peak EVMs. Take the peak EVMs from each burst and average them together. 5. Maximum peak EVM – a floating point number (in percent) of the maximum peak EVM. Take the peak EVMs from each burst and identify the highest peak. 6. Symbol position of the peak EVM error – an integer number of the symbol position where the peak EVM error is detected. 7. Magnitude error – a floating point number (in percent) of average magnitude error over the entire measurement area. 8. Maximum magnitude error – a floating point number (in percent) of maximum magnitude error over the entire measurement area. 9. Phase error – a floating point number (in degree) of average phase error over the entire measurement area. 10. Maximum Phase error – a floating point number (in degree) of maximum phase error over the entire measurement area. 11. Frequency error – a floating point number (in Hz) of the frequency error in the measured signal. 12. Maximum frequency error – a floating point number (in Hz) of the highest frequency error in the measured signal. 13. I/Q origin offset – a floating point number (in dB) of the I and Q error (magnitude squared) offset from the origin. 14. Droop Error – a floating point number (in dB) of the amplitude droop measured across the 142 symbol burst. 15. Maximum Droop Error – a floating point number (in dB) of the maximum amplitude droop measured across the 142 symbol burst. 16. Training Sequence – an integer number of the current training sequence code value.
2	Returns series of floating point numbers (in percent) that represent each sample in the EVM vector trace for the last slot. The first number is the symbol 0 decision point and there is 1 point per symbol.
3	Returns series of floating point numbers (in percent) that represent each sample in the magnitude error vector trace for the last slot. The first number is the symbol 0 decision point and there is 1 point per symbol.

Programming Commands

n	Results Returned
4	Returns series of floating point numbers (in degrees) that represent each sample in the phase error vector trace for the last slot. The first number is the symbol 0 decision point and there is 1 point per symbol.
5	Returns series of floating point numbers that alternately represent I and Q pairs of the final corrected measured data for the last slot. The magnitude of each I and Q pair are normalized to 1.0. The first number is the in-phase (I) sample of symbol 0 decision point and the second is the quadrature-phase (Q) sample of symbol 0 decision point. As in the EVM, there is 1 point per symbol, so the series of numbers is: 1st number = I of the symbol 0 decision point 2nd number = Q of the symbol 0 decision point . . . (2) + 1 (or 3rd) number = I of the symbol 1 decision point (2) + 2 (or 4th) number = Q of the symbol 1 decision point . . . (2) × N + 1 number = I of the symbol N decision point (2) × N + 2 number = Q of the symbol N decision point
7 VSA, PSA only	Returns series of integer values that represent the demoded symbols (octal bits) of the final corrected measured data for the last slot. Each bit/symbol is represented as a value between 0 - 7. All 142 symbols in slot are returned.

EDGE Output RF Spectrum Measurement

This measures adjacent channel power. From 1 to 15 offsets can be measured at one time. You must be in GSM, EDGE mode to use these commands. Use INSTrument:SELect to set the mode.

The general functionality of CONFigure, FETCh, MEASure, and READ are described at the beginning of this section. See the SENSe:EORFspectr commands for more measurement related commands.

:CONFigure:EORFspectr

:FETCh:EORFspectr[n]?

:READ:EORFspectr[n]?

:MEASure:EORFspectr[n]?

Front Panel Access: **Measure, EDGE Output RF Spectrum**

After the measurement is selected, press **Restore Meas Defaults** to restore factory defaults.

Measurement Results Available

Measurement Method	n	Results Returned
	0	Returns unprocessed I/Q trace data, as a series of trace point values, in volts. The I values are listed first in each pair, using the 0 through even-indexed values. The Q values are the odd-indexed values.
Single Offset	n=1 (or not specified)	Returns four comma separated measurement results for the specified offset: 1. Modulation spectrum power, dB 2. Modulation spectrum power, dBm 3. Switching transient power, dB 4. Switching transient power, dBm

Measurement Method	**n**	**Results Returned**
Multiple Offsets	n=1 (or not specified)	Returns a list of values for the modulation spectrum at all the offsets (lower and upper.) This is followed by the switching transients results at all the offsets (lower and upper). Note that the carrier is considered offset zero (0) and is the first set of results sent. Four values are provided for each of the offsets (including the carrier), in this order: 1. Negative offset(a) - power relative to carrier (dB) 2. Negative offset(a) - absolute average power (dBm) 3. Positive offset(a) - power relative to carrier (dB) 4. Positive offset(a) - absolute average power (dBm) Values for all possible offsets are sent. Zeros are sent for offsets that have not been defined. The total number of values sent (120) = (4 results/offset) × (15 offsets) × (2 measurement types - modulation & switching) Carrier - modulation measurement values Offset 1 - modulation measurement values . . . Offset 14 - modulation measurement values Carrier - switching transients measurement values Offset 16 - switching transients measurement values . . . Offset 29 - switching transients measurement values
Single Offset or Swept	2	Returns floating point numbers (in dBm) of the captured trace data. It contains N data points of the “spectrum due to modulation” signal, where N is the specified number of samples.
Single Offset or Swept	3	Returns floating point numbers (in dBm) of the captured trace data. It contains N data points of the “spectrum due to switching transients” signal, where N is the specified number of samples.

EDGE Power vs. Time Measurement

This measures the average power during the “useful part” of the burst comparing the power ramp to required timing mask. You must be in GSM, EDGE mode to use these commands. Use INSTrument:SELect to set the mode.

The general functionality of CONFigure, FETCh, MEASure, and READ are described at the beginning of this section. See the SENSe:EPVTime commands for more measurement related commands.

:CONFigure:EPVTime

:FETCh:EPVTime[n]?

:READ:EPVTime[n]?

:MEASure:EPVTime[n]?

Front Panel Access: **Measure, EDGE Pwr vsTime**

After the measurement is selected, press **Restore Meas Defaults** to restore factory defaults.

Programming Commands

Measurement Results Available

n	Results Returned
n=1 (or not specified)	Returns the following scalar results: 1. **Sample time** is a floating point number that represents the time between samples when using the trace queries (n=0,2,etc.). 2. **Power single burst** is the mean power (in dBm) across the useful part of the selected burst in the most recently acquired data, or in the last data acquired at the end of a set of averages. If averaging is on, the power is for the last burst. 3. **Power averaged** is the power (in dBm) of N averaged bursts, if averaging is on. The power is averaged across the useful part of the burst. Average *m* is a single burst from the acquired trace. If there are multiple bursts in the acquired trace, only one burst is used for average *m*. This means that N traces are acquired to make the complete average. If averaging is off, the value of **power averaged** is the same as the **power single burst** value. 4. **Number of samples** is the number of data points in the captured signal. This number is useful when performing a query on the signal (i.e. when n=0,2,etc.). 5. **Start** is the index of the data point at the start of the useful part of the burst 6. **Stop** is the index of the data point at the end of the useful part of the burst 7. $\mathbf{T_0}$ is the index of the data point where t_0 occurred, where T_0 is the time point of the transition from bit 13 to bit 14 of the midamble training sequence. 8. **Burst width** is the width of the burst measured at –3 dB below the mean power in the useful part of the burst. 9. **Maximum value** is the maximum value of the most recently acquired data (in dBm). 10. **Minimum value** is the minimum value of the most recently acquired data (in dBm). 11. **Burst search threshold** is the value (in dBm) of the threshold where a valid burst is identified, after the data has been acquired.
2	Returns trace point values of the entire waveform data. These data points are floating point numbers representing the power of the signal (in dBm). There are N data points, where N is the **number of samples**. The period between the samples is defined by the **sample time**.

Monitor Band/Channel Measurement

Verifies that the GSM band and channels are free of interference by measuring the spurious signals in the bands and channels specified by the selected standard and tuning plan.

The general functionality of CONFigure, FETCh, MEASure, and READ are described at the beginning of this section. See the SENSe:MONitor commands for more measurement related commands.

:CONFigure:MONitor

:FETCh:MONitor[n]?

:READ:MONitor[n]?

:MEASure:MONitor[n]?

Front Panel
Access: **Measure, Monitor Band/Channel**

After the measurement is selected, press **Restore Meas Defaults** to restore factory defaults.

Measurement Results Available

n	Results Returned
n=1 (or not specified)	Returns one scalar value: Total Power (only for band meas)
2	Returns the RF Envelope Trace (data array). This data array contains 401 data points.
3	Returns the Max Hold Trace (data array). This trace contains 401 data points.

Programming Commands

Out of Band Spurious Emissions Measurement

This measures the out of band spurious emissions relative to the receive channel power in the selected channel. You must be in the GSM or cdmaOne mode to use these commands. Use INSTrument:SELect to set the mode.

The general functionality of CONFigure, FETCh, MEASure, and READ are described at the beginning of this section. See the SENSe:OOBSpur commands for more measurement related commands.

:CONFigure:OOBSpur

:FETCh:OOBSpur[n]?

:READ:OOBSpur[n]?

:MEASure:OOBSpur[n]?

Front Panel
Access: **Measure, Out Of Band Spurious**

After the measurement is selected, press **Restore Meas Defaults** to restore factory defaults.

Measurement Results Available

n	Results Returned
0	No return value.
n=1 (or not specified) cdmaOne mode	Returns the following two components: 1st–the number of ranges that were measured (1 - 20) 2nd–the results for each range are returned. Each result is made up of seven values for each of a maximum of 10 spurs for a total of 10 ¥ N spurs and 70 ¥ N return values, where N = the number of ranges set. The return values for each spur are: 1. Range number 2. Spur number 3. Center frequency 4. Amplitude 5. Delta absolute limit 6. Delta relative limit 7. Pass/Fail results

n	Results Returned
n=1 (or not specified) GSM mode	Returns a list of spurious result values for each of the spurs found: 1. Frequency (a) Hz 2. Amplitude (a) dBm 3. Limit specification (a) dBm 4. Delta from limit (a) dB Where a = 0 to number of spurs (variable).
2 GSM mode	Returns the number of spurs found.

Output RF Spectrum Measurement

This measures adjacent channel power. From 1 to 15 offsets can be measured at one time. You must be in the GSM mode to use these commands. Use INSTrument:SELect to set the mode.

The general functionality of CONFigure, FETCh, MEASure, and READ are described at the beginning of this section. See the SENSe:ORFSpectrum commands for more measurement related commands.

:CONFigure:ORFSpectrum

:FETCh:ORFSpectrum[n]?

:READ:ORFSpectrum[n]?

:MEASure:ORFSpectrum[n]?

Front Panel Access: **Measure, Output RF Spectrum**

After the measurement is selected, press **Restore Meas Defaults** to restore factory defaults.

Measurement Results Available

The default settings for the MEASure command only measure the carrier and 5 standard offsets. The default does not measure the switching transients. If you use the CONFigure, INITiate, and FETCh commands in place of the MEASure command, you can then use the SENSe commands to change the settings from these defaults.

Measurement Method	n	Results Returned
Single Offset	n=1 (or not specified)	Returns measurement results for the specified offset: 1. Modulation spectrum power, dB 2. Modulation spectrum power, dBm 3. Switching transient power, dB 4. Switching transient power, dBm

Measurement Method	**n**	**Results Returned**
Multiple offsets	n=1 (or not specified)	Returns a list of values for the modulation spectrum at all the offsets (lower and upper.) This is followed by the switching transients results at all the offsets (lower and upper). Note that the carrier is considered offset zero (0) and is the first set of results sent. Four values are provided for each of the offsets (including the carrier), in this order: 1. Negative offset(a) - power relative to carrier (dB) 2. Negative offset(a) - absolute average power (dBm) 3. Positive offset(a) - power relative to carrier (dB) 4. Positive offset(a) - absolute average power (dBm) Values for all possible offsets are sent. Zeros are sent for offsets that have not been defined. The total number of values sent (120) = (4 results/offset) × (15 offsets) × (2 measurement types - modulation & switching) Carrier - modulation measurement values Offset 1 - modulation measurement values and so on Offset 14 - modulation measurement values Carrier - switching transients measurement values Offset 16 - switching transients measurement values Offset 29 - switching transients measurement values and so on This measurement defaults to modulation measurements and not switching measurements. If you want to return the switching measurement values, you must change that default condition and use FETCh or READ to return values, rather than MEASure. NOTE: When using custom modulation and switching offsets the maximum number of measured values returned is: 13 modulation offsets + 0 Hz carrier 4 switching offsets + 0 Hz carrier
Swept	Not specified, or n=1	Returns l boolean value: 1 if limits passed, 0 if limits failed.
Single offset	2	Returns floating point numbers (in dBm) of the captured trace data. It contains 401 data points of the “spectrum due to modulation” signal.
Swept	2	Returns floating point numbers (in dBm) of the captured trace data. It contains 401 points of the “spectrum due to modulation” signal.
Single offset	3	Returns floating point numbers (in dBm) of the captured trace data. It contains 401 points of the “spectrum due to switching transients” signal.

Programming Commands

Measurement Method	n	Results Returned
Swept	3	Returns floating point numbers (in dBm) of the captured trace data. It contains 401 points of the “spectrum due to switching transients” signal.

Phase & Frequency Error Measurement

This measures the modulation quality of the transmitter by checking phase and frequency accuracy. You must be in the GSM mode to use these commands. Use INSTrument:SELect to set the mode.

The general functionality of CONFigure, FETCh, MEASure, and READ are described at the beginning of this section. See the SENSe:PFERror commands for more measurement related commands.

:CONFigure:PFERror

:FETCh:PFERror[n]?

:READ:PFERror[n]?

:MEASure:PFERror[n]?

Front Panel
Access: **Measure, Phase & Freq**

After the measurement is selected, press **Restore Meas Defaults** to restore factory defaults.

Measurement Results Available

n	Results Returned
0	Returns a series of floating point numbers (in volts) that represent each sample of the complete current time record raw I/Q vector trace length scalar value (giving the total number of I/Q vector sample pairs = n/2). The I/Q vector sample pair data is organized as: I(0), Q(0), I(1), Q(1) . . . I([n/2]-1), Q([n/2]-1) The start of bit 0 (zero) of the useful part of the measured GSM burst within the vector sample pairs is located at: I(x/2), Q(x/2) where x = raw I/Q vector trace index to burst.

n	Results Returned
n=1 (or not specified)	Returns the following scalar values: 1. **RMS phase error** is a floating point number (in degrees) of the rms phase error between the measured phase and the ideal phase. The calculation is based on symbol decision points and points halfway between symbol decision points (i.e. 2 points/symbol). If averaging is on, this is the average of the individual rms phase error measurements. 2. **Peak phase error** is a floating point number (in degrees) of the peak phase error of all the individual symbol decision points (prior to the rms averaging process). If averaging is on, this is the average of the individual peak phase error measurements. 3. **Peak phase bit** is a floating point number (in bits) representing the bit number at which the peak phase error occurred. Averaging does not affect this calculation. 4. **Frequency error** is a floating point number (in Hz) of the frequency error in the measured signal. This is the difference between the measured phase trajectory and the reference phase trajectory. If averaging is on, this is the average of the individual frequency error measurements. 5. **I/Q offset** is a floating point number (in dB) of the I and Q error (magnitude squared) offset from the origin. If averaging is on, this is the average of the individual IQ Offset measurements. 6. **Trace phase sample** is a floating point number (in units of bits) representing the time between samples. It is used in querying phase error vector traces. 7. **Trace bit 0 decision offset** is an integer number in units of sample pairs for the sample points in an I/Q vector trace that represents the bit 0 (zero) decision point. The sample pairs in the trace are numbered 0 to N. 8. **Trace sync start** is an integer number in units of bits for the bit number, within the data bits trace, that represents the start of the sync word. 9. **Trace time sample** is a floating point number (in seconds) of the time between samples. It is used in querying time domain traces. For the n=0 trace, of acquired I/Q pairs, this is the time between pairs. 10. **Phase error trace length** is an integer number (in units of samples) representing the number of samples returned by the current phase error trace and phase error frequency trace. 11. **RF envelope trace length** is an integer number (in units of samples) representing the number of samples returned by the current RF envelope trace. 12. **RF envelope trace index to burst** is an integer number (in units of samples) representing the trace sample which represents the start of bit 0 (zero) decision point of the useful part of the measured GSM burst.

n	Results Returned
n=1 (or not specified) (cont.)	13. I/Q vector trace length is an integer number (in units of samples) representing the number of samples returned by the current IQ Vector Trace (i.e. this number divided by two represents the number of sample pairs in the trace.) 14. Raw I/Q vector trace length is an integer number (in units of samples) representing the number of samples returned by the current Raw IQ Vector Trace (i.e. this number divided by two represents the number of sample pairs in the trace. 15. Raw I/Q vector trace index to burst is an integer number (in units of samples) representing the trace sample which represents the start of bit 0 (zero) decision point of the useful part of the measured GSM burst.
2	Returns a series of floating point numbers (in degrees) that represent each sample of the current phase error trace data over the useful part of the measured GSM burst. It contains n samples, where n = phase error trace length scalar value. The first sample represents the start of bit 0 (zero) of the useful part of the demodulated burst.
3	Returns a series of floating point numbers (in degrees) that represent each sample of the current phase error with frequency trace data over the useful part of the measured GSM burst. Phase error with frequency is the error vector between the measured phase (that has not had frequency compensation) and the ideal reference phase. It contains n samples, where n = phase error trace length scalar value. The first sample represents the start of bit 0 (zero) of the useful part of the demodulated burst.
4	Returns a series of floating point numbers (in dB relative to peak of signal) that represent each sample of the complete current time record RF envelope trace data. It contains n samples where n = RF envelope trace length scalar value. The start of bit 0 (zero) of the useful part of the measured GSM burst within the sample time record is located at the point referred to by ‘RF envelope trace index to burst’.

n	Results Returned
5	Returns a series of floating point numbers (with magnitudes normalized to 1) that represent each sample of the current correlated I/Q vector trace data over the useful part of the measured GSM burst. It contains n samples where n = I/Q vector trace length scalar value (giving the total number of I/Q vector sample pairs = n/2. The I/Q vector sample pair data is organized as: I(0), Q(0), I(1), Q(1), ------------- I([n/2]-1), Q([n/2]-1) The decision point pairs are located at: I(d), Q(d) I(d+10), Q(d+10) I(d+20), Q(d+20) and so on. where d = trace bit 0 decision offset.

Power Steps Measurement

This measurement uses long sweep times to display the different power steps resulting from adaptive power control. You must be in GSM mode to use these commands. Use INSTrument:SELect to set the mode.

The general functionality of CONFigure, FETCh, MEASure, and READ are described at the beginning of this section. See the SENSe:PSTeps commands for more measurement related commands.

:CONFigure:PSTeps

:FETCh:PSTeps[n]?

:READ:PSTeps[n]?

:MEASure:PSTeps[n]?

Front Panel
Access: **Measure, Power Steps**

After the measurement is selected, press **Restore Meas Defaults** to restore factory defaults.

Measurement Results Available

n	Results Returned
n=1 (or not specified)	Returns scalar values: 1. **Power Difference** is the relative difference in power (in dB) between the two active marker positions. 2. **Time Difference** is the relative difference in time (in seconds) between the two active marker positions. 3. **Mean Carrier Power** is the mean power (in dBm) of the trace data between the two active marker positions. 4. **Max Carrier Power** is the maximum power (in dBm) of the trace data between the two active marker positions. 5. **Min Carrier Power** is the minimum power (in dBm) of the trace data between the two active marker positions.

Power vs. Time Measurement

This measures the average power during the “useful part” of the burst comparing the power ramp to required timing mask. You must be in GSM mode to use these commands. Use INSTrument:SELect to set the mode.

The general functionality of CONFigure, FETCh, MEASure, and READ are described at the beginning of this section. See the SENSe:PVTime commands for more measurement related commands.

:CONFigure:PVTime

:FETCh:PVTime[n]?

:READ:PVTime[n]?

:MEASure:PVTime[n]?

Front Panel Access:	**Measure**, **Power vs Time**
	After the measurement is selected, press **Restore Meas Defaults** to restore factory defaults.
History:	Modified in version A.05.00.

Measurement Results Available

n	Results Returned
n=1 (or not specified)	Returns the following scalar results: 1. **Sample time** is a floating point number that represents the time between samples when using the trace queries (n=0,2,etc.). 2. **Power of single burst** is the mean power (in dBm) across the useful part of the selected burst in the most recently acquired data, or in the last data acquired at the end of a set of averages. If averaging is on, the power is for the last burst. 3. **Power averaged** is the power (in dBm) of N averaged bursts, if averaging is on. The power is averaged across the useful part of the burst. Average *m* is a single burst from the acquired trace. If there are multiple bursts in the acquired trace, only one burst is used for average *m*. This means that N traces are acquired to make the complete average. If averaging is off, the value of **power averaged** is the same as the **power single burst** value. 4. **Number of samples** is the number of data points in the captured signal. This number is useful when performing a query on the signal (i.e. when n=0,2,etc.). 5. **Start point of the useful part of the burst** is the index of the data point at the start of the useful part of the burst 6. **Stop point of the useful part of the burst** is the index of the data point at the end of the useful part of the burst 7. Index of the data point where T_0 occurred, where T_0 is the time point of the transition from bit 13 to bit 14 of the midamble training sequence. 8. **Burst width of the useful part of the burst** is the width of the burst measured at –3dB below the mean power in the useful part of the burst. 9. **Maximum value** is the maximum value of the most recently acquired data (in dBm). 10. **Minimum value** is the minimum value of the most recently acquired data (in dBm). 11. **Burst search threshold** is the value (in dBm) of the threshold where a valid burst is identified, after the data has been acquired. 12. **IQ point delta** is the number of data points offset that are internally applied to the useful data in traces *n*=2,3,4. You must apply this correction value to find the actual location of the **Start**, **Stop**, or T_0 values.
2	Returns the entire captured RF envelope (data array). It is represented as log-magnitude versus time. The number of data points contained in the array is determined by the Trace Points setting. The default number of data points is 1601.

Programming Commands

n	Results Returned
8, only available when averaging is set to both maximum and minimum	Returns trace point values of the minimum waveform data. These data points are floating point numbers representing the power of the signal (in dBm). There are N data points, where N is the **number of samples**. The period between the samples is defined by the **sample time**. Use SENSe:PVT:AVERage:TYPE MXMinimum to set averaging to max and min. Use n=2 to return the corresponding maximum trace.

Receiver Spurious Response Measurement

This measures the spurious emissions in the receive band relative to the channel power in the selected channel. You must be in the GSM mode to use this command. Use INSTrument:SELect to set the mode.

The general functionality of CONFigure, FETCh, MEASure, and READ are described at the beginning of this section. See the SENSe:RSPur commands for more measurement related commands.

:CONFigure:RSPur

:FETCh:RSPur[n]?

:READ:RSPur[n]?

:MEASure:RSPur[n]?

Front Panel Access: **Measure, RX Spur**

After the measurement is selected, press **Restore Meas Defaults** to restore factory defaults.

Measurement Results Available

n	Results Returned
0	No return value.
n=1 (or not specified)	Returns 3 scalar results for the worst spur 1. The worst spur's frequency (in Hz) 2. The worst spur's amplitude (in dB relative to the limit) 3. This is not supported in GSM, and a value of 9.9099E37 will be returned
n=2	Returns the current trace data (401 data points, comma separated list of real numbers)

Transmit Band Spurs Measurement

This measures the spurious emissions in the transmit band relative to the channel power in the selected channel. You must be in the GSM mode to use these commands. Use INSTrument:SELect to set the mode.

The general functionality of CONFigure, FETCh, MEASure, and READ are described at the beginning of this section. See the SENSe:TSPur commands for more measurement related commands.

:CONFigure:TSPur

:FETCh:TSPur[n]?

:READ:TSPur[n]?

:MEASure:TSPur[n]?

History: Version A.03.00 or later

Front Panel Access: **Measure, Tx Band Spurs**

After the measurement is selected, press **Restore Meas Defaults** to restore factory defaults.

Measurement Results Available

n	Results Returned
n=1 (or not specified)	Returns scalar results: 1. The frequency of the worst spur (in Hz) 2. The amplitude of the worst spur relative to limit (in dB) 3. 9.9099E37 is returned at all times for GSM
2	Returns the current trace data (401 point real number comma separated list).

Transmit Power Measurement

This measures the power in the channel. It compares the average power of the RF signal burst to a specified threshold value. You must be in the GSM mode to use these commands. Use INSTrument:SELect to set the mode.

The general functionality of CONFigure, FETCh, MEASure, and READ are described at the beginning of this section. See the SENSe:TXPower commands for more measurement related commands.

:CONFigure:TXPower

:FETCh:TXPower[n]?

:READ:TXPower[n]?

:MEASure:TXPower[n]?

Front Panel Access: **Measure, Transmit Power**

After the measurement is selected, press **Restore Meas Defaults** to restore factory defaults.

Measurement Results Available

n	Results Returned
n=1 (or not specified)	Returns the following scalar results: 1. **Sample time** is a floating point number representing the time between samples when using the trace queries (n=0,2,etc). 2. **Power** is the mean power (in dBm) of the power above the threshold value. If averaging is on, the power is for the latest acquisition. 3. **Power averaged** is the threshold power (in dBm) for N averages, if averaging is on. An average consists of N acquisitions of data which represents the current trace. If averaging is off, the value of **power averaged** is the same as the **power** value. 4. **Number of samples** is the number of data points in the captured signal. This number is useful when performing a query on the signal (i.e. when n=0,2,etc.). 5. **Threshold value** is the threshold (in dBm) above which the power is calculated. 6. **Threshold points** is the number of points that were above the threshold and were used for the power calculation. 7. **Maximum value** is the maximum of the most recently acquired data (in dBm). 8. **Minimum value** is the minimum of the most recently acquired data (in dBm).

n	Results Returned
2	Returns the RF Envelope Trace (data array). This array contains 401 points of data.

MMEMory Subsystem

The purpose of the MMEMory subsystem is to provide access to mass storage devices such as internal or external disk drives. If mass storage is not specified in the filename, the default mass storage will be used.

NOTE Refer also to :CALCulate and :TRACe subsystems for more trace and limit line commands.

Agilent ESA analyzers use two types of mass storage devices:

- 3.5 inch disk drive (high density, 1.44 MBytes formatted) designated "A:"
- Part of flash memory and treated as a device designated "C:"

The MMEMory command syntax term <file_name> is a specifier having the form: drive:name.ext, where the following rules apply:

- "drive" is "A:" or "C:"
- "name" is a DOS file name of up to eight characters, letters (A-Z, a-z) and numbers (0-9) only (lower case letters are read as uppercase)
- "ext" is an optional file extension using the same rules as "name," but consists of up to three characters total. (The default file extension will be added if it is not specified.)

Store a Measurement Results in a File

`:MMEMory:STORe:RESults filename.csv`

Saves the measurement results to a file in memory. The file name must have a file extension of .csv and will be in the CSV (comma-separated values) format.

Example: MMEM:STOR:RES 'C:mymeas.csv'

Front Panel Access: **File**, **Save**, **Type, Measurement Results**

SENSe Subsystem

These commands are used to set the instrument state parameters so that you can measure a particular input signal. Some SENSe commands are only for use with specific measurements found under the MEASURE key menu or the "MEASure Group of Commands" on page 254. The measurement must be active before you can use these commands.

Cable Fault Location Measurement

Commands for querying the cable fault location measurement results and for setting to the default values are found in the MEASure group of commands. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **Cable Fault** measurement has been selected from the **MEASURE** key menu.

Cable Fault Location—Average Count

[:SENSe]:CFLocation:AVERage:COUNt <integer>

[:SENSe]:CFLocation:AVERage:COUNt?

Set the number of sweeps that will be averaged. After the specified number of sweeps (average counts) have been averaged, the averaging termination setting determines the averaging action.

Factory Preset: 10

Range: 1 to 1,000

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Cable Fault Location—Averaging State

[:SENSe]:CFLocation:AVERage[:STATe] OFF|ON|0|1

[:SENSe]:CFLocation:AVERage:STATe?

Turn cable fault location averaging on or off.

Factory Preset: ON

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Cable Fault Location—Averaging Termination Control

[:SENSe]:CFLocation:AVERage:TCONtrol EXPonential|REPeat

[:SENSe]:CFLocation:AVERage:TCONtrol?

Select the type of termination control used for averaging. This determines the averaging action after the specified number of frames (average count) is reached.

EXPonential - After the average count has been reached, each successive data acquisition is exponentially weighted and combined with the existing average.

REPeat - After reaching the average count, the averaging is reset

and a new average is started.

Factory Preset: EXPonential

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Cable Fault Location—Resolution Bandwidth

[:SENSe]:CFLocation:BANDwidth|BWIDth:RESolution <freq>

[:SENSe]:CFLocation:BANDwidth|BWIDth:RESolution?

Set the resolution BW. This is an advanced control that normally does not need to be changed. Setting this to a value other than the factory default may cause invalid measurement results.

Factory Preset: 3 MHz

Default Unit: Hz

Range: 1 kHz to 5 MHz

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Cable Fault Location—Resolution Bandwidth Coupling Mode

[:SENSe]:CFLocation:BANDwidth|BWIDth[:RESolution]:RAUTo OFF|ON|0|1

[:SENSe]:CFLocation:BANDwidth|BWIDth:[:RESolution]RAUTo?

Specify the resolution bandwidth (OFF or 0) or couple the resolution bandwidth to the frequency span (ON or 1).

Factory Preset: RAUTo

Range: On/Off/1/0

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Cable Fault Location—Video Bandwidth

[:SENSe]:CFLocation:BANDwidth|BWIDth:VIDeo <freq>

[:SENSe]:CFLocation:BANDwidth|BWIDth:VIDeo?

Specifies the video bandwidth.

Factory Preset: 3 MHz

Range: 1 kHz to 5 MHz

Default Unit: Hz

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Cable Fault Location—Video Bandwidth Coupling Mode

[:SENSe]:CFLocation:BANDwidth|BWIDth:VIDeo:VAUTo OFF|ON|0|1

[:SENSe]:CFLocation:BANDwidth|BWIDth:VIDeo:VAUTo?

Couples the video bandwidth to the resolution bandwidth.

Factory Preset: ON or 1

Range: OFF/ON/0/1

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Cable Fault Location—Calibrate

[:SENSe]:CFLocation:CALibrate

Calibrate for the measurement.

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Cable Fault Location—Cable Loss Per Meter

[:SENSe]:CFLocation:CLOSs <cable loss dB>

[:SENSe]:CFLocation:CLOSs?

Specify the known loss per meter for the cable to be measured.

Factory Preset: 0 dB

Range: 0 to 5 dB

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Cable Fault Location—FFT Window

[:SENSe]:CFLocation:FFT:WINDow RECTangular|FTOP|GAUSsian|HANNing

[:SENSe]:CFLocation:FFT:WINDow?

Specify the type of windowing function to apply when performing the FFT.

Factory Preset: FTOP

Range RECT/FTOP/GAUS/HANN

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Cable Fault Location—Center Frequency

[:SENSe]:CFLocation:FREQuency:CENTer <freq>

[:SENSe]:CFLocation:FREQuency:CENTer?

Set the center frequency.

Default Unit: Hz

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Cable Fault Location—Frequency Span

[:SENSe]:CFLocation:FREQuency:SPAN <freq>

[:SENSe]:CFLocation:FREQuency:SPAN?

Set the frequency span.

Default Unit: Hz

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Cable Fault Location—Start Frequency

[:SENSe]:CFLocation:FREQuency:STARt <freq>

[:SENSe]:CFLocation:FREQuency:STARt?

Set the start frequency.

Factory Preset: 3 MHz

Default Unit: Hz

Range: ESA model dependent.

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Cable Fault Location—Stop Frequency

[:SENSe]:CFLocation:FREQuency:STOP <freq>

[:SENSe]:CFLocation:FREQuency:STOP?

Set the stop frequency.

Factory Preset: 3 MHz

Default Unit: Hz

Range: ESA model dependent.

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Cable Fault Location—Number of Trace Points

[:SENSe]:CFLocation:POINts <number of points>

[:SENSe]:CFLocation:POINts?

Specify the number of trace points per sweep. Higher numbers of points result in greater accuracy, but the measurements take longer to be performed.

Factory Preset: 512

Range: Minimum: 128

Maximum: 8192

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Measurements will be performed faster if you select a number which is a power of 2, for example 256, 512 or 1024.

Cable Fault Location—Trace Points

[:SENSe]:CFLocation:POINts:AUTO AUTO|MANual|1|0

[:SENSe]:CFLocation:POINts:AUTO?

Select auto or manual control of the number of trace points used in the measurement.

Factory Preset: AUTO

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

In AUTO mode, the number of points used is determined by a combination of factors such as range, resolution and measurement speed. In MANual mode, the minimum and maximum distances change depending on the number of trace points you have entered.

Cable Fault Location—Measured Range

[:SENSe]:CFLocation:RANGe <distance>

[:SENSe]:CFLocation:RANGe?

Specify the range in meters to be measured. This is usually slightly more than the DUT length.

Factory Preset: 20 m

Range: Minimum: (trace pts/2)(speed of light x velocity factor)/2 x max span
Maximum: (trace pts/2)(speed of light x velocity factor)/2 x 100kHz.

Default Unit: meters

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Cable Fault Location—Measured Offset

[:SENSe]:CFLocation:RANGe:OFFSet <distance>

[:SENSe]:CFLocation:RANGe:OFFSet?

Specify the start position, measured in meters from the beginning of the DUT.

Factory Preset: 0 m

Range: Minimum: 0 meters

Maximum: Must be less than the range specified in SENSe:CFLocation:RANGe command (above)

Default Unit: meters

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Cable Fault Location—TG Amplitude

[:SENSe]:CFLocation:SOURce:POWer <dBm power>

[:SENSe]:CFLocation:SOURce:POWer?

Set the tracking generator source power.

Factory Preset: –10 dBm

Range: –66 to +3 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Cable Fault Location—Velocity Factor

[:SENSe]:CFLocation:VFACtor <velocity factor>

[:SENSe]:CFLocation:VFACtor?

Specify the speed a signal can travel through the cable as a factor of the speed of light in a vacuum (3 ¥ 10E8).

Factory Preset: 0.71

Range: 0 to 1

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Channel Commands

Select the ARFCN—Absolute RF Channel Number

[:SENSe]:CHANnel:ARFCn <integer>

[:SENSe]:CHANnel:ARFCn?

Set the analyzer to a frequency that corresponds to the ARFCN (Absolute RF Channel Number).

Factory Preset: 38

Range:	0 to 124, and 975 to 1023 for E-GSM
	1 to 124 for P-GSM
	0 to 124, and 955 to 1023 for R-GSM
	512 to 885 for DCS1800
	512 to 810 for PCS1900
	259 to 293 for GSM450
	306 to 340 for GSM480
	438 to 511 for GSM700
	128 to 251 for GSM850
Remarks:	You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.
	Global to the current mode.
Front Panel Access:	**FREQUENCY Channel, ARFCN**

Channel Burst Type

[:SENSe]:CHANnel:BURSt NORMal|SYNC|ACCess

[:SENSe]:CHANnel:BURSt?

Set the burst type that the analyzer will search for and to which it will sync. This only applies with normal burst selected.

NORMal: Traffic Channel (TCH) and Control Channel (CCH)

SYNC: Synchronization Channel (SCH)

ACCess: Random Access Channel (RACH)

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Global to the current mode.

Front Panel Access: **FREQUENCY Channel, Burst Type**

Auto ARFCN

[:SENSe]:CHANnel:LOCate

Locate the strongest signal in the current band and update ARFCN accordingly. If there is no signal in the current band, other bands will be searched until a signal is detected

Remarks: Global to the current mode.

You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

This command cannot be queried.

Front Panel Access: **FREQUENCY Channel, Auto ARFCN**

DCS/PCS Overlap Priority

[:SENSe]:CHANnel:PREFerences DCS|PCS

[:SENSe]:CHANnel:PREFerences?

Select a priority band when entering an ARFCN that is common to more than one band.

Factory Preset: DCS

Remarks: Global to the current mode.

You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel
Access: **Mode Setup, Radio, DCS/PCS Overlap Priority**

Reference Burst Type

[:SENSe]:CHANnel:RBURst NORMal|SYNC|ACCess

[:SENSe]:CHANnel:RBURst?

Select the type of burst to be used as the reference burst.

Factory Preset: NORMal

Remarks: Global to the current mode.

You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel
Access: **FREQUENCY Channel, Timeslot, Ref Burst**

Reference Training Sequence Code

[:SENSe]:CHANnel:RTSCode <integer>

[:SENSe]:CHANnel:RTSCode?

Set the reference training sequence code to search for, with normal burst selected and RTSC auto set to off.

Factory Preset: 0

Range: 0 to 7

Remarks: Global to the current mode.

You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel
Access: **TIMESLOT, Ref TSC (Std)**

Reference Training Sequence Code Auto

[:SENSe]:CHANnel:RTSCode:AUTO OFF|ON|0|1

[:SENSe]:CHANnel:RTSCode:AUTO?

Select auto or manual control for reference training sequence code (RTSC) search. With auto on, the measurement is made on the first burst found to have one of the valid TSCs in the range 0 to 7 (i.e. normal bursts only). With auto off, the measurement is made on the 1st burst found to have the selected TSC.

Factory Preset: AUTO

Remarks: Global to the current mode.

You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **TIMESLOT, Ref TSC (Std)**

Frequency Hopping

[:SENSe]:CHANnel:SFHopping OFF|ON|0|1

[:SENSe]:CHANnel:SFHopping?

Set the signal's frequency hopping repetition factor on or off.

Factory Preset: OFF

Remarks: Global to the current mode.

You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Mode Setup, Radio, Frequency Hopping Repetition Factor**

Frequency Hopping Repetition Factor

[:SENSe]:CHANnel:SFHRepeat <integer>

[:SENSe]:CHANnel:SFHRepeat?

Set the frequency hopping repetition factor.

Factory Preset: 3

Range: 1 to 100

Remarks: Global to the current mode.

You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Mode Setup, Radio, Frequency Hopping Repetition Factor**

Time Slot number

[:SENSe]:CHANnel:SLOT <integer>

[:SENSe]:CHANnel:SLOT?

Select the slot number that you want to measure.

in GSM, EDGE mode the measurement frame is divided into the eight expected measurement timeslots.

Factory Preset: 0

Range: 0 to 7

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Frequency Channel, Timeslot, Timeslot**

Time Slot Auto

[:SENSe]:CHANnel:SLOT:AUTO OFF|ON|0|1

[:SENSe]:CHANnel:SLOT:AUTO?

Select auto or manual control for slot searching. The feature is only supported in external and frame trigger source modes. In external trigger mode when timeslot is set on, the demodulation measurement is made on the nth timeslot specified by the external trigger point + n timeslots, where n is the selected timeslot value 0 to 7. In frame trigger mode when timeslot is set on, then demodulation measurement is only made on the nth timeslot specified by bit 0 of frame reference burst + n timeslots, where n is the selected timeslot value 0 to 7 and where the frame reference burst is specified by Ref Burst and Ref TSC (Std) combination.

Factory Preset: OFF, for GSM mode

Remarks: You must be in GSM, EDGE, NADC, or PDC mode to use this command.Use INSTrument:SELect to set the mode.

Front Panel Access: **Frequency Channel, Timeslot, Timeslot**

Training Sequence Code (TSC)

[:SENSe]:CHANnel:TSCode <integer>

[:SENSe]:CHANnel:TSCode?

Set the training sequence code to search for, with normal burst selected and TSC auto set to off.

Factory Preset: 0

Range: 0 to 7

Remarks: Global to the current mode.

You must be in the GSM mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **FREQUENCY Channel, TSC (Std)**

Training Sequence Code (TSC) Auto

[:SENSe]:CHANnel:TSCode:AUTO OFF|ON|0|1

[:SENSe]:CHANnel:TSCode:AUTO?

Select auto or manual control for training sequence code (TSC) search. With auto on, the measurement is made on the first burst found to have one of the valid TSCs in the range 0 to 7 (i.e. normal bursts only). With auto off, the measurement is made on the 1st burst found to have the selected TSC.

Factory Preset: AUTO

Remarks: Global to the current mode.

You must be in the GSM mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **FREQUENCY Channel, TSC (Std)**

Programming Commands

Signal Corrections Commands

Correction For BTS RF Port External Gain

[:SENSe]:CORRection:BTS:GAIN <rel_power>

[:SENSe]:CORRection:BTS:GAIN?

Set equal to the external gain used when measuring base transmit stations. This is only used in 'Receive Band' measurements.

Factory Preset: 0 dB

Range: 0 to 81.9 dB

Default Unit: dB

Remarks: Global to the current mode.

You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Mode Setup, Input....**

or

Input, Ext Gain, Base Gain

Correction For BTS RF Port External Attenuation

[:SENSe]:CORRection:BTS:LOSS <rel_power>

[:SENSe]:CORRection:BTS:LOSS?

Set equal to the external attenuation used when measuring base transmit stations. This is only used in 'Transmit Band' measurements.

Factory Preset: 0 dB

Range: 0 to 81.9 dB

Default Unit: dB

Remarks: Global to the current mode.

You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Mode Setup, Input....**

or

Input, Ext Atten, Base Atten

Correction For MS RF Port External Gain

GSM Mode

[:SENSe]:CORRection:MS:GAIN <rel_power>

[:SENSe]:CORRection:MS:GAIN?

Set equal to the gain of an external amplifier used when measuring mobile stations.

Factory Preset: 0 dB

Range: 0 to 81.9 dB for GSM

Default Unit: dB

Remarks: Global to the current mode.

You must be in GSM, EDGE or cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.

For GSM.EDGE the Gain setting is applied only in the following measurements:

- Rx Spurious (RXSpur)
- Monitor/Band Channel (MONitor) - when Methos = Band AND Band = Rx

Front Panel Access: For GSM: **Mode Setup, Input....**

or **Input, Ext Gain, Mobile Gain**

Correction For MS RF Port External Attenuation

[:SENSe]:CORRection:MS:LOSS <rel_power>

[:SENSe]:CORRection:MS:LOSS?

Set equal to the external attenuation used when measuring mobile stations. This is only used for 'Transmit Band' measurements.

Factory Preset: 0 dB

Range: 0 to 81.9 dB

Default Unit: dB

Remarks: Global to the current mode.

You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Mode Setup, Input....**

or

Input, Ext Atten, Mobile Atten

Default Reset

[:SENSe]:DEFaults

Restores personality Mode Setup defaults.

Front Panel Access:	**Mode Setup**
Remarks:	This command sets all the SENSe defaults but has no effect on the MEASure default settings. Use the CONFigure:<measurement> command to set measurement defaults

EDGE Error Vector Magnitude Measurement

Commands for querying the EDGE error vector magnitude measurement results and for setting to the default values are found in the "MEASure Group of Commands" on page 254. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the measurement has been selected from the **MEASURE** key menu.

History: For E4406A: the EEVM measurement was added in version A.04.00.

For ESA: the EEVM measurement was added in the GSM,EDGE personality version C.01.00.

EDGE Error Vector Magnitude—Average Count

[:SENSe]:EEVM:AVERage:COUNt <integer>

[:SENSe]:EEVM:AVERage:COUNt?

Sets the number of data acquisitions that will be averaged. After the specified number of average counts, the average mode (termination control) setting determines the average action.

Factory Preset: 10

Range: 1 to 10,000 for VSA, PSA

1 to 1000 for ESA

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Error Vector Magnitude—Averaging State

[:SENSe]:EEVM:AVERage[:STATe] OFF|ON|0|1

[:SENSe]:EEVM:AVERage[:STATe]?

Turn average on or off.

Factory Preset: ON for VSA, PSA

OFF for ESA

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Error Vector Magnitude—Averaging Termination Control

[:SENSe]:EEVM:AVERage:TCONtrol EXPonential|REPeat

[:SENSe]:EEVM:AVERage:TCONtrol?

Select the type of termination control used for the averaging function. This determines the averaging action after the specified number of data acquisitions (average count) is reached.

EXPonential - After the average count has been reached, each successive data acquisition is exponentially weighted and combined with the existing average.

REPeat – After reaching the average count, the averaging is reset and a new average is started.

Factory Preset: EXPonential

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Programming Commands

EDGE Error Vector Magnitude—Burst Synchronization Source

For VSA,PSA:

[:SENSe]:EEVM:BSYNc:SOURce RFBurst|TSEQuence|NONE

[:SENSe]:EEVM:BSYNc:SOURce?

Query only for ESA:

[:SENSe]:EEVM:BSYNc:SOURce?

Select the method of synchronizing the measurement to the bursts.

RFBurst – The burst synchronization approximates the start and stop of the useful part of the burst without demodulation of the burst. This type of synchronization has a frequency lock range of up to 9 kHz and allows you to demodulate RF bursts that do not have a training sequence.

Training Sequence (TSEQuence) – The burst synchronization performs a demodulation of the burst and determines the start and stop of the useful part of the burst based on the midamble training sync sequence. This type of synchronization provides better noise immunity but has a smaller frequency lock range (~200 Hz).

None – The measurement is performed without searching burst.

Factory Preset: TSEQuence

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Remarks: On ESA Series analyzers, only Training Sequence (TSEQuence) is supported. The query command will always return TSEQuence as the result.

EDGE Error Vector Magnitude—Droop Compensation

[:SENSe]:EEVM:DROop OFF|ON|0|1

[:SENSe]:EEVM:DROop?

Turn droop compensation on or off. Droop compensation corrects amplitude variations across a burst. You may want to turn off this compensation so you can see the changes in the measured magnitude error. Droop can result from signal impairments such as a power amplifier problem.

Factory Preset: ON

Range: OFF, ON

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Error Vector Magnitude—Symbol Dots (Quad View)

[:SENSe]:EEVM:GSDots[:STATe]OFF|ON|0|1

[:SENSe]:EEVM:GSDots[:STATe]?

Activates or deactivates points/symbol dot display in quad view.

Factory Preset: ON

Range: OFF, ON

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Error Vector Magnitude - Limit Test

[:SENSe]:EEVM:LIMit[:STATe] ON|OFF|1|0

[:SENSe]:EEVM:LIMit[:STATe]?

Turn active limit checking of phase and frequency error results on or off.

Factory Preset: On

Range: On | Off

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Error Vector Magnitude - Rotation

[:SENSe]:EEVM:ROTation[:STATe] ON|OFF|1|0

[:SENSe]:EEVM:ROTation[:STATe]?

Specifies whether or not rotation is applied to the IQ constellation diagram.

Factory Preset: On

Range: On | Off

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Error Vector Magnitude—Points/Symbol Dots

[:SENSe]:EEVM:SDOTs[:STATe]OFF|ON|0|1

[:SENSe]:EEVM:SDOTs[:STATe]?

Activates or deactivates points/symbol dot display in polar view.

Factory Preset: ON

Range: OFF, ON

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Error Vector Magnitude—Trigger Source

For VSA, PSA:

[:SENSe]:EEVM:TRIGger:SOURce EXTernal[1]|EXTernal2|FRAMe|IF|IMMediate|RFBurst

[:SENSe]:EEVM:TRIGger:SOURce?

For ESA:

[:SENSe]:EEVM:TRIGger:SOURce IMMediate|RFBurst|EXTernal|FRAMe

[:SENSe]:EEVM:TRIGger:SOURce?

Select the trigger source used to control the data acquisitions.

EXTernal 1 – front panel external trigger input

EXTernal 2 – rear panel external trigger input

EXTernal – rear panel external trigger input for ESA, front panel external input for VSA, PSA

IF – internal IF envelope (video) trigger

IMMediate – the next data acquisition is immediately taken, capturing the signal asynchronously (also called free run)

FRAMe – internal frame trigger from front panel input

RFBurst – wideband RF burst envelope trigger that has automatic level control for periodic burst signals

Factory Preset: IMMediate for VSA,PSA BS

RFBurst for VSA,PSA MS

RFBurst for ESA

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

NOTE Option B7E: RF Comms Hardware has at least three possible part numbers. Press **System**, **More**, **Show Hdwr** to show your instrument's RF Comms Hardware and view the part number. If the part number is E4401-60087 (the original version), the RF Burst trigger source will not be available with this measurement, and the default will be **EXTernal**.

EDGE Output RF Spectrum Measurement

Commands for querying the EDGE output RF spectrum measurement results and for setting to the default values are found in the "MEASure Group of Commands" on page 254. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **EDGE Output RF Spectrum** measurement has been selected from the **MEASURE** key menu.

History: For E4406A: the EORF measurement was added in version A.04.00.

For ESA: the EORF measurement was added in the GSM,EDGE personality version C.01.00.

EDGE Output RF Spectrum—Number of Bursts Averaged

[:SENSe]:EORFspectr:AVERage:COUNt <integer>

[:SENSe]:EORFspectr:AVERage:COUNt?

Set the number of bursts that will be averaged. For the output RF spectrum due to switching transients, it is more accurate to consider this the number of frames that are measured. After the specified number of bursts (average counts), the averaging mode (termination control) setting determines the averaging action.

Factory Preset: 20 for VSA, PSA
10 for ESA

Range: 1 to 10,000 for VSA, PSA
1 to 1000 for ESA

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Output RF Spectrum—Averaging Control

[:SENSe]:EORFspectr:AVERage[:STATe] OFF|ON|0|1

[:SENSe]:EORFspectr:AVERage[:STATe]?

Turn averaging on or off.

Factory Preset: ON for VSA, PSA
OFF for ESA

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Output RF Spectrum—Averaging Termination

[:SENSe]:EORFspectr:AVERage:TCONtrol EXPonential|REPeat

[:SENSe]:EORFspectr:AVERage:TCONtrol?

Select the type of termination control used for the averaging function. This determines the averaging action after the specified number of frames (average count) is reached.

EXPonential - After the average count is reached, each successive data acquisition is exponentially weighted and combined with the existing average.

REPeat - After reaching the average count, the averaging is reset and a new average is started.

Factory Preset: REPeat

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Output RF Spectrum—Resolution BW For Modulation At Close Offsets

For VSA, PSA:

[:SENSe]:EORFspectr:BANDwidth|BWIDth[:RESolution]:MODulation:OFFSet:CLOSe <freq>

[:SENSe]:EORFspectr:BANDwidth|BWIDth[:RESolution]:MODulation:OFFSet:CLOSe?

For ESA:

[:SENSe]:EORFspectr:BANDwidth[:RESolution]:MODulation:OFFSet:CLOSe <freq>

[:SENSe]:EORFspectr:BANDwidth[:RESolution]:MODulation:OFFSet:CLOSe?

Set the resolution bandwidth used for the spectrum due to modulation part of the EORF measurement for offset frequencies less than 1800 kHz.

This parameter is only used with the Standard or Short lists, and not with the Custom list.

Factory Preset: 30 kHz

Range: 1 kHz to 5 MHz

Default Unit: Hz

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Output RF Spectrum—Resolution BW for Modulation at Far Offsets

For VSA, PSA:

[:SENSe]:EORFspectr:BANDwidth|BWIDth[:RESolution] :MODulation:OFFSet:FAR <freq>

[:SENSe]:EORFspectr:BANDwidth|BWIDth[:RESolution] :MODulation:OFFSet:FAR?

For ESA:

[:SENSe]:EORFspectr:BANDwidth[:RESolution] :MODulation:OFFSet:FAR <freq>

[:SENSe]:EORFspectr:BANDwidth[:RESolution] :MODulation:OFFSet:FAR?

Set the resolution bandwidth used for the spectrum due to modulation part of the EORF measurement for offset frequencies greater than or equal to 1800 kHz.

This parameter is only used with the Standard or Short lists, and not with the Custom list.

Factory Preset:	100 kHz
Range:	1 kHz to 5 MHz
Default Unit:	Hz
Remarks:	You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Output RF Spectrum—Resolution BW For Switching Transients At Close Offsets

For VSA, PSA:

[:SENSe]:EORFspectr:BANDwidth|BWIDth[:RESolution] :SWITching:OFFSet:CLOSe <freq>

[:SENSe]:EORFspectr:BANDwidth|BWIDth[:RESolution] :SWITching:OFFSet:CLOSe?

For ESA:

[:SENSe]:EORFspectr:BANDwidth[:RESolution] :SWITching:OFFSet:CLOSe <freq>

[:SENSe]:EORFspectr:BANDwidth[:RESolution] :SWITching:OFFSet:CLOSe?

Set the resolution bandwidth used for the spectrum due to switching transients part of the EORF measurement for offset frequencies less than 1800 kHz.

This parameter is only used with the Standard or Short lists, and not with the Custom list.

Factory Preset: 30 kHz

Range: 1 kHz to 5 MHz

Default Unit: Hz

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Output RF Spectrum—Resolution BW For Switching Transients At Far Offsets

For VSA, PSA:

[:SENSe]:EORFspectr:BANDwidth|BWIDth[:RESolution]:SWITching:OFFSet:FAR <freq>

[:SENSe]:EORFspectr:BANDwidth|BWIDth[:RESolution]:SWITching:OFFSet:FAR?

For ESA:

[:SENSe]:EORFspectr:BANDwidth[:RESolution]:SWITching:OFFSet:FAR <freq>

[:SENSe]:EORFspectr:BANDwidth[:RESolution]:SWITching:OFFSet:FAR?

Set the resolution bandwidth used for the spectrum due to switching transients part of the EORF measurement for offset frequencies greater than or equal to 1800 kHz.

This parameter is only used with the standard or short lists, and not with the custom list.

Factory Preset: 30 kHz

100 kHz

Range: 1 kHz to 5 MHz

Default Unit: Hz

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Output RF Spectrum—Burst Synchronization Source

[:SENSe]:EORFspectr:BSYNc:SOURce TSEQuence|RFAMplitude|NONE

[:SENSe]:EORFspectr:BSYNc:SOURce?

Select the method of synchronizing the measurement to the bursts.

Training Sequence (TSEQuence) - the training sequence burst sync performs a demodulation of the burst and determines the start and stop of the useful part of the burst based on the midamble training sequence.

RFAMplitude - the RF amplitude burst sync approximates the start and stop of the useful part of the burst without digital demodulation of the burst.

NONE - no burst sync is used.

Factory Preset: TSEQuence when options B7E/B7D are present

RFAMplitude without options B7E/B7D

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Output RF Spectrum—Offset Frequency List

For VSA, PSA:

[:SENSe]:EORFspectr:LIST:SELect CUSTom|SHORt|STANdard

[:SENSe]:EORFspectr:LIST:SELect?

For ESA:

[:SENSe]:EORFspectr:LIST:SELect SHORt|STANdard

[:SENSe]:EORFspectr:LIST:SELect?

Select the list of settings that will be used to make the EORF measurement. This specifies standard or customized lists and short lists. The lists contain the offset frequencies (and bandwidths) that are used for the modulation spectrum and transient spectrum parts of the EORF measurement.

CUSTom - uses the four user-defined lists that specify:

— Offset frequencies for modulation spectrum measurement
— Corresponding resolution bandwidths for each of the modulation offset frequencies
— Offset frequencies for switching transient spectrum measurement
— Corresponding resolution bandwidths for each of the switching transient offset frequencies

SHORt - a shortened list of the offset frequencies specified in the

EDGE Standards. It uses two internal offset frequency lists, one for modulation spectrum and the other for switching transient spectrum. These offset frequencies cannot be changed, but the resolution bandwidths can be changed by other commands in the SENSe:EORFpectr subsystem.

STANdard - the complete list of the offset frequencies specified in the EDGE Standards, except for those offsets greater than 6 MHz. It uses two internal offset frequency lists, one for modulation spectrum and the other for switching transient spectrum. These offset frequencies cannot be changed, but the resolution bandwidths can be changed by other commands in the SENSe:EORFpectr subsystem.

Factory Preset: SHORt

Remarks: This command is only valid if SENS:EORF:MEAS is set to multiple.

If you change the number of custom offsets then the number of offset bandwidths, frequencies and level offsets must also be changed.

You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Output RF Spectrum—Measure Offsets Measurement Method

For VSA, PSA:

[:SENSe]:EORFspectr:MEASure MULTiple|SINGle

[:SENSe]:EORFspectr:MEASure?

For ESA:

[:SENSe]:EORFspectr:MEASure MULTiple|SINGle|SWEPt

[:SENSe]:EORFspectr:MEASure?

Select the measurement method to be used.

MULTiple - the measurement is done at all offsets in the offset frequency list.

SINGle - the measurement is done at only one offset as determined by the offset frequency setting. This allows detailed examination of the time-domain waveform at the specified offset frequency.

SWEPt - sets the trigger source to free run. The previous trigger source selection is restored when measurement mode is returned to SINGle or MULTiple.

Factory Preset: MULTiple

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Output RF Spectrum—Offset Frequency

[:SENSe]:EORFspectr:OFRequency <freq>

[:SENSe]:EORFspectr:OFRequency?

Set the offset frequency that is used to measure a single offset. This command is only valid if SENS:EORF:MEAS is set to single.

Factory Preset: 250 kHz

Range: –12.0 MHz to +12.0 MHz for VSA, PSA

–6.0 MHz to +6.0 MHz for ESA

Step Size: Steps through the values in the selected offset frequency list

Default Unit: Hz

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Output RF Spectrum—Maximum RF Mixer Power

[:SENSe]:EORFspectr:POWer:MIXer:RANGe[:UPPer] <real>

[:SENSe]:EORFspectr:POWer:MIXer:RANGe?

Set the attenuation to automatically maintain the specified maximum power level at the RF mixer input.

Factory Preset: 0.00 dBm

Range: -100 to +10 dBm

Remarks: This is an advanced parameter that has been set up for maximum performance. Using settings greater than 0 dBm could result in a compressed signal or spurious signals or both.

You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Output RF Spectrum—Reference Power Average

[:SENSe]:EORFspectr:REFerence:AVERage:COUNt <integer>

[:SENSe]:EORFspectr:REFerence:AVERage:COUNt?

Set the number of bursts to be averaged when measuring the reference power. Reference power average state must be set to OFF. Reference power averages is valid only if SENS:EORFS:MEAS is set to single.

Factory Preset: 10

Range: 1 to 1,000

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Output RF Spectrum—Reference Power Average State

[:SENSe]:EORFspectr:REFerence:AVERage[:AUTO] OFF|ON|0|1

[:SENSe]:EORFspectr:REFerence:AVERage[:AUTO]?

Specifies how many averages to use when measuring the reference power. Set it to ON to use the same number of averages as specified in the number of bursts averaged command. Set it to OFF to use the number specified in the reference power averages command (for further information refer to the previous command). Reference power average state is valid only if SENS:EORFS:MEAS is set to single.

Factory Preset: ON

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Output RF Spectrum—Trigger Source

For VSA, PSA:

[:SENSe]:EORFspectr:TRIGger:SOURce EXTernal[1]|EXTernal2|FRAMe|IMMediate|RFBurst

[:SENSe]:EORFspectr:TRIGger:SOURce?

For ESA:

[:SENSe]:EORFspectr:TRIGger:SOURce EXTernal|FRAMe|RFBurst

[:SENSe]:EORFspectr:TRIGger:SOURce?

Select the trigger source used to control the data acquisitions.

EXTernal 1 - front panel external trigger input

EXTernal 2 - rear panel external trigger input

EXTernal - rear panel external trigger input for ESA, front panel external trigger input for VSA, PSA

FRAMe - uses the internal frame timer, which has been synchronized to the selected burst sync

IMMediate - the next data acquisition is immediately taken, capturing the signal asynchronously (also called free run)

RFBurst - wideband RF burst envelope trigger that has automatic level control for periodic burst signals

Factory Preset: RFburst for VSA, PSA

RFburst for ESA with options B7E/B7D

EXTernal for ESA without options B7E/B7D

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

NOTE Option B7E: RF Comms Hardware has at least three possible part numbers. Press **System**, **More**, **Show Hdwr** to show your instrument's RF Comms Hardware and view the part number. If the part number is E4401-60087 (the original version), the RF Burst trigger source will not be available with this measurement, and the default will be **EXTernal**.

EDGE Output RF Spectrum—Measurement Type

For VSA, PSA:

[:SENSe]:EORFspectr:TYPE MODulation|MSWitching|SWITching|FFModulation

[:SENSe]:EORFspectr:TYPE?

For ESA:

[:SENSe]:EORFspectr:TYPE MODulation|SWITching

[:SENSe]:EORFspectr:TYPE?

Select the measurement type.

MODulation - only the modulation spectrum is measured.

MSWitching (Modulation & Switching - VSA, PSA only)- both modulation and switching transient spectrums are measured.

SWITching - only the switching transient spectrum is measured.

FFModulation (VSA, PSA only) - full frame modulation improves measurement speed by acquiring a full frame of data prior to performing the FFT calculation. FFT modulation can only be used if all slots in the transmitted frame are active.

Factory Preset: MODulation

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Programming Commands

EDGE Output RF Spectrum—Wideband Noise

[:SENSe]:EORFspectr:WBNoise OFF|ON|0|1

[:SENSe]:EORFspectr:WBNoise?

Set wideband noise function to ON or OFF. When set to OFF, the analyzer is tuned to the carrier and -1800 kHz to +1800 kHz either side of the center frequency is swept. When set to ON, the whole of the relevant band 2 MHz either side is swept.

Factory Preset: OFF

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs. Time (Burst Power) Measurement

Commands for querying the power versus time measurement results and for setting to the default values are found in the "MEASure Group of Commands" on page 254. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **EDGE PvT** measurement has been selected from the **MEASURE** key menu.

History: For E4406A: the EPVT measurement was added in version A.04.00.

For ESA: the EPVT measurement was added in the GSM,EDGE personality version C.01.00.

EDGE Power vs. Time—Number of Bursts Averaged

[:SENSe]:EPVTime:AVERage:COUNt <integer>

[:SENSe]:EPVTime:AVERage:COUNt?

Set the number of bursts that will be averaged. After the specified number of bursts (average counts), the averaging mode (termination control) setting determines the averaging action.

Factory Preset: 10

Range: 1 to 10,000 for PSA, VSA

1 to 1000 for ESA

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs. Time—Averaging State

[:SENSe]:EPVTime:AVERage[:STATe] OFF|ON|0|1

[:SENSe]:EPVTime:AVERage[:STATe]?

Turn averaging on or off.

Factory Preset: OFF

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs. Time—Averaging Termination Control

[:SENSe]:EPVTime:AVERage:TCONtrol EXPonential|REPeat

[:SENSe]:EPVTime:AVERage:TCONtrol?

Select the type of termination control used for the averaging function. This specifies the averaging action after the specified number of bursts (average count) is reached.

EXPonential - After the average count has been reached, each successive data acquisition is exponentially weighted and combined with the existing average.

REPeat - After reaching the average count, the averaging is reset and a new average is started.

Factory Preset: EXPonential

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs. Time—Averaging Type

For VSA, PSA:

[:SENSe]:EPVTime:AVERage:TYPE LOG|MAXimum|MINimum|MXMinimum|RMS

[:SENSe]:EPVTime:AVERage:TYPE?

For ESA:

[:SENSe]:EPVTime:AVERage:TYPE LPOWer|POWer

[:SENSe]:EPVTime:AVERage:TYPE?

Select the type of averaging to be performed.

LOG - The log of the power is averaged. (This is also known as video averaging.)

MAXimum - The maximum values are retained.

MINimum - The minimum values are retained.

MXMinimum - Both the maximum and the minimum values are retained.

RMS - The power is averaged, providing the rms of the voltage.

LPOWer - Sums the trace data and divides by the average count.

POWer - Trace data is converted from dB to power units, then averaged. This type is more time consuming.

Factory Preset: RMS for VSA, PSA

POWer for ESA

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs. Time—Resolution BW

[:SENSe]:EPVTime:BANDwidth|BWIDth[:RESolution] <freq>

[:SENSe]:EPVTime:BANDwidth|BWIDth[:RESolution]?

Set the resolution BW. This is an advanced control that normally does not need to be changed. Setting this to a value other than the factory default, may cause invalid measurement results.

Factory Preset:	500 kHz for VSA, PSA
	300 kHz for ESA
Range:	1 kHz to 5 MHz for VSA, PSA
	1 kHz to 5 MHz for ESA without Option 1DR
	10 Hz to 5 MHz for ESA with Option 1DR
	1 Hz to 5 MHz for ESA with Options 1DR and 1D5
Default Unit:	Hz
Remarks:	You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs. Time—Video BW

[:SENSe]:EPVTime:BANDwidth|BWIDth:VIDeo <bandwidth>

[:SENSe]:EPVTime:BANDwidth|BWIDth:VIDeo?

Sets the video BW. This is an advanced control that normally does not need to be changed. Setting this to a value other than the factory default, may cause invalid measurement results.

Factory Preset:	300 kHz
Range:	30 Hz to 3 MHz without Option 1DR
	1 Hz to 3 MHz with Option 1DR
Default Unit:	Hz
Remarks:	You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs. Time—Burst Synchronization Source

For VSA, PSA:

[:SENSe]:EPVTime:BSYNc:SOURce RFBurst|TSEQuence

[:SENSe]:EPVTime:BSYNc:SOURce?

For ESA:

[:SENSe]:EPVTime:BSYNc:SOURce TSEQuence|RFAMplitude|NONe

[:SENSe]:EPVTime:BSYNc:SOURce?

Select the method of synchronizing the measurement to the EDGE bursts.

RFBurst - the RF burst sync approximates the start and stop of the useful part of the burst without digital demodulation of the burst.

TSEQuence - the training sequence burst sync performs a demodulation of the burst and determines the start and stop of the useful part of the burst based on the midamble training sequence.

RFAMplitude - synchronizes the measurement to the burst transition of the measured RF carrier.

NONe - Uses the start of the time record as the start of the useful part of the burst.

Factory Preset: TSEQuence for VSA, PSA

TSEQuence for ESA when options B7E/B7D are present

RFAMplitude for ESA without Options B7E/B7D

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs. Time—Current Data

[:SENSe]:EPVTime:CDATa ON|OFF|1|0

[:SENSe]:EPVTime:CDATa?

Use to turn On or Off the current data calculation and display of the Mean Carrier Power, Maximum Point, and Minimum Point values for the current trace. The measurement executes faster when this parameter is set to off.

Factory Preset: ON

Range: On | Off

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs. Time—Limit Line Mask Display

[:SENSe]:EPVTime:LIMit:MASK OFF|ON|0|1

[:SENSe]:EPVTime:LIMit:MASK?

Show or hide the limit mask. Does not affect limit pass/fail calculation.

Same as :DISPlay:EPVTime:LIMit:MASK. The sense version was added to be compatible/consistent with ESA.

Factory Preset: ON

Range: ON|OFF

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs. Time—Limit Test

[:SENSe]:EPVTime:LIMit:TEST ON|OFF|1|0

[:SENSe]:EPVTime:LIMit:TEST?

Turns active limit checking On or Off. Measurement results are not checked against test limit requirements when set to Off.

Factory Preset: ON

Range: On | Off

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs. Time—Lower Mask Absolute Amplitude Levels

[:SENSe]:EPVTime:MASK:LIST:LOWer:ABSolute <power>, <power>, <power>, <power>, <power>

[:SENSe]:EPVTime:MASK:LIST:LOWer:ABSolute?

Enter a power level for any of your mask line segments that require an absolute minimum power limit in addition to its relative limit. Each time a measurement is made the Ref Level is determined. (This is the power level of the useful part of the burst, or midway between the upper/lower masks). Remember, as the power of the Ref Level changes, all of the relative mask power levels will change by the same amount.

Each relative limit is then compared to the Ref Level and an equivalent absolute power level is calculated. This power level is compared to the specified absolute limit for each line segment. If this calculated relative limit is lower then the absolute limit you've specified, then the value of the absolute limit is used for this segment. Therefore, if the absolute limit is set to a very low value (–200 dBm), the calculated value of the reference limit will never be lower, and the specified relative limit will always be used for that segment. See Figure 4-1 on page 323.

Every time point you defined with PVT:MASK:LOW:TIME must have a power value defined in the same order. You can put a comma in the SCPI command as a place holder for any points where an absolute power is not specified, and that segment will then use the default value.

Factory Preset:	Selected EDGE standard
Range:	–200 dBm to +100 dBm
Default Unit:	dBm
Remarks:	You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs. Time—Lower Mask Points

[:SENSe]:EPVTime:MASK:LIST:LOWer:POINts?

Query the number of elements in the lower mask. This value is determined by the number of time points entered using [:SENSe]:EPVTime:MASK:LIST:LOWer:TIME.

Range:	integer, 1 to 25
Remarks:	You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs. Time—Lower Mask Relative Amplitude Levels

[:SENSe]:EPVTime:MASK:LIST:LOWer:RELative <rel_power>, <rel_power>, <rel_power>, <rel_power>, <rel_power>, ...

[:SENSe]:EPVTime:MASK:LIST:LOWer:RELative?

Enter the relative power level for each horizontal line segment in the lower limit mask. There should be a power level for each time point entered using [:SENSe]:EPVTime:MASK:LIST:LOWer:TIME, and they must be entered in the same order. These power levels are all relative to the defined Reference Power Level (the average power in the useful part of the data).

Any portion of the signal that has no limit line segment defined for it, will default to a very low limit (–100 dB relative to the reference power). This will keep the measurement from indicating a failure for that portion of the data.

Factory Preset:	Selected EDGE standard
Range:	+200 dB to –100 dB, relative to the reference power

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs. Time—Lower Mask Time Points

[:SENSe]:EPVTime:MASK:LIST:LOWer:TIME <seconds>, <seconds>, <seconds>, <seconds>, <seconds>

[:SENSe]:EPVTime:MASK:LIST:LOWer:TIME?

Enter the time points that define the horizontal line segments of the lower limit. A reference point designated "t_0" is at the center of the useful data (usually the center of the burst). Each line segment to the right of the t_0 reference point is designated as a positive time value and each segment to the left of t_0 is a negative time value.

First enter positive values in sequence starting from t_0, then negative values in sequence starting from t_0. See Figure 4-1 on page 323 and the [:SENSe]:EPVT:MASK:LIST:UPPER:TIME example below it. (This is an upper mask example, but they work the same.)

We recommend that you select a large time value for your first and last mask points (e.g. –1 and +1 second). This guarantees that you've defined a limit for all the measured data. (See Mask Segments 4 and 9 in the Table on page 323 for an example.

Factory Preset: Selected EDGE standard

Range: –1s to +1s, referenced to t_0 at the center of the useful data (burst center)

1 to 25 time points in a mask

Default Unit: seconds

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs. Time—Upper Mask Absolute Amplitude Levels

[:SENSe]:EPVTime:MASK:LIST:UPPer:ABSolute <power>, <power>, <power>, <power>, <power>, ...

[:SENSe]:EPVTime:MASK:LIST:UPPer:ABSolute?

Enter a power level for any of your mask line segments that require an absolute minimum power limit in addition to its relative limit. Each time a measurement is made the Ref Level is determined. (This is the power level of the useful part of the burst, or midway between the upper/lower masks). Remember, as the power of the Ref Level changes, all of the relative mask power levels will change by the same amount.

Each relative limit is then compared to the Ref Level and an equivalent absolute power level is calculated. This power level is compared to the specified absolute limit for each line segment. If this calculated relative limit is lower then the absolute limit you've specified, then the value of the absolute limit is used for this segment. Therefore, if the absolute limit is set to a very low value (–200 dBm), the calculated value of the reference limit will never be lower, and the specified relative limit will always be used for that segment. See Figure 4-1 on page 323.

Every time point you defined with PVT:MASK:LOW:TIME must have a power value defined in the same order. You can put a comma in the SCPI command as a place holder for any points where an absolute power is not specified, and that segment will then use the default value.

Example: **EPVT:MASK:LIST:UPP:ABS -200, -200, -58, -200, -200, -200, -200, -58, -200**

Factory Preset: Selected EDGE standard

Range: –200 dBm to +100 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs. Time—Upper Mask Points

[:SENSe]:EPVTime:MASK:LIST:UPPer:POINts?

Query the number of elements in the upper mask. This value is determined by the number of time points entered using [:SENSe]:EPVTime:MASK:LIST:UPPer:TIME.

Range: integer, 1 to 25

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

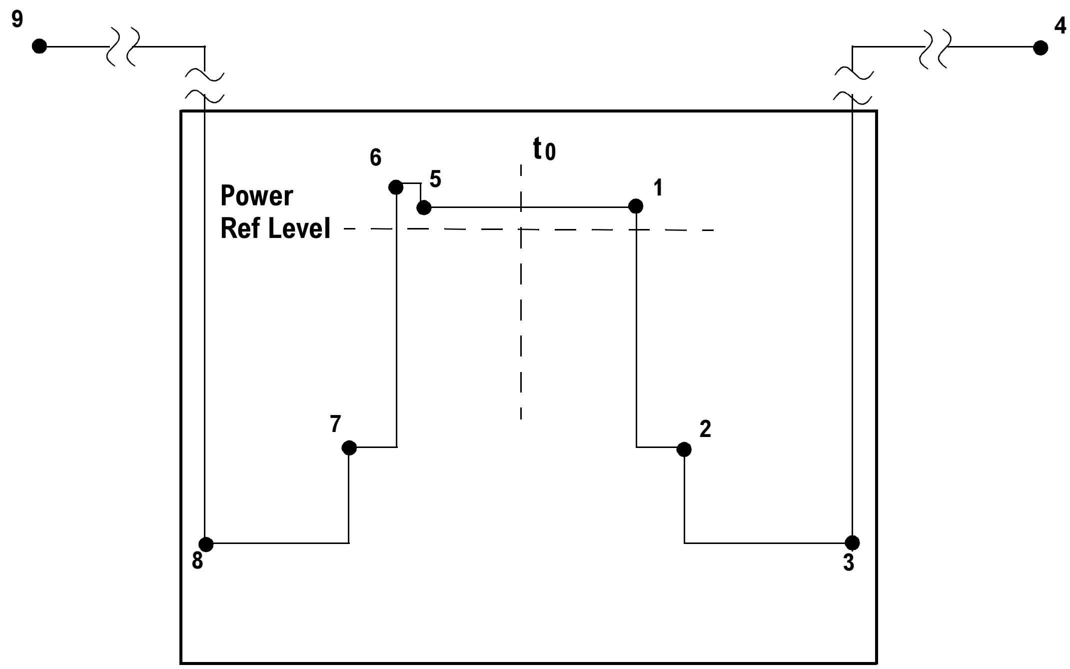
EDGE Power vs. Time—Upper Mask Relative Amplitude Levels

[:SENSe]:EPVTime:MASK:LIST:UPPer:RELative <rel_power>, <rel_power>, <rel_power>, <rel_power>, <rel_power>

[:SENSe]:EPVTime:MASK:LIST:UPPer:RELative?

Enter the relative power level for each horizontal line segment in the upper limit mask. There should be a power level for each time point entered using [:SENSe]:EPVTime:MASK:LIST:UPPer:TIME, and they must be entered in the same order. These power levels are all relative to the defined Reference Power Level (the average power in the useful part of the data). See Figure 4-1 on page 323.

Figure 4-1 Custom Upper Limit Mask Example



a. Notice that this segment, with this value of Ref Level, has a calculated relative level of -60 dBm. This is lower then the specified absolute level of -58 dBm, so the -58 dBm value will be used as the test limit for the segment.

Example: **EPVT:MASK:LIST:UPP:REL 4, -32, -48, 100, 4, 7, -25, -43, 100**

Factory Preset: Selected EDGE standard

Range: 200 dB to –100 dB, relative to the reference power

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs. Time—Upper Mask Time Points

[:SENSe]:EPVTime:MASK:LIST:UPPer:TIME <seconds>, <seconds>, <seconds>, <seconds>, <seconds>, ...

[:SENSe]:EPVTime:MASK:LIST:UPPer:TIME?

Enter the time points that define the horizontal line segments of the upper limit. A reference point designated “t_0” is at the center of the useful data (usually the center of the burst). Each line segment to the right of the t_0 reference point is designated as a positive value and each segment to the left of t_0 is a negative value.

First enter positive values in sequence starting from t_0, then the negative values in sequence starting from t_0. See Figure 4-1 on page 323 and the EPVT:MASK:LIST:UPPER:TIME example below it.

We recommend that you select a large time value for your first and last mask points (e.g. –1 and +1 second). This guarantees that you’ve defined a limit for all the measured data. (See Mask Segments 4 and 9 in the Table on page 323 for an example.

Example: **EPVT:MASK:LIST:UPP:TIME 280e-6, 15e-6, 1, -270e-6, -10e-6, -20e-6, -1**

Factory Preset: Selected EDGE standard

Range: –1s to +1s, referenced to t_0 at the center of the useful data (burst center)

1 to 25 time points in a mask

Default Unit: seconds

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs. Time—Mask Offset

[:SENSe]:EPVTime:MASK:OFFSet <rel_ampl>

[:SENSe]:EPVTime:MASK:OFFSet?

Specify the amount of amplitude offset to use when calculating the relative portions of the limit mask. This value is used in conjunction with Mask Reference Power to determine where to position the limits mask. This value does not affect any areas of the limit mask that are absolute (dBm).

Factory Preset: 0.00 dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs. Time—Mask Reference Power

[:SENSe]:EPVTime:MASK:REFerence TSC|DEMOD

[:SENSe]:EPVTime:MASK:REFerence?

Select how the limit mask reference power is measured—over the TSC part of the burst, or the Demod part of the burst. This value is used in conjunction with the Mask Offset value to determine where to position the limits mask.

Factory Preset: TSC

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs. Time—Custom Limit Masks

[:SENSe]:EPVTime:MASK:SELect STANdard|CUSTom

[:SENSe]:EPVTime:MASK:SELect?

Select standard masks or user-defined custom masks against which to compare your measured data.

Factory Preset: STANdard

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs. Time—Max Hold

[:SENSe]:EPVTime:MAXHold[:STATe] ON|OFF|1|0

[:SENSe]:EPVTime:MAXHold?

Set to On to display and hold the maximum responses of a signal.

Factory Preset: OFF

Range: On | Off

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs. Time—Measurement Timeslots

[:SENSe]:EPVTime:MTIMe <integer>

[:SENSe]:EPVTime:MTIMe?

Set the number of timeslots to show on screen with each measurement cycle.

Factory Preset: 1

Range: 1 to 8

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs Time - Select Power Control Level

Allows user to indicate the output power of the transmitter; in MS testing transmitter output power level will affect the mask. The appropriate power level for measuring the device under test will correspond with the transmitter power control level setting.

[:SENSe]:EPVTime:PCLevel <integer>

[**:SENSe]:EPVTime:PCLevel?**

Range: 0 to 40

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode

Front Panel Access: **Meas Setup**, **More (1 of 2)**, **Pwr Cntrl Lvl**.

EDGE Power vs. Time—Trace Points

[:SENSe]:EPVTime:POINts TP401|TP801|TP1601|TP3201|TP6401

[:SENSe]:EPVTime:POINts?

Set the number of trace points used in the measurement. More trace points will improve measurement accuracy, but slower measurement speed. TP3201 is recommended with Rise & Fall view.

Factory Preset: TP1601

Range: TP401 | TP801 | TP1601 | TP3201 | TP6401

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

EDGE Power vs. Time—Trigger Source

For VSA, PSA:

[:SENSe]:EPVTime:TRIGger:SOURce EXTernal[1]|EXTernal2 |FRAMe|IF|IMMediate|RFBurst

[:SENSe]:EPVTime:TRIGger:SOURce?

For ESA:

[:SENSe]:EPVTime:TRIGger:SOURce |RFBurst|EXTernal|FRAMe

[:SENSe]:EPVTime:TRIGger:SOURce?

Select the trigger source used to control the data acquisitions.

EXTernal 1 - front panel external trigger input

EXTernal 2 - rear panel external trigger input

FRAMe - uses the internal frame timer, which has been synchronized to the selected burst sync.

IF - internal IF envelope (video) trigger

IMMediate - the next data acquisition is immediately taken, capturing the signal asynchronously (also called Free Run).

RFBurst - wideband RF burst envelope trigger that has automatic level control for periodic burst signals.

EXTernal - rear panel external trigger input

Factory Preset: RFBurst for VSA, PSA

RFBurst for ESA when options B7E/B7D are present

EXTernal for ESA without Options B7E/B7D

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

NOTE Option B7E: RF Comms Hardware has at least three possible part numbers. Press **System**, **More**, **Show Hdwr** to show your instrument's RF Comms Hardware and view the part number. If the part number is E4401-60087 (the original version), the RF Burst trigger source will not be available with this measurement, and the default will be **EXTernal**.

Frequency Commands

Center Frequency

[:SENSe]:FREQuency:CENTer <freq>

[:SENSe]:FREQuency:CENTer?

Set the center frequency.

Factory Preset:	ESA E4401B, E4411B: 750 MHz for SA
	ESA E4402B, E4403B: 1.5 GHz for SA
	ESA E4404B: 3.35 GHz for SA
	ESA E4405B: 6.6 GHz for SA
	ESA E4407B, E4408B: 13.25 GHz for SA
	942.6 MHz for GSM
	The first channel in the current tuning plan, for cdmaOne.
	2.40200 GHz for Bluetooth
Range:	ESA E4401B, E4411B: –80 MHz to 1.58 GHz for SA
	ESA E4402B, E4403B: –80 MHz to 3.10 GHz for SA
	ESA E4404B: –80 MHz to 6.78 GHz for SA
	ESA E4405B: –80 MHz to 13.3 GHz for SA
	ESA E4407B, E4408B: –80 MHz to 27.0 GHz for SA
	942.6 MHz for GSM
	The same as the SA range for cdmaOne
	2.400 to 2.4835 GHz for Bluetooth
Default Unit:	Hz
Remarks:	Global to the current mode.
Front Panel Access:	*For ESA SA, GSM, and Bluetooth*
	FREQUENCY/Channel, Center Freq
	For ESA cdmaOne
	FREQUENCY/Channel, Channel Freq

Programming Commands

Frequency Span

[:SENSe]:FREQuency:SPAN <freq>

[:SENSe]:FREQuency:SPAN?

Set the frequency span. Setting the span to 0 Hz puts the analyzer into zero span. If resolution bandwidth is set to a value less than 1 kHz, maximum span is limited to 5 MHz.

Factory Preset:	ESA E4401B, E4411B: 1.5 GHz
	ESA E4402B, E4403B: 3.0 GHz
	ESA E4404B: 6.7 GHz
	ESA E4405B: 13.2 GHz
	ESA E4407B, E4408B: 26.5 GHz
	PSA E4443A: 6.78 GHz
	PSA E4445A: 13.3 GHz
	PSA E4440A: 27.0 GHz
Range:	ESA E4401B, E4411B: 100 Hz to 1.58 GHz
	ESA E4402B, E4403B: 100 Hz to 3.10 GHz
	ESA E4404B: 100 Hz to 6.78 GHz
	ESA E4405B: 100 Hz to 13.3 GHz
	ESA E4407B, E4408B: 100 Hz to 27.0 GHz
	PSA E4443A: 3 Hz to 6.78 GHz
	PSA E4445A: 3 Hz to 13.3 GHz
	PSA E4440A: 3 Hz to 27.0 GHz
Default Unit:	Hz
Front Panel Access:	**SPAN/X Scale, Span**
	or **SPAN/X Scale, Zero Span**

Full Frequency Span

[:SENSe]:FREQuency:SPAN:FULL

Set the frequency span to full scale. If resolution bandwidth is set to a value less than 1 kHz, maximum span is limited to 5 MHz.

Factory Preset:	ESA E4401B, E4411B: 1.5 GHz
	ESA E4402B, E4403B: 3.0 GHz

ESA E4404B: 6.7 GHz

ESA E4405B: 13.2 GHz

ESA E4407B, E4408B: 26.5 GHz

PSA E4443A: 6.78 GHz

PSA E4445A: 13.3 GHz

PSA E4440A: 27.0 GHz

Front Panel Access: **SPAN/X Scale, Full Span**

Monitor Spectrum or Monitor Band/Channel Measurement

Commands for querying the monitor spectrum or monitor band/channel measurement results and for setting to the default values are found in the “MEASure Group of Commands” on page 254. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **Monitor Spectrum** or **Monitor Band/Channel** measurement has been selected from the **MEASURE** key menu.

Monitor Spectrum or Monitor Band/Channel—Average Count

[:SENSe]:MONitor:AVERage:COUNt <integer>

[:SENSe]:MONitor:AVERage:COUNt?

Set the number of data acquisitions that will be averaged. After the specified number of average counts, the averaging mode (termination control) setting determines the averaging action.

Factory Preset:	10
Range:	1 to 1,000
Remarks:	For ESA: You must be in the Bluetooth, cdmaOne, GSM, Modulation Analysis, Noise Figure or Phase Noise mode to use this command. Use INSTrument:SELect to set the mode.
	For PSA: You must be in the Phase Noise or Noise Figure mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**Meas Setup, Avg Number**

Monitor Spectrum or Monitor Band/Channel—Averaging State

[:SENSe]:MONitor:AVERage[:STATe] OFF|ON|0|1

[:SENSe]:MONitor:AVERage[:STATe]?

Turn averaging on or off.

Factory Preset:	On for GSM, Bluetooth
	Off for cdmaOne, Modulation Analysis, Phase Noise and Noise Figure.
Remarks:	For ESA: You must be in the Bluetooth, cdmaOne, GSM, Modulation Analysis, Noise Figure or Phase Noise mode to use this command. Use INSTrument:SELect to set the mode.

For PSA: You must be in the Phase Noise or Noise Figure mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Avg Number**

Monitor Spectrum or Monitor Band/Channel—Averaging Termination Control

[:SENSe]:MONitor:AVERage:TCONtrol EXPonential|REPeat

[:SENSe]:MONitor:AVERage:TCONtrol?

Select the type of termination control used for the averaging function. This determines the averaging action after the specified number of data acquisitions (average count) is reached.

Exponential - After the average count is reached, each successive data acquisition is exponentially weighted and combined with the existing average.

Repeat - After reaching the average count, the averaging is reset and a new average is started.

Factory Preset: Exponential

Remarks: For ESA: You must be in the Bluetooth, cdmaOne, GSM, Modulation Analysis, Noise Figure or Phase Noise mode to use this command. Use INSTrument:SELect to set the mode.

For PSA: You must be in the Phase Noise or Noise Figure mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Avg Mode**

Monitor Spectrum or Monitor Band/Channel—Transmit or Receive Band Selection

For cdmaOne mode:

[:SENSe]:MONitor:FBAND TRANsmit|RECeive

[:SENSe]:MONitor:FBAND?

For GSM mode:

[:SENSe]:MONitor:BAND TRANsmit|RECeive

[:SENSe]:MONitor:BAND?

Set the band monitor measurement to monitor the transmit or receive band.

Factory Preset: TRANsmit

Remarks: You must be in the cdmaOne or GSM mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Band Setup, Band**

Monitor Spectrum or Monitor Band/Channel—Band Method Resolution Bandwidth

[:SENSe]:MONitor:BAND:BANDwidth|BWIDth[:RESolution] <freq>

[:SENSe]:MONitor:BAND:BANDwidth|BWIDth[:RESolution]?

Set the value of the resolution bandwidth for the band method of the monitor band/channel measurement. If span is set to a value greater than 5 MHz, minimum resolution bandwidth is limited to 1 kHz.

Factory Preset: 100 kHz for Bluetooth, GSM

300 kHz for cdmaOne

Range: 10 Hz to 5 MHz for GSM

Option 1DR—10 Hz to 5 MHz for Bluetooth

Option 1DR—30 Hz to 3 MHz for cdmaOne

non-Option 1DR—1 kHz to 5 MHz for Bluetooth

non-Option 1DR—1 kHz to 3 MHz for cdmaOne, GSM

Default Unit: Hz

Remarks: You must be in the Bluetooth, cdmaOne, or GSM mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Band Setup, Res BW**

Monitor Spectrum or Monitor Band/Channel—Band Method Video Bandwidth

[:SENSe]:MONitor:BAND:BANDwidth|BWIDth:VIDeo <freq>

[:SENSe]:MONitor:BAND:BANDwidth|BWIDth:VIDeo?

Set the video bandwidth for the band method of the monitor band/channel measurement.

Factory Preset: 100 kHz for Bluetooth, GSM

300 kHz for cdmaOne

Range: 30 Hz to 3 MHz for Bluetooth

Option 1DR—30 Hz to 3 MHz for cdmaOne, GSM

non-Option 1DR—1 kHz to 3 MHz for cdmaOne, GSM

Default Unit: Hz

Remarks: You must be in the Bluetooth, cdmaOne, or GSM mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Band Setup, Video BW**

Monitor Spectrum or Monitor Band/Channel—Band Method Maximum Hold Trace Average State

[:SENSe]:MONitor:BAND:MAXHold[:STATe] OFF|ON|0|1

[:SENSe]:MONitor:BAND:MAXHold[:STATe]?

Turn maximum hold trace average feature on or off for the band method of the monitor band/channel measurement.

Factory Preset: OFF

Remarks: You must be in the Bluetooth, cdmaOne, or GSM mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Band Setup, Max Hold**

Monitor Spectrum or Monitor Band/Channel—Channel Span

[:SENSe]:MONitor:CHANnel SINGle|TRIPle

[:SENSe]:MONitor:CHANnel?

Switch view between a single or triple channel display.

Factory Preset: SINGle

Remarks: You must be in Bluetooth or GSM mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Channel Span**

Monitor Spectrum or Monitor Band/Channel—Channel Method Resolution Bandwidth

[:SENSe]:MONitor:CHANnel:BANDwidth|BWIDth[:RESolution] <freq>

[:SENSe]:MONitor:CHANnel:BANDwidth|BWIDth[:RESolution]?

Set the resolution bandwidth for the channel method of the monitor band/channel measurement. If span is set to a value greater than 5 MHz, minimum resolution bandwidth is limited to 1 kHz.

Factory Preset:	10 kHz for GSM
	30 kHz for cdmaOne and Modulation Analysis
	100 kHz for Bluetooth
Range:	Option 1DR—10 Hz to 5 MHz
	non-Option 1DR—1 kHz to 5 MHz
Default Unit:	Hz
Remarks:	You must be in the Bluetooth, cdmaOne, or GSM mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**Meas Setup, Chan Setup, Res BW**

Monitor Spectrum or Monitor Band/Channel—Channel Method Video Bandwidth

[:SENSe]:MONitor:CHANnel:BANDwidth|BWIDth:VIDeo <freq>

[:SENSe]:MONitor:CHANnel:BANDwidth|BWIDth:VIDeo?

Set the video bandwidth for the channel method of the monitor band/channel measurement.

Factory Preset: 10 kHz for GSM

30 kHz for cdmaOne and Modulation Analysis

100 kHz for Bluetooth

Range: Option 1DR—30 Hz to 3 MHz

non-Option 1DR—1 kHz to 3 MHz

Default Unit: Hz

Remarks: You must be in the Bluetooth, cdmaOne, GSM, or Modulation Analysis mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Chan Setup, Video BW**

Monitor Spectrum or Monitor Band/Channel—Channel Method Detector Mode

[:SENSe]:MONitor:CHANnel:DETector POSitive|SAMPle|NEGative

[:SENSe]:MONitor:CHANnel:DETector?

Set the detector mode type for the channel method of the monitor band/channel measurement.

POSitive - positive peak detection displays the highest sample taken during the interval being displayed.

SAMPle - sample detection displays the first sample taken during the interval being displayed.

NEGative - negative peak detection displays the lowest sample taken during the interval being displayed.

Factory Preset: POSitive

Remarks: You must be in the Bluetooth, cdmaOne, GSM, or Modulation Analysis mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Chan Setup, Detector**

Monitor Spectrum or Monitor Band/Channel—Channel Method Maximum Hold Trace Average State

[:SENSe]:MONitor:CHANnel:MAXHold[:STATe] OFF|ON|0|1

[:SENSe]:MONitor:CHANnel:MAXHold[:STATe]?

Turn maximum hold trace average feature on or off for the channel method of the monitor band/channel measurement. When max hold is turned on, trace averaging is turned off.

Factory Preset: OFF

Remarks: You must be in the Bluetooth, cdmaOne, GSM, or Modulation Analysis mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Chan Setup, Max Hold**

Monitor Spectrum or Monitor Band/Channel—Method Selection

[:SENSe]:MONitor:METHod CHANnel|BAND

[:SENSe]:MONitor:METHod?

Sets the monitor measurement method to either channel or band.

Factory Preset: BAND

Remarks: You must be in the Bluetooth, cdmaOne, or GSM mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup**, **Method**

Out of Band Spurious Measurement

Commands for querying the out of band spurious measurement results and for setting to the default values are found in the Measure group of commands. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **Out Of Band Spurious** measurement has been selected from the **MEASURE** key menu.

Out of Band Spurious—Average Count

[:SENSe]:OOBSpur:AVERage:COUNt <integer>

[:SENSe]:OOBSpur:AVERage:COUNt?

For cdmaOne: Set the number of data acquisitions that will be averaged. After the specified number of average counts, the averaging mode (termination control) setting determines the averaging action.

For GSM: Set the number of max hold data acquisitions that will be averaged per frequency range. The averaging mode (termination control) setting is unavailable for this measurement.

Factory Preset: 10

Range: 1 to 1,000

Remarks: You must be in cdmaOne or GSM mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Avg Number**

Out of Band Spurious—Averaging State

[:SENSe]:OOBSpur:AVERage[:STATe] OFF|ON|0|1

[:SENSe]:OOBSpur:AVERage[:STATe]?

Turn averaging on or off.

Factory Preset: OFF

Remarks: You must be in cdmaOne or GSM mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Avg Number**

Out of Band Spurious—Inspect Spur Resolution Bandwidth

[:SENSe]:OOBSpur:BANDwidth[:RESolution] <freq>

[:SENSe]:OOBSpur:BANDwidth[:RESolution]?

Set the resolution bandwidth of the out of band spurious measurement. Can only be used when the measurement has completed and Inspect Spur is set to on. ([:SENSe]:OOBSpur:ISPur:STATe ON)

Range: 1 kHz to 5 MHz

Default Unit: Hz

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Inspect Spur, Res BW**

Out of Band Spurious—Inspect Spur Video Bandwidth

[:SENSe]:OOBSpur:BANDwidth:VIDeo <freq>

[:SENSe]:OOBSpur:BANDwidth:VIDeo?

Set the video bandwidth of the out of band spurious measurement. Can only be used when the measurement has completed and Inspect Spur is set to on. ([:SENSe]:OOBSpur:ISPur:STATe ON)

Range: 1 kHz to 3 MHz

Default Unit: Hz

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Inspect Spur, Video BW**

Out of Band Spurious—Inspect Spur Center Frequency

[:SENSe]:OOBSpur:FREQuency[:CENTer] <freq>

[:SENSe]:OOBSpur:FRequency[:CENTer]?

Set the center frequency of the out of band spurious measurement. Can only be used when the measurement has completed and Inspect Spur is set to on. ([:SENSe]:OOBSpur:ISPur:STATe ON)

Range: 9 kHz to maximum of current ESA model.

Default Unit: Hz

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **FREQUENCY Channel**

Out of Band Spurious—Inspect Spur Frequency Span

[:SENSe]:OOBSpur:FREQuency:SPAN <freq>

[:SENSe]:OOBSpur:FREQuency:SPAN?

Set the frequency span of the out of band spurious measurement. Can only be used when the measurement has completed and Inspect Spur is set to on. ([:SENSe]:OOBSpur:ISPur:STATe ON)

Range: ESA model dependent.

Default Unit: Hz

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **SPAN X Scale, Span**

Out of Band Spurious—Inspect Spur

[:SENSe]:OOBSpur:ISPur:COUNt <integer>

[:SENSe]:OOBSpur:ISPur:COUNt?

Select the spur number that you want to inspect from the table of results. Can only be used when the measurement has completed and Inspect Spur is set to on. ([:SENSe]:OOBSpur:ISPur:STATe ON)

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Inspect Spur, Inspect Spur**

Out of Band Spurious—Inspect Spur

[:SENSe]:OOBSpur:ISPur:[STATe] OFF|ON|0|1

[:SENSe]:OOBSpur:ISPur?

Set inspect spur on or off. The measurement must have completed and found at least one spur.

Factory Preset: OFF

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Inspect Spur, Inspect Spur**

Out of Band Spurious—MS Idle

[:SENSe]:OOBSpur:MSIDle OFF|ON|0|1

[:SENSe]:OOBSpur:MSIDle?

Set MS idle on to specify that you wish to measure a mobile station that is in idle mode—that is, with no call in progress. The measurement uses filter bandwidth and sweep times according to the specifications. This may involve sweep times of greater than 60 seconds.

Factory Preset: OFF

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, MS Idle**

Out of Band Spurious—Maximum Mixer Level

[:SENSe]:OOBSpur:POWer:MIXer:RANGe[:UPPer] <dB>

[:SENSe]:OOBSpur:POWer:MIXer:RANGe?

Set the maximum power at the input mixer for the out of band spurious measurement.

Factory Preset: 5 dBm

Range: -100 dBm to 10 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Advanced, Max Mxr Lvl**

Out of Band Spurious—Inspect Spur RF Port Input Attenuation

[:SENSe]:OOBSpur:POWer[:RF]:ATTenuation <dB>

[:SENSe]:OOBSpur:POWer[:RF]:ATTenuation?

Set the RF input attenuator. Can only be used when the measurement has completed and Inspect Spur is set to on. ([:SENSe]:OOBSpur:ISPur:STATe ON)

Range: 0 to 75 dB in 5 dB steps for E4402B, E4404B, and E4405B.

0 to 65 dB in 5 dB steps for E4407B.

Default Unit: dB

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **AMPLITUDE Y Scale, Atten**

Out of Band Spurious—Inspect Spur Reference Level

[:SENSe]:OOBSpur:RLEVel <dBm>

[:SENSe]:OOBSpur:RLEVel?

Set the reference level when inspecting spurs. Can only be used when the measurement has completed and Inspect Spur is set to on. ([:SENSe]:OOBSpur:ISPur:STATe ON)

Range: -150 to 150 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **AMPLITUDE Y Scale, Ref Level**

Out Of Band Spurious—Inspect Spur Sweep Time

[:SENSe]:OOBSpur:SWEep:TIME <seconds>

[:SENSe]:OOBSpur:SWEep:TIME?

Change the sweep time when inspecting spurs. Can only be used when the measurement has completed and Inspect Spur is set to on ([:SENSe]:OOBSpur:ISPur:STATe ON).

Factory Preset: 2 s

Range: 4 ms to 500 s

Default Unit: Seconds

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Inspect Spur, Sweep Time**

Reference Oscillator

Reference Oscillator External Frequency

[:SENSe]:OPTion:ROSCillator:EXTernal:FREQuency <freq>

[:SENSe]:OPTion:ROSCillator:EXTernal:FREQuency?

Set the frequency of the external reference oscillator being supplied to the option B7E RF assembly Ext Ref In jack. This provides the proper frequency division in the option B7E RF assembly to achieve the required 10 MHz reference frequency. Switch to the external reference with OPT:ROSC:SOUR.

Preset
and *RST: 10 MHz

Range: 1 MHz to 30 MHz

Default Unit: Hz

Front Panel
Access: **Mode Setup, Demod**

Reference Oscillator Rear Panel Output

[:SENSe]:OPTion:ROSCillator:OUTPut[:STATe] OFF|ON|0|1

[:SENSe]:OPTion:ROSCillator:OUTPut?

Set the frequency source for the option B7E RF assembly 10 MHz Out jack to the option reference oscillator.

Preset
and *RST: OFF

Front Panel
Access: **Mode Setup, Demod**

Reference Oscillator Source

[:SENSe]:OPTion:ROSCillator:SOURce INTernal|EXTernal

[:SENSe]:OPTion:ROSCillator:SOURce?

Select the reference oscillator (time base) source to the internal reference oscillator or an external oscillator. Use OPT:ROSC:EXT:FREQ to tell the instrument the frequency of the external reference.

INTernal - uses 10 MHz internal time base

EXTernal - uses the signal at the rear panel external reference input port.

Preset and *RST:	INTernal
Front Panel Access:	**Mode Setup, Properties**

Programming Commands

Output RF Spectrum Measurement

Commands for querying the output RF spectrum measurement results and for setting to the default values are found in the "MEASure Group of Commands" on page 254. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **Output RF Spectrum** measurement has been selected from the **MEASURE** key menu.

Output RF Spectrum—Number of Bursts Averaged

[:SENSe]:ORFSpectrum:AVERage:COUNt <integer>

[:SENSe]:ORFSpectrum:AVERage:COUNt?

Set the number of bursts that will be averaged. For the output RF spectrum due to switching transients, it is more accurate to consider this the number of frames that are measured. After the specified number of bursts (average counts), the averaging mode (termination control) setting determines the averaging action.

Factory Preset: 10

Range: 1 to 1,000

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Output RF Spectrum—Averaging Control

[:SENSe]:ORFSpectrum:AVERage[:STATe] OFF|ON|0|1

[:SENSe]:ORFSpectrum:AVERage[:STATe]?

Turn averaging on or off.

Factory Preset: ON

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Output RF Spectrum—Averaging Termination Control

[:SENSe]:ORFSpectrum:AVERage:TCONtrol EXPonential|REPeat

[:SENSe]:ORFSpectrum:AVERage:TCONtrol?

Select the type of termination control used for the averaging function. This determines the averaging action after the specified number of frames (average count) is reached.

EXPonential - After the average count is reached, each successive data acquisition is exponentially weighted and combined with the existing average.

REPeat - After reaching the average count, the averaging is reset and a new average is started.

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Factory Preset: REPeat

Output RF Spectrum—Resolution BW For Modulation At Close Offsets

[:SENSe]:ORFSpectrum:BANDwidth[:RESolution]:MODulation:OFFSet:CLOSe <freq>

[:SENSe]:ORFSpectrum:BANDwidth[:RESolution]:MODulation:OFFSet:CLOSe?

Set the resolution bandwidth used for the spectrum due to modulation part of the ORFS measurement for offset frequencies less than 1800 kHz.

Factory Preset: 30 kHz

Range: 1 kHz to 5 MHz

Default Unit: Hz

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Output RF Spectrum—Resolution BW for Modulation at Far Offsets

[:SENSe]:ORFSpectrum:BANDwidth[:RESolution]:MODulation:OFFSet:FAR <freq>

[:SENSe]:ORFSpectrum:BANDwidth[:RESolution]:MODulation:OFFSet:FAR?

Set the resolution bandwidth used for the spectrum due to modulation part of the ORFS measurement for offset frequencies greater than or equal to 1800 kHz.

Factory Preset: 100 kHz

Range: 1 kHz to 5 MHz

Default Unit: Hz

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Output RF Spectrum—Resolution BW For Switching Transients At Close Offsets

[:SENSe]:ORFSpectrum:BANDwidth[:RESolution]:SWITching:OFFSet:CLOSe <freq>

[:SENSe]:ORFSpectrum:BANDwidth[:RESolution]:SWITching:OFFSet:CLOSe?

Set the resolution bandwidth used for the spectrum due to switching transients part of the ORFS measurement for offset frequencies less than 1800 kHz.

Factory Preset: 30 kHz

Range: 1 kHz to 5 MHz

Default Unit: Hz

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Output RF Spectrum—Resolution BW For Switching Transients At Far Offsets

[:SENSe]:ORFSpectrum:BANDwidth[:RESolution]:SWITching:OFFSet:FAR <freq>

[:SENSe]:ORFSpectrum:BANDwidth[:RESolution]:SWITching:OFFSet:FAR?

Set the resolution bandwidth used for the spectrum due to switching transients part of the ORFS measurement for offset frequencies greater than or equal to 1800 kHz.

Factory Preset: 100 kHz

Range: 1 kHz to 5 MHz

Default Unit: Hz

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Output RF Spectrum—Burst Synchronization Source

[:SENSe]:ORFSpectrum:BSYNc:SOURce TSEQuence|RFAMplitude|NONE

[:SENSe]:ORFSpectrum:BSYNc:SOURce?

Select the method of synchronizing the measurement to the GSM bursts.

Training Sequence (TSEQuence) - the training sequence burst sync performs a demodulation of the burst and determines the start and stop of the useful part of the burst based on the midamble training sequence.

RFAMplitude - the RF amplitude burst sync approximates the start and stop of the useful part of the burst without digital demodulation of the burst.

NONE - no burst sync is used.

Factory Preset: TSEQuence if both Option B7D (DSP and Fast ADC), and Option B7E (RF Communications Hardware) are installed.

RFAMplitude if either or both of Option B7D (DSP and Fast ADC), and Option B7E (RF Communications Hardware) are missing.

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Output RF Spectrum—Offset Frequency List

[:SENSe]:ORFSpectrum:LIST:SELect SHORt|STANdard

[:SENSe]:ORFSpectrum:LIST:SELect?

Select the list of frequency offsets and bandwidths to be used to make the ORFS measurement. This command is used only in the ORFS multiple measurement method for both ORFS due to Modulation and ORFS due to Switching Transients.

SHORt - a shortened list of the offset frequencies specified in the GSM Standards. It uses two internal offset frequency lists, one for modulation spectrum and the other for switching transient spectrum. These offset frequencies cannot be changed, but the resolution bandwidths can be changed by other commands in the SENSe:ORFSpectrum subsystem.

STANdard - the complete list of the offset frequencies specified in the GSM Standards, except for those offsets greater than 6 MHz. It uses two internal offset frequency lists, one for modulation spectrum and the other for switching transient spectrum. These offset frequencies cannot be changed, but the resolution bandwidths can be changed by other commands in the SENSe:ORFSpectrum subsystem.

Factory Preset: SHORt

Remarks: This command is only valid if SENS:ORFS:MEAS is set to multiple.

You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Output RF Spectrum—Measure Offsets Measurement Method

[:SENSe]:ORFSpectrum:MEASure MULTiple|SINGle|SWEPt

[:SENSe]:ORFSpectrum:MEASure?

Select the measurement method to be used.

MULTiple - the measurement is done at all offsets in the offset frequency list.

SINGle - the measurement is done at only one offset as determined by the offset frequency setting. This allows detailed examination of the time-domain waveform at the specified offset frequency.

SWEPt - the measurement is done in the frequency domain. For output RF spectrum due to modulation it is done using time-gated spectrum analysis to sweep the analyzer with the gate turned on for the desired portion of the burst only.

Factory Preset: MULTiple

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Output RF Spectrum—Offset Frequency

[:SENSe]:ORFSpectrum:OFRequency <freq>

[:SENSe]:ORFSpectrum:OFRequency?

Set the offset frequency that is used to measure a single offset. This command is only valid if SENS:ORFS:MEAS is set to single.

Factory Preset: 250 kHz

Range: –6.0 MHz to +6.0 MHz

Step Size: Steps through the values in the selected offset frequency list.

Default Unit: Hz

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Output RF Spectrum—Maximum RF Mixer Power

[:SENSe]:ORFSpectrum:POWer:MIXer:RANGe[:UPPer] <power>

[:SENSe]:ORFSpectrum:POWer:MIXer:RANGe?

Set the attenuation to automatically maintain the specified maximum power level at the RF mixer input.

Factory Preset: 0 dBm

Range: -100 to +10 dBm

Remarks: This is an advanced parameter that has been set up for maximum performance. Using settings greater than 0 dBm could result in a compressed signal or spurious signals or both.

Front Panel Access: **Meas Setup, Advanced**

Output RF Spectrum—Reference Power Averages

[:SENSe]:ORFSpectrum:REFerence:AVERage:COUNt <integer>

[:SENSe]:ORFSpectrum:REFerence:AVERage:COUNt?

Set the number of bursts to be averaged when measuring the reference power. Reference power average state must be set to OFF (for further information refer to the next command). Reference power averages is valid only if SENS:ORFS:MEAS is set to single.

Factory Preset: 10

Range: 1 to 1,000

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Output RF Spectrum—Reference Power Average State

[:SENSe]:ORFSpectrum:REFerence:AVERage[:AUTO] OFF|ON|0|1

[:SENSe]:ORFSpectrum:REFerence:AVERage[:AUTO]?

Specifies how many averages to use when measuring the reference power. Set it to ON to use the same number of averages as specified in the number of bursts averaged command. Set it to OFF to use the number specified in the reference power averages command (for further information refer to the previous command). Reference power average state is valid only if SENS:ORFS:MEAS is set to single.

Factory Preset: ON

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Output RF Spectrum—Trigger Source

[:SENSe]:ORFSpectrum:TRIGger:SOURce EXTernal|RFBurst|FRAMe|IMMediate

[:SENSe]:ORFSpectrum:TRIGger:SOURce?

Select the trigger source used to control the data acquisitions.

EXTernal - rear panel external trigger input

FRAMe - uses the internal frame timer, which has been synchronized to the selected burst sync

IMMediate - the next data acquisition is immediately taken, capturing the signal asynchronously (also called free run)

RFBurst - wideband RF burst envelope trigger that has automatic level control for periodic burst signals

Factory Preset: RFBurst if the RF Communications Hardware (option B7E) has been installed

EXTernal if option B7E has not been installed

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Output RF Spectrum—Measurement Type

[:SENSe]:ORFSpectrum:TYPE MODulation|SWITching

[:SENSe]:ORFSpectrum:TYPE?

Select the measurement type.

MODulation - only the modulation spectrum is measured.

SWITching - only the switching transient spectrum is measured.

Factory Preset: MODulation

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Output RF Spectrum—Wideband Noise

[:SENSe]:ORFSpectrum:WBNoise OFF|ON|0|1

[:SENSe]:ORFSpectrum:WBNoise?

Set wideband noise function to ON or OFF. When set to OFF, the analyzer is tuned to the carrier and -1800 kHz to +1800 kHz either side of the center frequency is swept. When set to ON, the whole of the relevant band 2 MHz either side is swept.

Factory Preset: OFF

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Phase & Frequency Error Measurement

Commands for querying the phase and frequency error measurement results and for setting to the default values are found in the "MEASure Group of Commands" on page 254. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **Phase & Freq** measurement has been selected from the **MEASURE** key menu.

Phase & Frequency Error—Number Of Bursts Averaged

[:SENSe]:PFERror:AVERage:COUNt <integer>

[:SENSe]:PFERror:AVERage:COUNt?

Set the number of bursts that will be averaged. After the specified number of bursts (average counts), the averaging mode (termination control) setting determines the averaging action.

Factory Preset: 15

Range: 1 to 1,000

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Phase & Frequency Error—Averaging State

[:SENSe]:PFERror:AVERage[:STATe] OFF|ON|0|1

[:SENSe]:PFERror:AVERage[:STATe]?

Turn averaging on or off.

Factory Preset: OFF

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Phase & Frequency Error—Averaging Termination Control

[:SENSe]:PFERror:AVERage:TCONtrol EXPonential|REPeat

[:SENSe]:PFERror:AVERage:TCONtrol?

Select the type of termination control used for the averaging function. This determines the averaging action after the specified number of bursts (average count) is reached.

EXPonential - After the average count has been reached, each successive data acquisition is exponentially weighted and combined with the existing average.

REPeat - After reaching the average count, the averaging is reset

and a new average is started.

Factory Preset: EXPonential

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Phase & Frequency Error—Averaging Type

[:SENSe]:PFERror:AVERage:TYPE MEAN|MAXimum

[:SENSe]:PFERror:AVERage:TYPE?

Select the type of averaging:

MEAN - the scalar results are averaged.

MAXimum - the maximum scalar results are retained.

Factory Preset: MAXimum.

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Phase & Frequency Error—I/Q Origin Offset Measurement

[:SENSe]:PFERror:IQOFfset[:STATe] OFF|ON|0|1

[:SENSe]:PFERror:IQOFfset[:STATe]?

Turn On or Off I/Q origin offset measurement. If it is set to On, I/Q origin offset is performed. When it is set to Off, the measurement is not performed, but the measurement speed is improved.

Factory Preset: On

On - I/Q origin offset measurement is performed.

Off - I/Q origin offset measurement is not performed.

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Phase & Frequency Error—Bit Dots State

[:SENSe]:PFERror:SDOTs[:STATe] OFF|ON|0|1

[:SENSe]:PFERror:SDOTs[:STATe]?

Set the graphical displays of Phase Error, Phase Error w/Freq and the Constellation Diagram to show (ON) or hide (OFF) the measurement points on the trace.

Factory Preset: ON

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

This SCPI command is included for completeness. but only affects the traces displayed on the screen.

Phase & Frequency Error—Burst Synchronization

[:SENSe]:PFERror:BSYNc:SOURce TSEQuence|RFAMplitude

[:SENSe]:PFERror:BSYNc:SOURce?

Select the method of synchronizing the measurement to the GSM bursts.

Training Sequence (TSEQuence) - the training sequence burst sync performs a demodulation of the burst and determines the start and stop of the useful part of the burst based on the midamble training sequence.

RFAMplitude - the RF amplitude burst sync approximates the start and stop of the useful part of the burst without demodulation of the burst.

None - no burst synchronization is used

Factory Preset: TSEQuence

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Phase & Frequency Error—Trace Data

[:SENSe]:PFERror:TRACe[:STATe] OFF|ON|0|1

[:SENSe]:PFERror:TRACe[:STATe]?

Turn On or Off trace data for phase and frequency error measurement. If it is set to On, the trace data is available. When it is set to Off, the trace data is not available, but the measurement speed is improved.

Factory Preset: On

On - Trace data is available.

Off - Trace data is not available.

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Phase & Frequency Error—Trigger Source

[:SENSe]:PFERror:TRIGger:SOURce EXTernal|FRAMe|IMMediate|RFBurst

[:SENSe]:PFERror:TRIGger:SOURce?

Select the trigger source used to control the data acquisitions.

EXTernal - rear panel external trigger input.

FRAMe - uses the internal frame timer, which has been synchronized to the selected burst sync.

IMMediate - the next data acquisition is immediately taken, capturing the signal asynchronously (also called free run).

RFBurst - wideband RF burst envelope trigger that has automatic level control for periodic burst signals.

Factory Preset: RFBurst

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

RF Power Commands

RF Port Input Attenuation

[:SENSe]:POWer[:RF]:ATTenuation <rel_power>

[:SENSe]:POWer[:RF]:ATTenuation?

Set the RF input attenuator. This value is set at its auto value if RF input attenuation is set to auto.

Factory Preset:	10 dB for SA
	5 dB for Bluetooth, cdmaOne, GSM, EDGE, Modulation Analysis
Range:	ESA E4401B, E4411B: 0 to 60 dB for SA
	ESA E4402B, E4403B: 0 to 75 dB for SA
	ESA E4404B: 0 to 75 dB for SA
	ESA E4405B: 0 to 75 dB for SA
	ESA E4407B, E4408B: 0 to 65 dB for SA
	0 to 75 dB in 5 dB steps for cdmaOne, Modulation Analysis
	0 to 65 dB in 5 dB steps for GSM, EDGE
	Same range as SA mode, but in 5 dB steps for Bluetooth
Default Unit:	dB
Front Panel Access:	**Input, Input Atten** for Bluetooth, cdmaOne, GSM, EDGE
	or **Mode Setup, Input, Tab⇒, Input Attenuation** for Bluetooth, cdmaOne, GSM, EDGE
	or **AMPLITUDE/Y Scale, Attenuation** for SA, cdmaOne, GSM, EDGE, Modulation Analysis

RF Carriers

[:SENSe]:POWer[:RF]:CARRiers SINGle|MULTiple

[:SENSe]:POWer[:RF]:CARRiers?

Switch between single and multiple carrier modes.

Factory Preset: SINGle

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Input, Tab⇒, Input Atten**

or

Input/Output, Tab⇒, Input Atten

Internal RF Preamplifier Control

[:SENSe]:POWer[:RF]:GAIN[:STATe] OFF|ON|0|1

[:SENSe]:POWer[:RF]:GAIN[:STATe]?

Turns the internal preamp on or off for the currently selected measurement.

Factory Preset: OFF

Remarks: You must be in GSM, EDGE or Bluetooth mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **AMPLITUDE/Y Scale, Int Preamp for SA**

or **Mode Setup, Input... for GSM, Bluetooth**

or **Input, Int Preamp for GSM, Bluetooth**

RF Port Power Range

[:SENSe]:POWer[:RF]:RANGe <dBm>

[:SENSe]:POWer[:RF]:RANGe?

Set the maximum total power to be applied at the RF input. There are two modes of operation as follows:

When RF Port Power Range Auto = AUTO, Max Total Pwr displays the actual measured power level.

When RF Port Power Range Auto = MANual, the input power range is determined by the manually entered Max Total Pwr value.

Range: -100 to +80

Default Unit: dBm

Remarks: You must be in GSM, EDGE or Bluetooth mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Mode Setup, Input....**

or

Input, Max Total Pwr

RF Port Power Range Auto

[:SENSe]:POWer[:RF]:RANGe:AUTO OFF|ON|0|1

[:SENSe]:POWer[:RF]:RANGe:AUTO?

Select the RF port power range to be set either automatically or manually.

ON - power range is automatically set as determined by the actual measured power level at the start of a measurement, as displayed by the Max Total Pwr value.

OFF - power range is manually set by either the manually entered Max Total Pwr or Input Atten value.

Factory Preset: ON

Remarks: You must be in GSM, EDGE or Bluetooth mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Mode Setup, Input....**

or

Input, Max Total Pwr

Power Steps Measurement (PST)

Commands for querying the power steps measurement results and for setting to the default values are found in the “MEASure Group of Commands” on page 254. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **Power Steps** measurement has been selected from the **MEASURE** key menu.

Power Steps—Resolution Bandwidth

[:SENSe]:PSTeps:BANDwidth|BWIDth[:RESolution] <freq>

[:SENSe]:PSTeps:BANDwidth|BWIDth[:RESolution]?

Set the resolution bandwidth to be used to make the power steps measurement over.

Factory Preset:	1 MHz
Range:	10 Hz to 5 MHz
Default unit:	Hz
Remarks:	You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Power Steps—Video Bandwidth

[:SENSe]:PSTeps:BANDwidth|BWIDth:VIDeo <freq>

[:SENSe]:PSTeps:BANDwidth|BWIDth:VIDeo?

Set the video bandwidth to be used to make the power steps measurement over.

Factory Preset:	300 kHz
Range:	30 Hz to 3 MHz
Default unit:	Hz
Remarks:	You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Power Steps—Sweep Time

[:SENSe]:PSTeps:SWEep:TIME <integer>

[:SENSe]:PSTeps:SWEep:TIME?

Set the sweep time that will be used to make the power steps measurement over. The value should be set to ≥ 2 seconds to ensure that the GSM modulation does not affect the trace.

Programming Commands

Factory Preset:	2
Range:	5 ms to 4000 s
Default unit:	Seconds
Remarks:	You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Power vs. Time Measurement

Commands for querying the power versus time measurement results and for setting to the default values are found in the “MEASure Group of Commands” on page 254. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **Pwr vs Time** measurement has been selected from the **MEASURE** key menu.

Power vs. Time—Number of Bursts Averaged

[:SENSe]:PVTime:AVERage:COUNt <integer>

[:SENSe]:PVTime:AVERage:COUNt?

Set the number of bursts that will be averaged. After the specified number of bursts (average counts), the averaging mode (termination control) setting determines the averaging action.

Factory Preset: 15

Range: 1 to 1,000

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Power vs. Time—Averaging State

[:SENSe]:PVTime:AVERage[:STATe] OFF|ON|0|1

[:SENSe]:PVTime:AVERage[:STATe]?

Turn averaging on or off.

Factory Preset: ON

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Power vs. Time—Averaging Termination Control

[:SENSe]:PVTime:AVERage:TCONtrol EXPonential|REPeat

[:SENSe]:PVTime:AVERage:TCONtrol?

Select the type of termination control used for the averaging function. This specifies the averaging action after the specified number of bursts (average count) is reached.

EXPonential - After the average count has been reached, each successive data acquisition is exponentially weighted and combined with the existing average.

REPeat - After reaching the average count, the averaging is reset

Programming Commands

and a new average is started.

Factory Preset: EXPonential

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Power vs. Time—Averaging Type

[:SENSe]:PVTime:AVERage:TYPE LPOWer|POWer

[:SENSe]:PVTime:AVERage:TYPE?

Select the type of averaging to be performed.

LPOWer - logarithmically averages the power of the video data.

POWer - averages the linear power of successive measurements.

Factory Preset: POWer

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Power vs. Time—Resolution BW

[:SENSe]:PVTime:BANDwidth|BWIDth[:RESolution] <freq>

[:SENSe]:PVTime:BANDwidth|BWIDth[:RESolution]?

Set the resolution bandwidth. This is an advanced control that normally does not need to be changed. Setting this to a value other than the factory default, may cause invalid measurement results.

Factory Preset: 300 kHz

Range: 1 kHz to 5 MHz

Default Unit: Hz

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Power vs. Time—Video BW

[:SENSe]:PVTime:BANDwidth|BWIDth:VIDeo <freq>

[:SENSe]:PVTime:BANDwidth|BWIDth:Video?

Specify the video bandwidth.

Factory Preset: 300 kHz

Range: 1 Hz to 3 MHz

Default Unit: Hz

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Power vs. Time—Burst Synchronization Source

[:SENSe]:PVTime:BSYNc:SOURce TSEQuence|RFAMplitude|NONE

[:SENSe]:PVTime:BSYNc:SOURce?

Select the method of synchronizing the measurement to the GSM bursts.

Training Sequence (TSEQuence) - the training sequence burst sync performs a demodulation of the burst and determines the start and stop of the useful part of the burst based on the midamble training sequence.

RFAMplitude - performs burst synchronization based on the rising and falling edges of the burst.

NONE - performs no burst synchronization.

Factory Preset: TSEQuence

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Power vs. Time—Current Data Calculation

[:SENSe]:PVTime:CDATa OFF|ON|0|1

[:SENSe]:PVTime:CDATa?

Turn calculation of current data results on or off. Current data is calculated at the end of each sweep and is based only on that sweep.

Factory Preset: ON

Range: ON/OFF

Remarks: Set the parameter to OFF to gain additional measurement speed over averaged results.

You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Power vs. Time—Limit Mask Display

[:SENSe]:PVTime:LIMit:MASK OFF|ON|0|1

[:SENSe]:PVTime:LIMit:MASK?

Show or hide the limit mask. Does not affect the pass/fail calculation for limit tests.

Factory Preset: ON

Remarks: You must be in GSM, EDGE, 1xEV-DO, or W-CDMA mode to use this command. Use INSTrument:SELect to set the mode.

Power vs. Time—Limit Line Mask Test

[:SENSe]:PVTime:LIMit:TEST OFF|ON|0|1

[:SENSe]:PVTime:LIMit:TEST?

Turn on or off limit pass/fail testing. Does not affect limit line display.

Factory Preset: ON

Range: ON/OFF

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Power vs. Time—Limit Line Mask Test

[:SENSe]:PVTime:LIMit:TEST OFF|ON|0|1

[:SENSe]:PVTime:LIMit:TEST?

Turn on or off limit pass/fail testing. Does not affect limit line display.

Factory Preset: ON

Range: ON/OFF

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Power vs. Time—Lower Mask Absolute Amplitude Levels

[:SENSe]:PVTime:MASK:LIST:LOWer:ABSolute <power>, <power>, <power>, <power>, <power>

[:SENSe]:PVTime:MASK:LIST:LOWer:ABSolute?

Enter a power level for any of your mask line segments that require an absolute minimum power limit in addition to its relative limit. Each time a measurement is made the Ref Level is determined. (This is the power level of the useful part of the burst, or midway between the upper/lower masks). Remember, as the power of the Ref Level changes, all of the relative mask power levels will change by the same amount.

Each relative limit is then compared to the Ref Level and an equivalent absolute power level is calculated. This power level is compared to the specified absolute limit for each line segment. If this calculated relative limit is lower then the absolute limit you've specified, then the value of the absolute limit is used for this segment. Therefore, if the absolute limit is set to a very low value (–200 dBm), the calculated value of the reference limit will never be lower, and the specified relative limit will always be used for that segment. See Figure 4-2 on page 370.

Every time point you defined with PVT:MASK:LOW:TIME must have a power value defined in the same order. You can put a comma in the SCPI command as a place holder for any points where an absolute power is not specified, and that segment will then use the default value.

Factory Preset: Selected GSM standard

Range: –200 dBm to +100 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Power vs. Time—Lower Mask Points

[:SENSe]:PVTime:MASK:LIST:LOWer:POINts?

Query the number of elements in the lower mask. This value is determined by the number of time points entered using `[:SENSe]:PVTime:MASK:LIST:LOWer:TIME`.

Range: Integer, 1 to 25

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Power vs. Time—Lower Mask Relative Amplitude Levels

[:SENSe]:PVTime:MASK:LIST:LOWer:RELative <rel_power>, <rel_power>, <rel_power>, <rel_power>, <rel_power>

[:SENSe]:PVTime:MASK:LIST:LOWer:RELative?

Enter the relative power level for each horizontal line segment in the lower limit mask. There should be a power level for each time point entered using `[:SENSe]:PVTime:MASK:LIST:LOWer:TIME`, and they must be entered in the same order. These power levels are all relative to the defined Reference Power Level (the average power in the useful part of the data). When an upper and lower limit masks have been defined, the Reference Power Level is the mid-point between these two limits at time t_0.

Factory Preset: Selected GSM standard

Range: –100 to 200 dB relative to the reference power

Default Unit: dB

Remarks: You must be in GSM, EDGE, 1xEV-DO, or W-CDMA mode to use this command. Use INSTrument:SELect to set the mode.

Power vs. Time—Lower Mask Time Points

[:SENSe]:PVTime:MASK:LIST:LOWer:TIME <seconds>{, <seconds>}

[:SENSe]:PVTime:MASK:LIST:LOWer:TIME?

Enter the time points that define the horizontal line segments of the lower limit. A reference point designated "t_0" is at the center of the useful data (usually the center of the burst). Each line segment to the right of the t_0 reference point is designated as a positive time value and each segment to the left of t_0 is a negative time value.

First enter positive values in sequence starting from t_0, then negative values in sequence starting from t_0. See Figure 4-2 on page 370 and the PVT:MASK:LIST:UPPer:TIME example below it. (This is an upper mask example, but they work the same.)

We recommend that you select a large time value for your first and last mask points (e.g. –1 and +1 second). This guarantees that you've defined a limit for all the measured data. (See Mask Segments 4 and 9 in the Table on page 370 for an example.

Factory Preset: Selected GSM standard

Range: –1s to +1s, referenced to t_0 at the center of the useful data (burst center)

1 to 25 time points in a mask

Default Unit: seconds

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Power vs. Time—Upper Mask Absolute Amplitude Levels

[:SENSe]:PVTime:MASK:LIST:UPPer:ABSolute <power>, <power>, <power>, <power>, <power>

[:SENSe]:PVTime:MASK:LIST:UPPer:ABSolute?

Enter a power level for any of your mask line segments that require an absolute minimum power limit in addition to its relative limit. Each time a measurement is made the Ref Level is determined. (This is the power level of the useful part of the burst, or midway between the upper/lower masks). Remember, as the power of the Ref Level changes, all of the relative mask power levels will change by the same amount.

Each relative limit is then compared to the Ref Level and an equivalent absolute power level is calculated. This power level is compared to the specified absolute limit for each line segment. If this calculated relative limit is lower then the absolute limit you've specified, then the value of the absolute limit is used for this segment. Therefore, if the absolute limit is set to a very low value (–200 dBm), the calculated value of the reference limit will never be lower, and the specified relative limit will always be used for that segment. See Figure 4-2 on page 370.

Every time point you defined with PVT:MASK:LOW:TIME must have a power value defined in the same order. You can put a comma in the SCPI command as a place holder for any points where an absolute power is not specified, and that segment will then use the default value.

Example: **PVT:MASK:LIST:UPP:ABS -200, -200, -58, -200, -200, -200, -200, -58, -200**

Factory Preset: Selected GSM standard

Range: –200 dBm to +100 dBm

Default Unit: dBm

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Power vs. Time—Upper Mask Points

[:SENSe]:PVTime:MASK:LIST:UPPer:POINts?

Query the number of elements in the upper mask. This value is determined by the number of time points entered using [:SENSe]:PVTime:MASK:LIST:UPPer:TIME.

Range: integer, 1 to 25

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

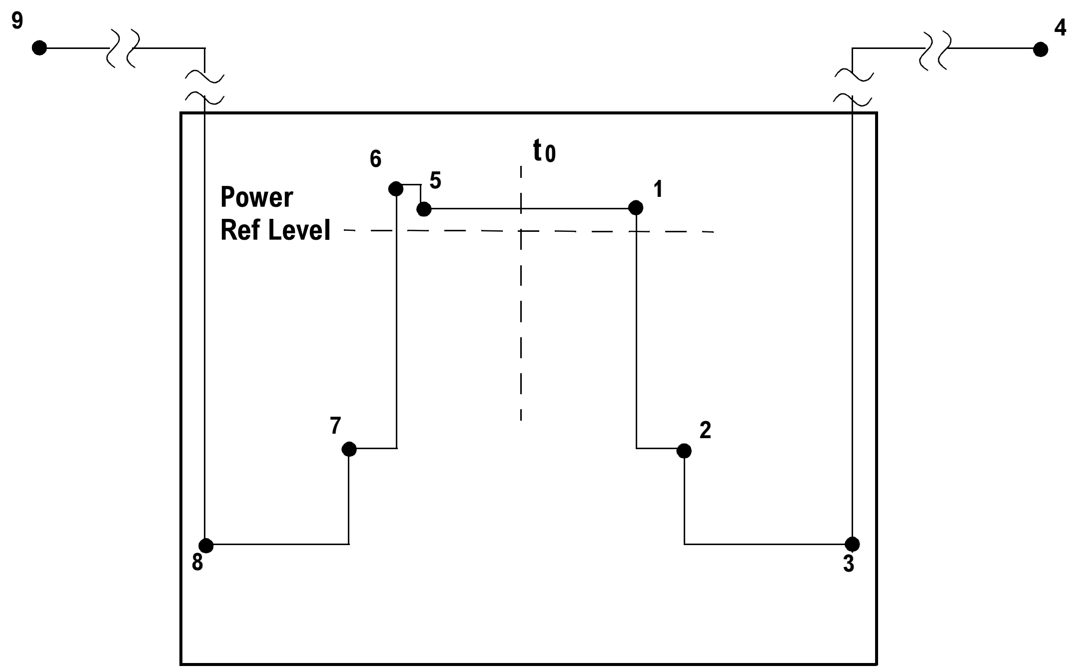
Power vs. Time—Upper Mask Relative Amplitude Levels

[:SENSe]:PVTime:MASK:LIST:UPPer:RELative <rel_power>, <rel_power>, <rel_power>, <rel_power>, <rel_power>

[:SENSe]:PVTime:MASK:LIST:UPPer:RELative?

Enter the relative power level for each horizontal line segment in the upper limit mask. There should be a power level for each time point entered using `[:SENSe]:PVTime:MASK:LIST:UPPer:TIME`, and they must be entered in the same order. These power levels are all relative to the defined Reference Power Level (the average power in the useful part of the data). When an upper and lower limit masks have been defined, the Reference Power Level is the mid-point between these two limits at time t_0. See Figure 4-2 on page 370.

Figure 4-2 Custom Upper Limit Mask Example



Entered Value for each Time Segment	Absolute Time Value	Relative Power (example with Ref Level = –12 dBm)		Entered Absolute Power (dBm)	Segment Number
		Entered Relative Power	Equivalent Absolute Power		
280.0e-6	280 µs	+4 dBc	–8 dBm	–200 dBm	1
15.0e-6	295 µs	–32 dBc	–44 dBm	–200 dBm	2
450.0e-6	745 µs	–48 dBc	–60 dBm[a]	–58 dBm[a]	3
1	>1 sec	+100 dBc	+112 dBm	–200 dBm	4
–270.0e-6	–270 µs	+4 dBc	–8 dBm	–200 dBm	5
–10.0e-6	–280 µs	+7 dBc	–5 dBm	–200 dBm	6

Entered Value for each Time Segment	Absolute Time Value	Relative Power (example with Ref Level = –12 dBm)		Entered Absolute Power (dBm)	Segment Number
		Entered Relative Power	Equivalent Absolute Power		
–20.0e–6	–300 µs	–25 dBc	–37 dBm	–200 dBm	7
–450e-6	–750 µs	–43 dBc	–55 dBm	–58 dBm	8
–1	<–1 sec	+100 dBc	+112 dBm	–200 dBm	9

a. Notice that this segment, with this value of Ref Level, has a calculated relative level of -60 dBm. This is lower then the specified absolute level of -58 dBm, so the -58 dBm value will be used as the test limit for the segment.

Example: **PVT:MASK:LIST:UPP:REL 4,-32,-48,100,4,7,-25,-43,100**

Factory Preset: Selected GSM standard

Range: –100 to +200 dB relative to the reference power

Default Unit: dB

Remarks: You must be in GSM, EDGE, 1xEV-DO, or W-CDMA mode to use this command. Use INSTrument:SELect to set the mode.

Power vs. Time—Upper Mask Time Points

[:SENSe]:PVTime:MASK:LIST:UPPer:TIME <seconds>, <seconds>, <seconds>, <seconds>, <seconds>

[:SENSe]:PVTime:MASK:LIST:UPPer:TIME?

Enter the time points that define the horizontal line segments of the upper limit. A reference point designated “t_0” is at the center of the useful data (usually the center of the burst). Each line segment to the right of the t_0 reference point is designated as a positive time value and each segment to the left of t_0 is a negative time value.

First enter positive values in sequence starting from t_0, then the negative values in sequence starting from t_0. See Figure 4-2 on page 370 and the PVTime:MASK:LIST:UPPer:TIME example below it.

We recommend that you select a large time value for your first and last mask points (e.g. –1 and +1 second). This guarantees that you’ve defined a limit for all the measured data. (See Mask Segments 4 and 9 in the table Table on page 370 for an example.

Example: **PVTime:MASK:LIST:UPPer:TIME 280e-6, 15e-6,**

450e-6, 1, -270e-6, -10e-6, -20e-6, -450-6, -1

Factory Preset: Selected GSM standard

Range: –1s to +1s, referenced to t_0 at the center of the useful data (burst center)

1 to 25 time points in a mask

Default Unit: seconds

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Power vs. Time—Custom Limit Masks

[:SENSe]:PVTime:MASK:SELect STANdard|CUSTom

[:SENSe]:PVTime:MASK:SELect?

Select standard masks or user-defined custom masks to compare you measured data against.

Factory Preset: STANdard

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Power vs. Time—Maximum Hold

[:SENSe]:PVTime:MAXHold 0|1|ON|OFF

[:SENSe]:PVTime:MAXHold?

Turn the max hold feature on or off. Available only in monitor view.

Factory Preset: OFF

Range: OFF/ON

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Power vs Time - Select Power Control Level

Allows user to indicate the output power of the transmitter; in MS testing transmitter output power level will affect the mask. The appropriate power level for measuring the device under test will correspond with the transmitter power control level setting.

[:SENSe]:PVTime:PCLevel <integer>

[:SENSe]:PVTime:PCLevel?

Range: 0 to 40

Remarks: You must be in the power vs. time measurement in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode

Front Panel Access: **Meas Setup**, **More (1 of 2)**, **Pwr Cntrl Lvl**.

Power vs. Time—Number of Trace Points

[:SENSe]:PVTime:POINts 401|801|1601|3201|6401

[:SENSe]:PVTime:POINts?

Set the number of trace points used in the measurement.

Factory Preset: 1601

Range: 401, 801, 1601, 3201, 6401

Remarks: The higher the value used here, the more accurate but slower the measurement will be.

More than 801 points are recommended for rise and fall views

Power vs. Time—Trigger Source

[:SENSe]:PVTime:TRIGger:SOURce EXTernal|RFBurst|FRAMe

[:SENSe]:PVTime:TRIGger:SOURce?

Select the trigger source used to control the data acquisitions.

EXTernal - rear panel external trigger input

FRAMe - uses the frame timer, which has been synchronized to the selected burst sync.

RFBurst - wideband RF burst envelope trigger that has automatic level control for periodic burst signals.

Factory Preset: RFBurst if the RF Communications Hardware (option B7E) has been installed

EXTernal, if option B7E has not been installed

Remarks: You must be in GSM, EDGE, Service, 1xEV-DO, or W-CDMA mode to use this command. Use INSTrument:SELect to set the mode.

Radio Standards Commands

Radio Device Under Test

[:SENSe]:RADio:DEVice MS|BTS|UBTS1|UBTS2|UBTS3|PBTS1 for GSM

[:SENSe]:RADio:DEVice PC1|PC2|PC3 for Bluetooth

[:SENSe]:RADio:DEVice?

Select the type of radio device to be tested.

Select the power class of the Bluetooth device to be measured. Choices are Power Class 1, 2, or 3.

MS – Mobile station transmitter test

BTS – Base station transmitter test

UBTS1 – Micro base station class M1 transmitter test

UBTS2 – Micro base station class M2 transmitter test

UBTS3 – Micro base station class M3 transmitter test

PBTS1 – Pico base station class P1 transmitter test

Factory Preset:	PC1 for Bluetooth
	BTS for GSM, EDGE
Remarks:	You must be in Bluetooth or GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.
	Global to current mode.
Front Panel Access:	**Mode Setup, Radio, Device**

Radio Device Under Test

[:SENSe]:RADio:DEVice:CLASS?

Query the type of device being tested. The two possible results are:

BTS - Base station transmitter test

MS - Mobile station test

Front Panel Access:	**Mode Setup, Radio, Device**

Radio Standard Band

[:SENSe]:RADio:STANdard:BAND PGSM|EGSM|RGSM|DCS1800|PCS1900|GSM450|GSM480|GSM700|GSM850

[:SENSe]:RADio:STANdard:BAND?

Select the standard variant that applies to the radio to be tested.

PGSM - Primary GSM in the 900 MHz band

EGSM - Extended GSM in the 900 MHz band

RGSM - Railway GSM in the 900 MHz band

DCS1800 - DSC1800 band; also known as GSM-1800

PCS1900 - PCS1900 band; also known as GSM-1900

GSM450 - GSM450 band

GSM480 - GSM480 band

GSM700 - GSM700band

GSM850 - GSM850 band, for IS-136HS

Factory Preset: EGSM900

Remarks: Global to the current mode.

You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Mode Setup, Radio, Band**

Receiver Spurious Measurement

Commands for querying the receiver spurious responses measurement results and for setting to the default values are found in the "MEASure Group of Commands" on page 254. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **RX Spur** measurement has been selected from the **MEASURE** key menu.

Receiver Spurious—Average Count

[:SENSe]:RSPur:AVERage:COUNt <integer>

[:SENSe]:RSPur:AVERage:COUNt?

Set the number of data acquisitions that will be averaged. After the specified number of average counts, the averaging mode (termination control) setting determines the averaging action.

Factory Preset: 10

Range: 1 to 1,000

Remarks: You must be in cdmaOne or GSM mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Avg Number**

Receiver Spurious—Averaging State

[:SENSe]:RSPur:AVERage[:STATe] OFF|ON|0|1

[:SENSe]:RSPur:AVERage[:STATe]?

Turn averaging on or off.

Factory Preset: OFF for cdmaOne

ON for GSM

Remarks: You must be in the cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Avg Number**

Receiver Spurious—Averaging Termination Control

[:SENSe]:RSPur:AVERage:TCONtrol EXPonential|REPeat

[:SENSe]:RSPur:AVERage:TCONtrol?

Select the type of termination control used for averaging. This

Programming Commands

determines the averaging action after the specified number of data acquisitions (average count) is reached.

EXPonential - After the average count has been reached, each successive data acquisition is exponentially weighted and combined with the existing average.

REPeat - After reaching the average count, the averaging is reset and a new average is started.

Factory Preset: EXPonential

Remarks: You must be in the cdmaOne or GSM mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup, Avg Mode**

Receiver Spurious—Resolution Bandwidth

[:SENSe]:RSPur:BANDwidth|BWIDth[:RESolution] <freq>

[:SENSe]:RSPur:BANDwidth|BWIDth[:RESolution]?

Set the resolution bandwidth that will be used. If span is set to a value greater than 5 MHz, minimum resolution bandwidth is limited to 1 kHz.

Factory Preset: 30 kHz

Range: Option 1DR—10 Hz to 5 MHz

non- Option 1DR—1 kHz to 5 MHz

Default Unit: Hz

Remarks: You must be in the cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Meas Setup**, **Advanced**, **Resolution BW**

Receiver Spurious—Video Bandwidth

[:SENSe]:RSPur:BANDwidth|BWIDth:VIDeo <freq>

[:SENSe]:RSPur:BANDwidth|BWIDth:VIDeo?

Set the video bandwidth that will be used.

Factory Preset: 3 kHz

Range: Option 1DR—30 Hz to 3 MHz

non- Option 1DR—1 kHz to 3 MHz

Default Unit:	Hz
Remarks:	You must be in the cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**Meas Setup**, **Advanced**, **Video BW**

Synchronization Commands

Sync Alignment

[:SENSe]:SYNC:ALIGnment GSM|HALF

[:SENSe]:SYNC:ALIGnment?

Select the sync alignment to be either to the GSM standard or the standard offset by 1/2 bit.

GSM - burst alignment as defined in the GSM standard

HALF - burst alignment is advanced by1/2 bit, which corresponds to an earlier interpretation of the GSM standard

Factory Preset: GSM

Remarks: Global to the current mode.

You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Mode Setup, Demod, Burst Align**

Sync Burst RF Amplitude Delay

[:SENSe]:SYNC:BURSt:RFAMplitude:DELay <time>

[:SENSe]:SYNC:BURSt:RFAMplitude:DELay?

Set the delay for the RF amplitude sync.

Factory Preset: 0 s

Range: -5 ms to 5 ms

Default Unit: seconds

Remarks: Global to the current mode.

You must be in Bluetooth or GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Mode Setup, Trigger, RF Sync Delay**

Programming Commands

Burst Search Threshold

[:SENSe]:SYNC:BURSt:STHReshold <rel_power>

[:SENSe]:SYNC:BURSt:STHReshold?

Set the power threshold, relative to the peak power, that is used to determine the burst rising edge and falling edge.

Factory Preset:	–10 dB
	–3.00 dB for Bluetooth
	–20 dB for Modulation Analysis and GSM
Range:	–200 to –0.01 dB
	–50.00 to –0.01 dB for Bluetooth
Default Unit:	dB
Remarks:	You must be in Bluetooth or GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**Mode Setup, Demod....**
	or
	Det/Demod, Burst Search Threshold

Transmit Band Spurs Measurement

Commands for querying the transmit band spurs measurement results and for setting to the default values are found in the "MEASure Group of Commands" on page 254. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **TxBand Spur** measurement has been selected from the **MEASURE** key menu.

Transmit Band Spurs—Average Count

[:SENSe]:TSPur:AVERage:COUNt <integer>

[:SENSe]:TSPur:AVERage:COUNt?

Set the number of data acquisitions that will be averaged. After the specified number of average counts, the averaging is reset and a new average is started.

Factory Preset: 10

Range: 1 to 1,000

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Transmit Band Spurs—Averaging State

[:SENSe]:TSPur:AVERage[:STATe] OFF|ON|0|1

[:SENSe]:TSPur:AVERage[:STATe]?

Turn averaging on or off.

Factory Preset: ON

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Transmit Band Spurs—Idle Mode

[:SENSe]:TSPur:IDLE OFF|ON|0|1

[:SENSe]:TSPur:IDLE?

Set idle mode to YES if the transmitter is set to idle, or NO if the transmitter has an active channel.

Factory Preset: NO

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Transmit Band Spurs—Type

[:SENSe]:TSPur:TYPE EXAMine|FULL

[:SENSe]:TSPur:TYPE?

Select the measurement type.

EXAMine - measures spurs in all the valid segments and then displays the segment that has the worst spur

FULL - continuously measures the spurs in all the valid segments

Factory Preset: FULL

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Transmit Power Measurement

Commands for querying the transmit power measurement results and for setting to the default values are found in the "MEASure Group of Commands" on page 254. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **Transmit Power** measurement has been selected from the **MEASURE** key menu.

Transmit Power—Number of Bursts Averaged

[:SENSe]:TXPower:AVERage:COUNt <integer>

[:SENSe]:TXPower:AVERage:COUNt?

Set the number of bursts that will be averaged. After the specified number of bursts (average counts), the averaging mode (termination control) setting determines the averaging action.

Factory Preset: 10

Range: 1 to 10,000

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Transmit Power—Averaging State

[:SENSe]:TXPower:AVERage[:STATe] OFF|ON|0|1

[:SENSe]:TXPower:AVERage[:STATe]?

Turn averaging on or off.

Factory Preset: ON

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Transmit Power—Averaging Termination Control

[:SENSe]:TXPower:AVERage:TCONtrol EXPonential|REPeat

[:SENSe]:TXPower:AVERage:TCONtrol?

Select the type of termination control used for the averaging function. This determines the averaging action after the specified number of frames (average count) is reached.

EXPonential - After the average count has been reached, each successive data acquisition is exponentially weighted and combined with the existing average.

REPeat - After reaching the average count, the averaging is reset

and a new average is started.

Factory Preset: EXPonential

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Transmit Power—Averaging Type

[:SENSe]:TXPower:AVERage:TYPE LPOWer|POWer

[:SENSe]:TXPower:AVERage:TYPE?

Select the type of averaging to be performed.

- LPOWer - logarithmically averages the power of the video data.
- POWer - averages the linear power of successive measurements.

Factory Preset: POWer

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Transmit Power—Resolution BW

[:SENSe]:TXPower:BANDwidth|BWIDth[:RESolution] <freq>

[:SENSe]:TXPower:BANDwidth|BWIDth[:RESolution]?

Set the resolution BW. This is an advanced control that normally does not need to be changed. Setting it to a value other than the factory default, may cause invalid measurement results.

Factory Preset: 300 kHz

Range: 1 kHz to 5 MHz

Default Unit: Hz

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Transmit Power—Video Bandwidth

[:SENSe]:TXPower:BANDwidth|BWIDth:VIDeo <freq>

[:SENSe]:TXPower:BANDwidth|BWIDth:VIDeo?

Specify the video bandwidth.

Factory Preset: 300 kHz

Range: 1 Hz to 3 MHz

Default Unit: Hz

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Transmit Power—Burst Synchronization Source

[:SENSe]:TXPower:BSYNc:SOURce TSEQuence|RFAMplitude|NONE

[:SENSe]:TXPower:BSYNc:SOURce?

Select the method of synchronizing the measurement to the GSM bursts.

TSEQuence - the training sequence burst sync performs a demodulation of the burst and determines the start and stop of the useful part of the burst based on the midamble training sequence.

RFAMplitude - the RF amplitude burst sync approximates the start and stop of the useful part of the burst without digital demodulation of the burst.

NONE - performs no burst synchronization.

Factory Preset: NONE

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Transmit Power—Current Data Calculation

[:SENSe]:TXPower:CDATa OFF|ON|0|1

[:SENSe]:TXPower:CDATa?

Turns calculation of current data calculation on of off. Current data is calculated at the end of each sweep and is based only on that sweep.

Factory Preset: ON

Range: ON/OFF

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Transmit Power—Maximum Timeslots

[:SENSe]:TXPower:MTIMe <num timeslots>

[:SENSe]:TXPower:MTIMe?

Sets the number of timeslots to capture and show on screen.

Factory Preset: 1

Range: 1 to 8

Remarks: You must be in GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Transmit Power—Threshold Level

[:SENSe]:TXPower:THReshold <power>

[:SENSe]:TXPower:THReshold?

Set the amplitude threshold level. Only the data above the threshold level is kept and used to compute the average transmit carrier power.

Factory Preset: –6.0 dB

Range: –60 dB to 0 dB, for relative mode

–60 dBm to +60 dBm, for absolute mode

Default Unit: dB for relative mode

dBm for absolute mode

Remarks: The command (SENSe:TXPower:THReshold:TYPe ABSolute|RELative) determines whether this command is setting an absolute or a relative power level.

You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Transmit Power—Threshold Type

[:SENSe]:TXPower:THReshold:TYPE ABSolute|RELative

[:SENSe]:TXPower:THReshold:TYPE?

Select auto or manual control of the threshold level.

ABSolute - threshold value is set to an absolute power level

RELative - threshold value is set relative to the reference

Factory Preset: RELative

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

Transmit Power—Trigger Source

[:SENSe]:TXPower:TRIGger:SOURce IMMediate|EXTernal|RFBurst|FRAMe

[:SENSe]:TXPower:TRIGger:SOURce?

Select the trigger source used to control the data acquisitions.

EXTernal - rear panel external trigger input

IMMediate - the next data acquisition is immediately taken (also called free run)

RFBurst - wideband RF burst envelope trigger that has automatic level control for periodic burst signals.

FRAMe - uses the frame timer, which has been synchronized to the selected burst sync.

Factory Preset: RFBurst if the RF Communications Hardware (option B7E) has been installed

EXTernal if option B7E has not been installed

Remarks: You must be in the GSM, EDGE mode to use this command. Use INSTrument:SELect to set the mode.

STATus Subsystem

The STATus subsystem controls the SCPI-defined instrument-status reporting structures. Each status register has a set of five commands used for querying or masking that particular register.

Operation Register

Operation Condition Query

:STATus:OPERation:CONDition?

This query returns the decimal value of the sum of the bits in the Status Operation Condition register.

NOTE The data in this register is continuously updated and reflects the current conditions.

Key Type: There is no equivalent front panel key.

Operation Enable

:STATus:OPERation:ENABle <integer>

:STATus:OPERation:ENABle?

This command determines which bits in the Operation Event register, will set the Operation Status Summary bit (bit 7) in the Status Byte Register. The variable <number> is the sum of the decimal values of the bits you want to enable.

NOTE The preset condition is to have all bits in this enable register set to 0. To have any Operation Events reported to the Status Byte Register, one or more bits need to be set to 1.

Key Type: There is no equivalent front panel key.

Factory Preset:

Range: 0 to 32767

Operation Event Query

:STATus:OPERation[:EVENt]?

This query returns the decimal value of the sum of the bits in the Operation Event register.

NOTE The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register.

The data in this register is latched until it is queried. Once queried, the register is cleared.

Key Type: There is no equivalent front panel key.

Operation Negative Transition

:STATus:OPERation:NTRansition <integer>

:STATus:OPERation:NTRansition?

This command determines which bits in the Operation Condition register will set the corresponding bit in the Operation Event register when the condition register bit has a negative transition (1 to 0). The variable <number> is the sum of the decimal values of the bits that you want to enable.

Key Type: There is no equivalent front panel key.

Factory Preset: 0

Range: 0 to 32767

Operation Positive Transition

:STATus:OPERation:PTRansition <integer>

:STATus:OPERation:PTRansition?

This command determines which bits in the Operation Condition register will set the corresponding bit in the Operation Event register when the condition register bit has a positive transition (0 to 1). The variable <number> is the sum of the decimal values of the bits that you want to enable.

Key Type: There is no equivalent front panel key.

Factory Preset: 32767 (all 1’s)

Range: 0 to 32767

TRIGger Subsystem

The Trigger Subsystem is used to set the controls and parameters associated with triggering the data acquisitions. Other trigger-related commands are found in the INITiate and ABORt subsystems.

The trigger parameters are global within a selected Mode. The commands in the TRIGger subsystem set up the way the triggers function, but selection of the trigger source is made from each measurement. There is a separate trigger source command in the SENSe:<meas> subsystem for each measurement. The equivalent front panel keys for the parameters described in the following commands, can be found under the **Mode Setup, Trigger** key.

External Trigger Delay

:TRIGger[:SEQuence]:EXTernal:DELay <time>

:TRIGger[:SEQuence]:EXTernal:DELay?

Set the trigger delay when using an external trigger. Set the trigger value to zero (0) seconds to turn off the delay.

Factory Preset: 0.0 s

Range: 0 ns to 429 s Anything less than 300 ns is equal to off, for SA

-5 ms to +5 ms, for GSM, EDGE, Bluetooth

Default Unit: seconds

Front Panel Access: **Mode Setup, Trigger....**

or **Trig, External, Delay**

Frame Trigger Delay

:TRIGger[:SEQuence]:FRAMe:DELay <time>

:TRIGger[:SEQuence]:FRAMe:DELay?

Set trigger delay to be used in zero span measurements to adjust the active burst within a mask. Use positive values to achieve trigger delay (that is, to measure later than the trigger source event) and use negative values to achieve pre-trigger (that is, to measure earlier than the trigger source event).

Factory Preset: 0

Range: -5 ms to +5 ms, for GSM

Range: 0 ns to 429 s Anything less than 300 ns is equal to off.

Default Unit: seconds

Front Panel Access: **Mode Setup, Trigger....**

or **Trig, Tab⇒, Frame Timer Delay**

RF Burst Trigger Delay

:TRIGger:RFBurst:DELay <time>

:TRIGger:RFBurst:DELay?

Set the trigger delay when using the RF burst (wideband) trigger.

Factory Preset: 0 s

Range: –5 ms to +5 ms

Default Unit: seconds

Front Panel Access: **Mode Setup, Trigger....**

or **Trig, RF Burst, Delay**

RF Burst Trigger Level

:TRIGger[:SEQuence]:RFBurst:LEVel <rel_power>

:TRIGger:RFBurst:LEVel <dB> for GSM mode

:TRIGger[:SEQuence]:RFBurst:LEVel?

Set the trigger level when using the RF Burst (wideband) Trigger. The value is relative to the peak of the signal. RF Burst is also known as RF Envelope.

Factory Preset: –25.0 dB

Range: –25.0 to 0.0 dB

Remarks: Option B7E: RF Comms Hardware has at least three possible part numbers. **Press System, More, Show Hdwr** to show your instrument’s RF Comms Hardware and to find out the part number. If the part number is E4401-60087 (the original version), it is important to set the RF Burst Peak Level to an appropriate level that will avoid the AM transitions which can occur during the active part of EDGE signal bursts, and which can lead to mis-triggering of the measurement.

To set the RF Burst Peak level, press Trigger, RF Burst, Peak Level and enter the peak level in dB.

Default Unit: dB

Front Panel Access: **Mode Setup, Trigger, Tab⇒, RF Burst Level**

or **Trig, RF Burst, Peak Level**

RF Burst Trigger Slope

:TRIGger:RFBurst:SLOPe NEGative|POSitive

:TRIGger[:SEQuence]:RFBurst:SLOPe?

Set the trigger slope when using the RF Burst (wideband) Trigger.

Factory Preset: Positive

Remarks: You must be in the cdmaOne, cdma2000, W-CDMA mode to use this command. Use :INSTrument:SELect to set the mode.

Front Panel Access: **Mode Setup, Trigger, RF Burst, Slope**

Front Panel Access: **Mode Setup, Trigger....**

or **Trig, RF Burst, Slope**

5 Concepts

Topics described include:

What are GSM and EDGE?

The Global System for Mobile communication (GSM) digital communications standard defines a voice and data over-air interface between a mobile radio and the system infrastructure. This standard was designed as the basis for a radio communications system. A base station control center (BSC) is linked to multiple base transceiver station (BTS) sites which provide the required coverage.

EDGE (Enhanced Data Rates for GSM Evolution) enhances the GSM standard by implementing a new modulation format and filtering designed to provide higher data rates in the same spectrum. EDGE and GSM signals can be transmitted on the same frequency, occupying different timeslots, and both use existing GSM equipment. EDGE has also been adopted as the basis for IS-136HS.

GSM 450, GSM 480, GSM 850, GSM 900, DCS 1800, and PCS 1900 are GSM-defined frequency bands. The term GSM 900 is used for any GSM system operating in the 900 MHz band, which includes P-GSM, E-GSM, and R-GSM. Primary (or standard) GSM 900 band (P-GSM) is the original GSM band. Extended GSM 900 band (E-GSM) includes all the P-GSM band plus an additional 50 channels. Railway GSM 900 band (R-GSM) includes all the E-GSM band plus additional channels. DCS 1800 is an adaptation of GSM 900, created to allow for smaller cell sizes for higher system capacity. PCS 1900 is intended to be identical to DCS 1800 except for frequency allocation and power levels. The term GSM 1800 is sometimes used for DCS 1800, and the term GSM 1900 is sometimes used for PCS 1900. The following documents detail the standards used when testing:

Table 5-1 Documents detailing the GSM/EDGE standards used:

	GSM-450 GSM-480 GSM-850 GSM-900	**DCS-1800**	**PCS-1900**
Mobile station	ETS 300 607-1 (11.10)	ETS 300 607-1 (11.10)	J-STD-007
Base station	ETS 300 609-1 (11.21)	ETS 300 609-1 (11.21)	J-STD-007
Radio transmission and reception	ETS 300 910 (5.05)	ETS 300 910 (5.05)	J-STD-007

NOTE These standards are continually being updated by the communications industry.

The GSM digital communications standard employs an 8:1 Time

Concepts

Division Multiple Access (TDMA) allowing eight channels to use one carrier frequency simultaneously. The 270.833 kbits/second raw bit rate is modulated on the RF carrier using Gaussian Minimum Shift Keying (GMSK).

The standard includes multiple traffic channels, a control channel, and a cell broadcast channel. The GSM specification defines a channel spacing of 200 kHz.

The framing structure for GSM and EDGE measurements is based on a hierarchical system consisting of timeslots, TDMA frames, multiframes, superframes, and hyperframes. One timeslot consists of 156.25 (157) symbol periods including tail, training sequence, encryption, guard time, and data bits. Eight of these timeslots make up one TDMA frame. Either 26 or 51 TDMA frames make up one multiframe. Frames 13 and 26 in the 26 frame multiframe are dedicated to control channel signaling.

These principles of the GSM systems lead to the need for the fundamental transmitter measurements such as:

- Power vs Time - which verifies that the transmitter output power has the correct amplitude, shape, and timing for the TDMA sequence.
- Phase and Frequency Error - which verifies the accuracy of the transmitters 0.3 GMSK modulation process.
- Output RF Spectrum - which verifies that the RF carrier is contained within the designated 200 kHz channel.

Mobile Stations And Base Transceiver Stations

The cellular system includes the following:

- base transceiver stations, referred to as BTS
  (frequency ranges dependent on the standard; refer to Table 5-1 on page 395)
- mobile stations, referred to as MS
  (frequency ranges dependent on the standard; refer to Table 5-1 on page 395)

Uplink And Downlink

Uplink is defined as the path from the mobile station to the base transceiver station. Downlink is the path from the base transceiver station to the mobile station.

What Is An ARFCN?

An ARFCN is the Absolute Radio Frequency Channel Number used in the GSM system. Each RF channel is shared by up to eight mobile stations using Time Division Multiple Access (TDMA). The ARFCN is an integer (in a range dependent on the chosen standard, refer to Table 5-1 on page 395) which designates the carrier frequency.

What Is A Timeslot?

GSM utilizes Time Division Multiple Access (TDMA) with eight time slots per RF channel which allows eight users to use a single carrier frequency simultaneously. Users avoid one another by transmitting in series. The eight users can transmit once every 4.62 ms for 1 timeslot which is 577 µs long. The eight user timeslots are numbered from 0 to 7.

Typically, each 577 µs timeslot has a length of 156.25 bit periods, which consists of 148 data bits and 8.25 guard bits. The 4.62 ms required to cycle through eight timeslots is called a frame. In a TDMA system, the shape of each transmitted burst must be controlled carefully to avoid over-lapping bursts in time.

Table 5-2 EDGE and GSM Band Data

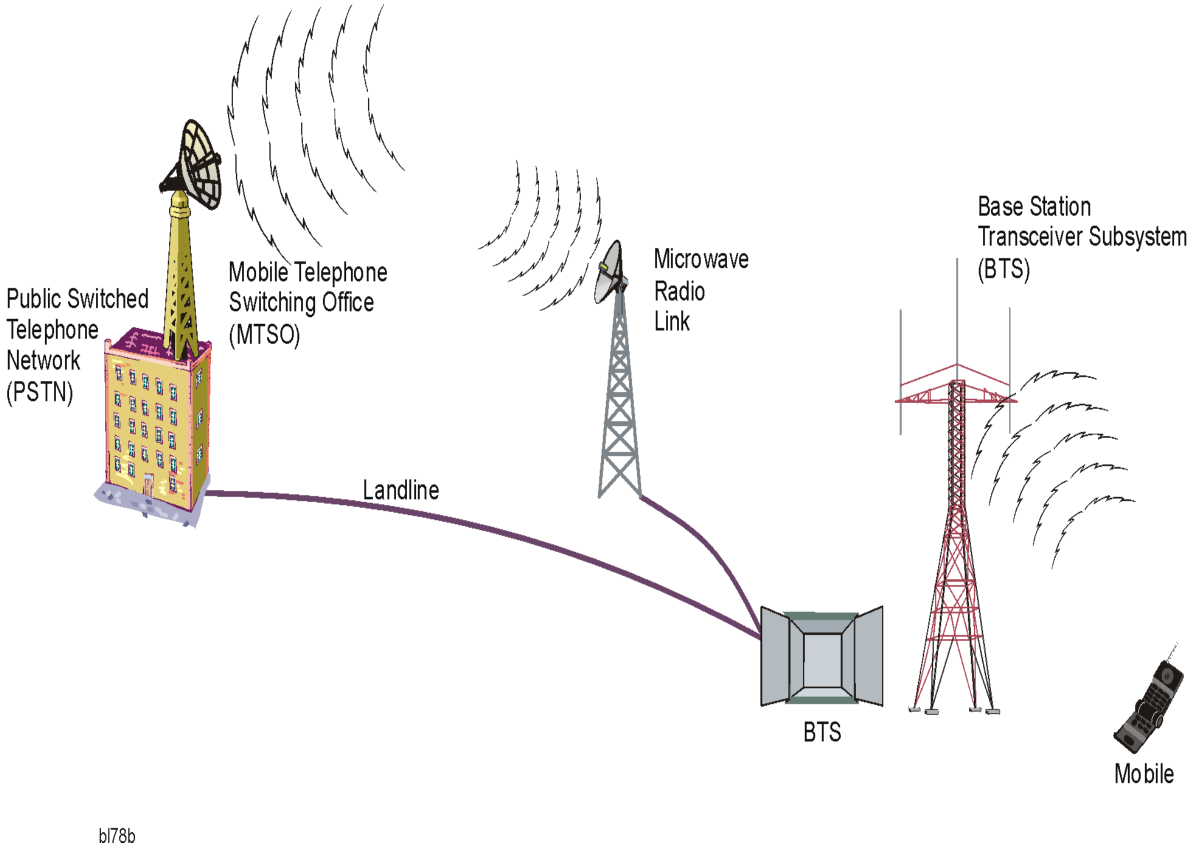
	P-GSM (GSM 900)	E-GSM (GSM 900)	R-GSM (GSM 900)	DCS 1800 (GSM 1800)	PCS 1900 (GSM 1900)	GSM 450	GSM 480	GSM 700	GSM 850
Uplink (MS Transmit)	890 to 915 MHz	880 to 915 MHz	876 to 915 MHz	1710 to 1785 MHz	1850 to 1910 MHz	450.4 to 457.6 MHz	478.8 to 486 MHz	777 to 792 MHz	824 to 849 MHz
Downlink (BTS Transmit)	935 to 960 MHz	925 to 960 MHz	921 to 960 MHz	1805 to 1880 MHz	1930 to 1990 MHz	460.4 to 467.6 MHz	488.8 to 496 MHz	747 to 762 MHz	869 to 894 MHz
Range (ARFCN)	1 to 124	0 to 124 and 975 to 1023	1 to 124 and 955 to 1023	512 to 885	512 to 810	259 to 293	306 to 340	438 to 511	128 to 251
TX/RX Spacing (Freq.)	45 MHz	45 MHz	45 MHz	95 MHz	80 MHz	45 MHz	45 MHz	30 MHz	45 MHz
TX/RX Spacing (Time)	3 timeslots	3 timeslots	3 timeslots	3 timeslots	3 timeslots	3 timeslots	3 timeslots	3 timeslots	3 timeslots
Modulation Data Rate GMSK (kbits/s) 8PSK (kbits/s):	270.833 812.499	270.833 812.499	270.833 812.499	270.833 812.499	270.833 812.499	270.833 812.499	270.833 812.499	270.833 812.499	270.833 812.499
Frame Period	4.615 ms	4.615 ms	4.615 ms	4.615 ms	4.615 ms	4.615 ms	4.615 ms	4.615 ms	4.615 ms

Table 5-2 EDGE and GSM Band Data

	P-GSM (GSM 900)	E-GSM (GSM 900)	R-GSM (GSM 900)	DCS 1800 (GSM 1800)	PCS 1900 (GSM 1900)	GSM 450	GSM 480	GSM 700	GSM 850
Timeslot Period	576.9 µs	576.9 µs	576.9 µs	576.9 µs	576.9 µs	576.9 µs	576.9 µs	576.9 µs	576.9 µs
GSM Bit and Symbol Period	3.692 µs	3.692 µs	3.692 µs	3.692 µs	3.692 µs	3.692 µs	3.692 µs	3.692 µs	3.692 µs
EDGE Symbol Period	3.692 µs	3.692 µs	3.692 µs	3.692 µs	3.692 µs	3.692 µs	3.692 µs	3.692 µs	3.692 µs
Modulation GSM EDGE	0.3 GMSK 3π/8 8PSK	0.3 GMSK 3π/8 8PSK	0.3 GMSK 3π/8 8PSK	0.3 GMSK 3π/8 8PSK	0.3 GMSK 3π/8 8PSK	0.3 GMSK 3π/8 8PSK	0.3 GMSK 3π/8 8PSK	0.3 GMSK 3π/8 8PSK	0.3 GMSK 3π/8 8PSK
Channel Spacing	200 kHz	200 kHz	200 kHz	200 kHz	200 kHz	200 kHz	200 kHz	200 kHz	200 kHz
TDMA Mux	8	8	8	8	8	8	8	8	8
Voice Coder Bit Rate	13 kbits/s	13 kbits/s, 5.6 kbits/s	13 kbits/s	13 kbits/s	13 kbits/s	13 kbits/s	13 kbits/s	13 kbits/s	13 kbits/s

Cellular Communications—Overview

Figure 5-1 Cellular Site Components



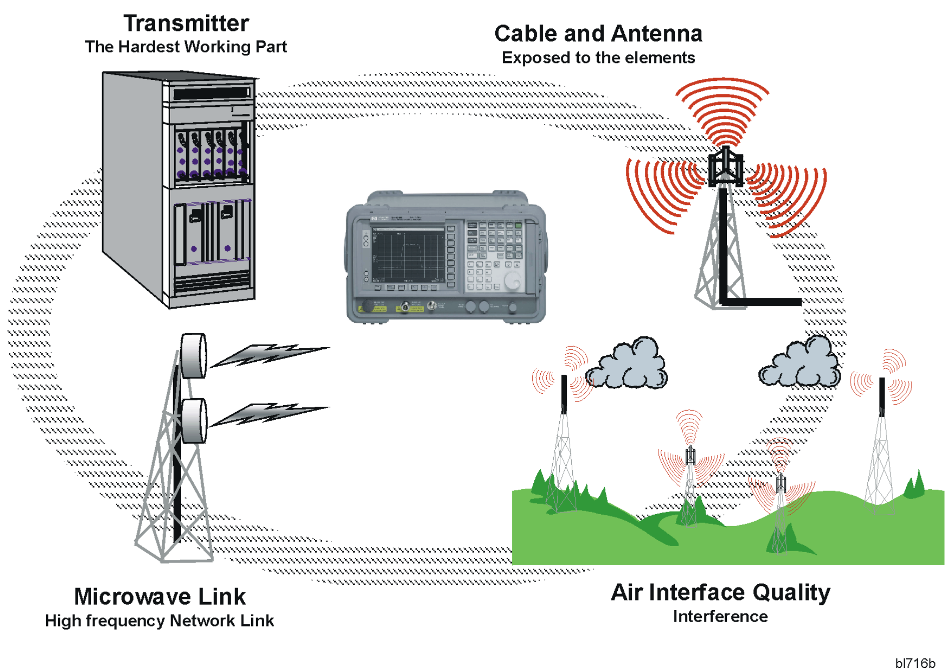
Wireless Digital communications systems are made up of five parts: a central phone switching system, a microwave or landline link, a base transceiver station (BTS), an antenna and preamplifier system, and the air interface with the mobile device shown in Figure 5-1. The ESA is designed to verify the satisfactory operation of the base station system which includes the microwave link, the base transceiver station, the antenna and preamplifier system, and the air interface with the mobile device. The measurements in this guide are divided into chapters according to the subsystems that each tests.

The Fault Finding Process

Four key elements, shown in Figure 5-2, can contribute to degraded cell performance:

- The **transmitter** is often described as the hardest working component of the cell site. Linear power amplifiers generate high power radio signals and run at high temperatures. Insufficient heat dissipation in humid climates can cause the transmitters to overheat, or extremes of cold can cause transmitter heat sinks to crack. As a result, specified performance will be degraded, causing low power transmissions, impaired modulation, and poor adjacent channel performance.
- Cables and antennae are directly exposed to the elements. Weather-damaged antennas, cables, and the connectors can further degrade performance. Sometimes a low noise amplifier close to the antenna is used to boost the signal or microwave radio transceivers are used to link the cell site to the communications network. These components are just as exposed to the same harsh environmental conditions making them prone to failure.
- When a mobile site transmits, other radio systems can interfere with the propagated signal resulting in a degraded signal at the cell site receiver. On the journey, **interference** from other radio systems can degrade the signal. Tall buildings and hills can deflect the signal away from the antenna and signal degradation can result.

Figure 5-2 **Sources Of System Degradation**

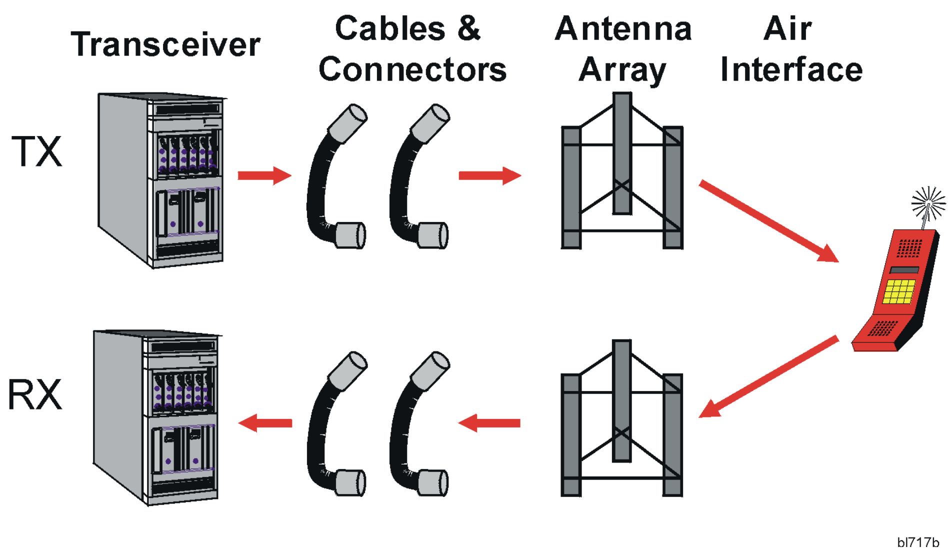


To help identify which component of the cell site is contributing to performance problems, a fault finding process is needed. Essentially, once the radio signal is modulated and transmitted, it is prone to degradation. The once perfect, error corrected, monitored digital signal, now has all the characteristics of any analog radio signal. What you want to do is ensure its transmission path is clear and presents no barriers that will hinder its performance. Starting at the transmitter, as indicated in Figure 5-3, you need to check that the correct signal is being generated.

You then need to ensure that it passes through the various cables and connectors without degrading its quality. Once transmitted through the antenna, a clear interference free radio band is required to ensure the handset receives the signal correctly. Then in reverse, you need to verify the reception band is clear and the path from the antenna to the receiver presents no obstacles to the radio receiver equipment, which will decode the signal and convert it back into digital data.

When troubleshooting, you need to ask yourself a set of basic questions. The first thing to question is the transmitter operation where the signal originates. If this is operating satisfactorily, then you need to determine that intermediate components are not attenuating the signal. Finally, you need to ensure that maximum power is being transferred into the antenna feed and array. On the receive side, you again need to ensure that maximum power is being transferred from the antenna to the BTS. You also need to ensure that intermediate components do not over-attenuate the received signal.

Figure 5-3 Fault Finding Process



Use Table 5-3 to help determine which measurement to perform when troubleshooting your cell site base transceiver system.

Table 5-3 Troubleshooting Your Cell Site Base Transceiver System

System Component	Fault Symptom	Related Measurements	Analyzer Mode
BTS	Power Levels	Transmitter power Power vs time	GSM or GSM (w/EDGE)
	Modulation Quality	Phase and frequency error	
	Interference with other systems	Output RF spectrum (ORFS) Power Steps	
Air Interface	In-channel interference	Transmitter power Monitor band/channel	GSM or GSM (w/EDGE)
	In-band interference	Monitor band/channel Transmit band spurious Receive band spurious	
	Out of band interference	Out of band spurious	
Cables and Antenna	Amplitude flatness	Loss/gain (manual measurement)	Spectrum Analysis
	Reflection Responses	Return loss (VSWR) (manual measurement)	
	Cable defect	Cable fault location	GSM or GSM (w/EDGE)

Identifying Interfering Signals

To identify interfering signals, you must first locate them in the GSM frequency band. This is best done by using the Monitor Band measurement. Sensitivity should be optimized to locate and view small interfering signals.

To optimize the spectrum analyzer for best sensitivity when identifying interference signals, three main parameters need to be understood: resolution bandwidth, internal attenuation, and internal pre-amplification:

- Resolution bandwidth: Choose the lowest possible resolution bandwidth filter. The noise floor decreases as resolution bandwidth decreases. This is because noise is a broadband signal, and as you reduce resolution bandwidth, less noise reaches the detector. Sweep speed is inversely proportional to the square of the resolution bandwidth and increases as resolution bandwidth decreases. To optimize speed, the smallest span and largest bandwidth possible should be used that still separates the signals and allows visibility of all signals of interest. Using monitor channel reduces the span by focusing on a specific channel instead of an entire band.
- Attenuation: Set the internal input attenuator to the least possible amount of attenuation, normally 0 dB. However, if the input signal total power is greater than –10 dBm for 0 dB attenuation, the analyzer may generate internal distortion. To determine if the analyzer is internally generating the distorted signals seen on the display, increase the attenuation and see if the displayed signals change in amplitude. If no amplitude change is evident, the distortion is caused by the unit under test and not the analyzer.
- Noise floor: Turn on the internal preamplifier (Option 1DS). This will drop the noise floor and allow you to view the signals that were previously below the analyzer noise floor.

Use the procedure shown in the Table on page 404 and the following examples of interfering signals to help you identify the source of interfering signals and achieve the best sensitivity.

Key Press Procedure			Remarks
Step	**Front-Panel Key**	**Menu Key**	
1	**Measure**	**More**	The **Monitor Band** function is used to identify low-level signals that may be interfering in the up- and down-link bands. The sensitivity of this measurement is improved by reducing the resolution bandwidth and removing the analyzer attenuation through **Meas Setup**.
2		**Monitor Band/Channel**	
3	**Meas Setup**	**Method Band**	
4		**Band Setup**	
5		**Res BW Man**	As the resolution bandwidth gets smaller, the sweep time gets longer.
6	⇓ (Down Arrow)		
7	**Input/Output**	**RF Input Range Man**	
8	**AMPLITUDE Y Scale**	**Attenuation**	To achieve 0 dB attenuation, you must enter the value using the numeric key pad. This is a safe guard against inadvertent front-end overload.
9	⇓ (Down Arrow)		
10	**Peak Search**		The marker is used to determine the frequency of the suspected interference signal.
11	**FREQUENCY Channel**	**Channel Freq** and enter the marker frequency.	
12	**Meas Setup**	**Method Channel**	The spectrum shape of the suspect signal can now be seen.
13	**Input/Output**	**Int Preamp On**	For very low level signals, use the built-in preamplifier to amplify the input so that the signals appear above the noise floor of the spectrum analyzer.

CAUTION Use a simple attenuator test to determine whether displayed distortion components are true input signals or internally generated signals caused by mixer overload. Press **AMPLITUDE**, **Attenuation**, and ⇑ to increase the attenuation. If the amplitude of the suspected signal changes, then it is internally generated. Continue increasing the attenuation until the displayed distortion does not change, then complete the measurement.

Examples of Interference Signals

Use these signal examples to help assess the bandwidth and spectral shape of the interfering signal to determine the type of transmission causing the interference. Best sensitivity is achieved using narrow resolution bandwidths and minimum attenuation with the built-in preamplifier Option 1DS. The resolution bandwidth used must be larger than the signal bandwidth to display the amplitude accurately. As the resolution bandwidth decreases, the amplitude of the broadband signal decreases. Use the settings in the following examples to identify the various signals.

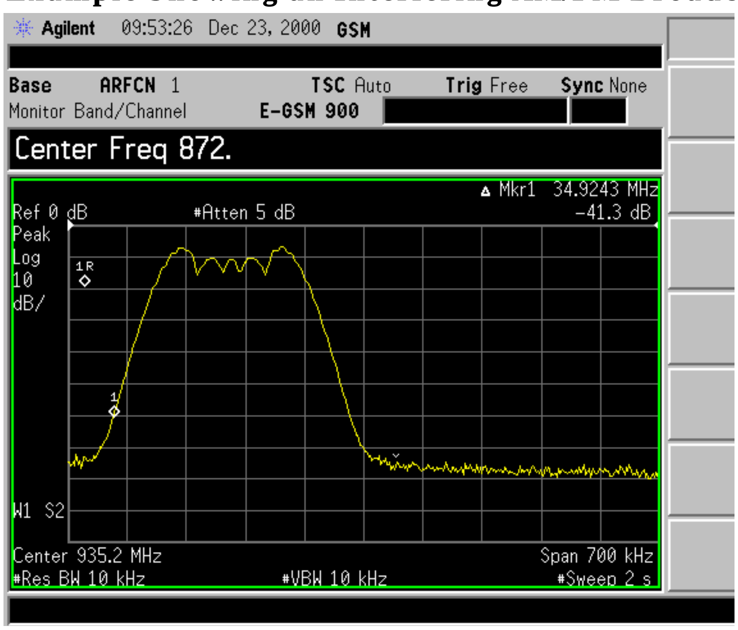
Using Monitor Band/Channel to Look for Interfering Signals

Using Monitor Band and Channel feature can help you quickly identify interfering signals within your transmission and reception bands or channels. Simple visual inspection, peak hold, and markers can help to determine the type of interference that may be causing network problems.

Commercial AM/FM Broadcast Signal

Press **MEASURE**, **More**, **Monitor Band/Channel**, **Meas Setup**, **Method Channel**

Figure 5-4 Example Showing an Interfering AM/FM Broadcast Signal

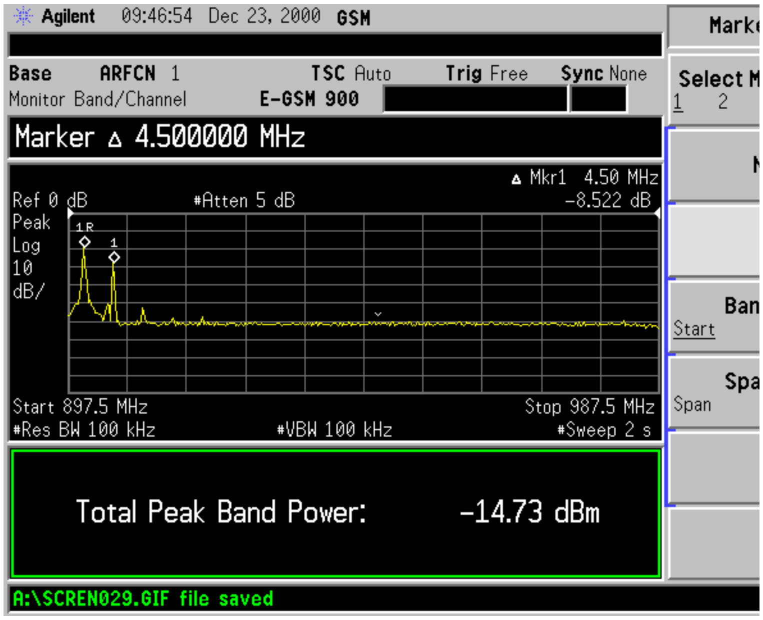


A narrow bandwidth signal within a channel, as shown in Figure 5-4, could be caused by AM/FM channels. In Spectrum Analysis mode use the built-in AM or optional FM (Option BAA) demod to determine the source of the transmission.

Commercial TV Broadcast Signal

Press **MEASURE**, **More**, **Monitor Band/Channel**, **Meas Setup**, **Method Band**

Figure 5-5 **Example**



Screen Showing an Interfering TV Broadcast Signal

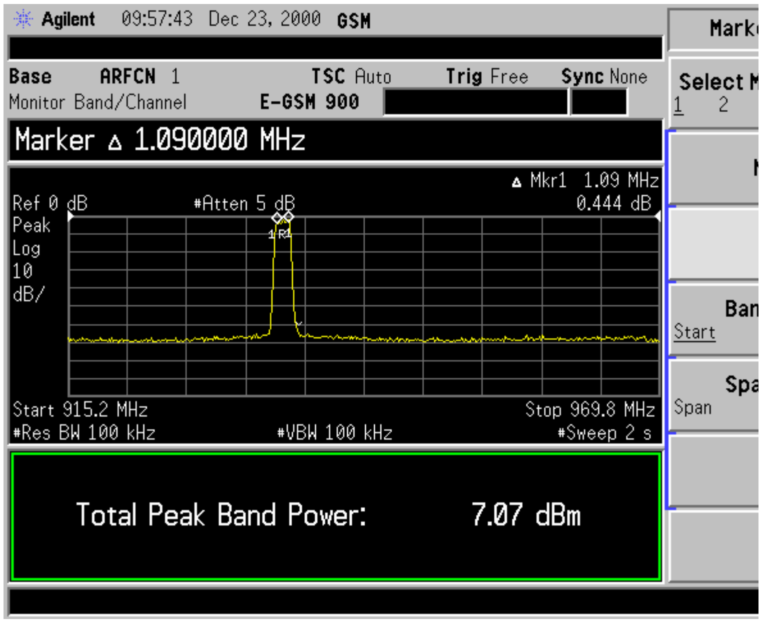
An interfering TV signal, as shown in Figure 5-5, can quickly be visually verified by its unique spectral characteristics (two large carriers 4 to 6 MHz apart). In Spectrum Analysis mode, use TV Trigger and Picture on Screen, and FM Demodulation (Options BAA and B7B) to determine the transmission source.

Concepts

GSM Signals

Press **MEASURE**, **More**, **Monitor Band/Channel**, **Meas Setup**, **Method Band**

Figure 5-6 Example Screen Showing Interfering GSM Signals



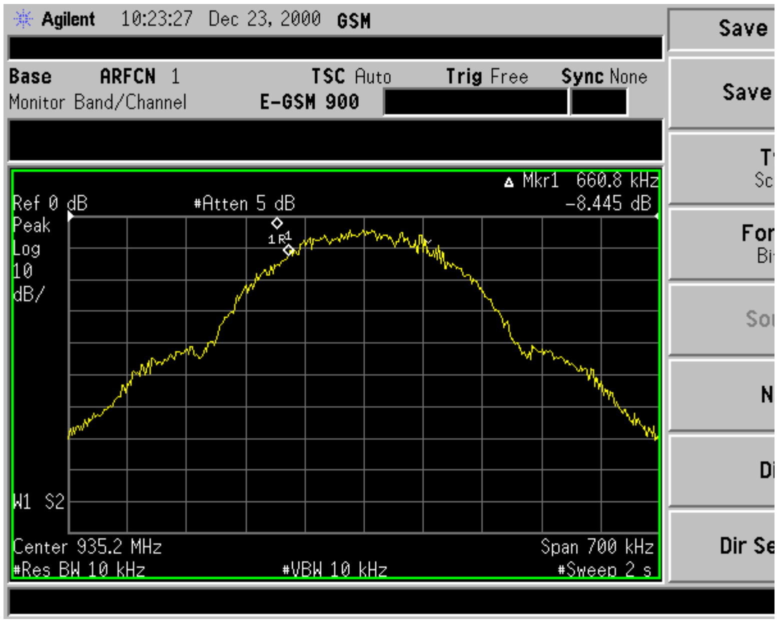
Adjacent interfering GSM signals will have the type of spectral characteristic shown in Figure 5-6.

Concepts

GSM/PCS Signal

Press **MEASURE**, **More**, **Monitor Band/Channel**, **Meas Setup**, **Method Channel**, **More**, **Chan Setup**, **Max Hold On**

Figure 5-7 Example Screen Showing an Interfering GSM/PCS Signal



GSM/PCS networks can cause in-band interference. A GSM signal will have the type of spectral characteristic shown in Figure 5-7.

GMSK Output RF Spectrum (ORFS) Measurement

Purpose

The Output RF Spectrum measurement is GSM's version of adjacent channel power (ACP). Either a single offset is measured with the corresponding trace visible or multiple (up to 15) offsets are measured and a table is displayed. It is also possible to measure output RF spectrum as a swept measurement.

The output RF spectrum measurements determine the spectral energy emitted into the adjacent channels. Since GSM is a TDMA format, RF power is being switched on and off depending on whether the actual burst is being transmitted. The switching of power causes spectral splatter at frequencies other than that being transmitted by the carrier. Fast transitions in the time domain causes switching transients that have high frequency content associated with them.

Excessive amounts of energy spilling into an adjacent frequency channel could interfere with signals being transmitted to other MS or BTS. The measurements are divided into two main groups: spectrum due to the 0.3 GMSK modulation and noise, and spectrum due to switching transients (burst ramping).

NOTE The default output RF spectrum measurements do not perform tests at frequency offsets greater than 1800 kHz from the carrier.

Measurement Method

In this measurement, the transmitter (source) is set to transmit a GSM frame at a given channel (frequency). The instrument acquires a time record at a particular offset from the channel being transmitted. When the offset is zero, the instrument is said to be measuring the carrier. For a given offset frequency from the carrier, the transmitter must not exceed a certain power level relative to the carrier. The GSM specification defines the offsets and their maximum absolute and relative power levels.

The general steps in making the measurement are as follows:

1. Acquire time record.
2. Measure power of the carrier.
3. Synchronize for gating on the carrier - finds 50% and 90% portion of burst for Spectrum Due to Modulation portion of the test
4. Compare each offset power to reference to get relative power level.

The output RF spectrum measurement consists of the following two measurements:

- Output RF spectrum due to modulation.
  For this measurement the average value during at least 40 bits between bit 87 and 132 (approximately equivalent to the 50% to 90% portion of the burst, excluding midamble) is retained. The vertical lines mark the section of the burst over which the measurement is made. If multiple bursts are examined, an average of the average values is calculated. The relative power (difference between the average power of the burst at zero offset and the average power of the burst at the indicated offset) and the absolute power are displayed.
- Output RF spectrum due to switching transients.
  For this measurement the peak value of the burst is retained. If multiple bursts are examined, then the maximum of the peak values is retained. The relative power (difference between the peak power of the burst at zero offset and the peak power of the burst at the indicated offset) and the absolute power are displayed.

The GSM standard specifies the tests are run on specified offsets from the carrier. The instrument identifies this as single offset, multiple offset or swept modes. The measurement made in these modes is the same, except for the following:

- Multiple offset mode automatically makes the measurement at all the specified offset frequencies and lists the results in a table at the end of the measurement.
- Swept mode makes the measurement in the frequency domain and shows the GSM burst relative to the limits mask.

Results

Figure 5-8 Output RF Spectrum (ORFS) Due To Modulation: Single Offset Measurement

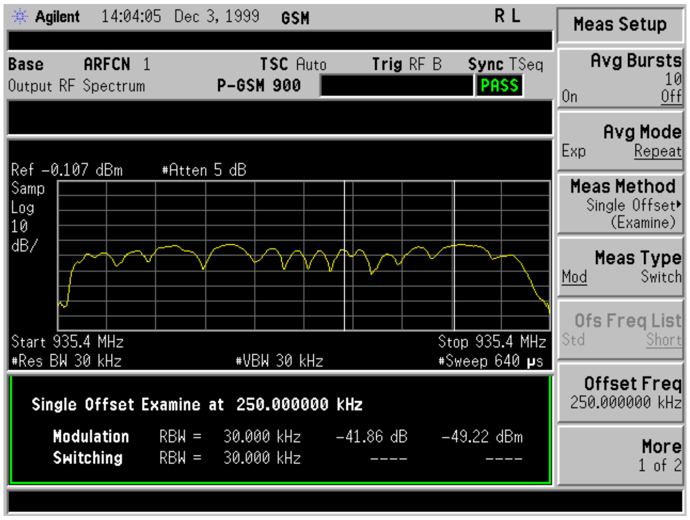


Figure 5-8 shows a single offset trace taken during an ORFS due to modulation measurement. The vertical bars show the portion used to measure power due to modulation. If averaging is turned on, the trace is averaged with previous traces using video averaging. The displayed value is the average of points within the vertical bars.

Figure 5-9 Output RF Spectrum (ORFS) Due To Modulation: Multiple Offset Measurement

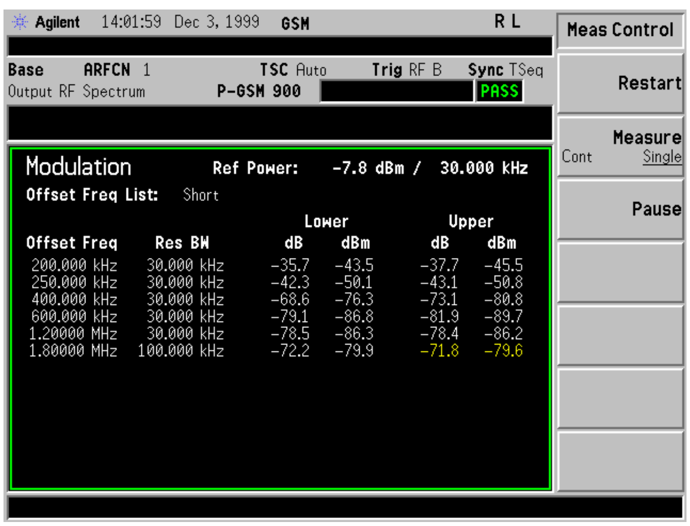


Figure 5-9 shows offset measurements taken during an ORFS due to modulation (multiple offset) measurement.

Figure 5-10 Output RF Spectrum (ORFS) Due To Modulation: Swept Measurement

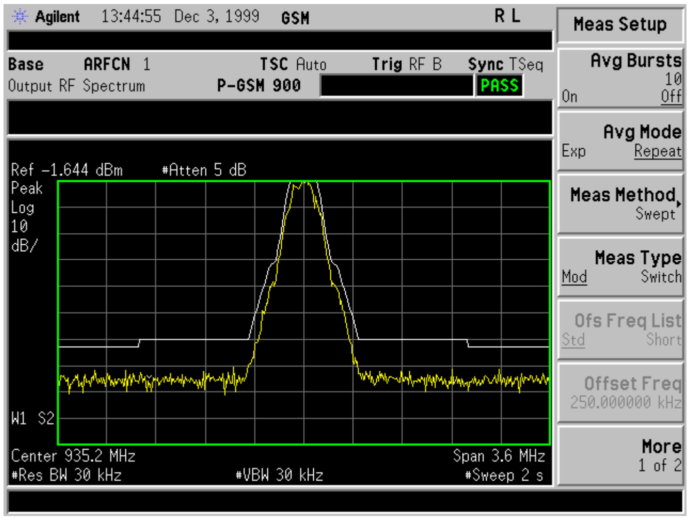


Figure 5-10 shows a swept trace taken during an ORFS due to modulation measurement. If averaging is turned on, the display is averaged over successive sweeps until the required number of sweeps has been reached. It then starts again with a fresh display.

Figure 5-11 Output RF Spectrum (ORFS) Due To Switching Transients: Single Offset Measurement

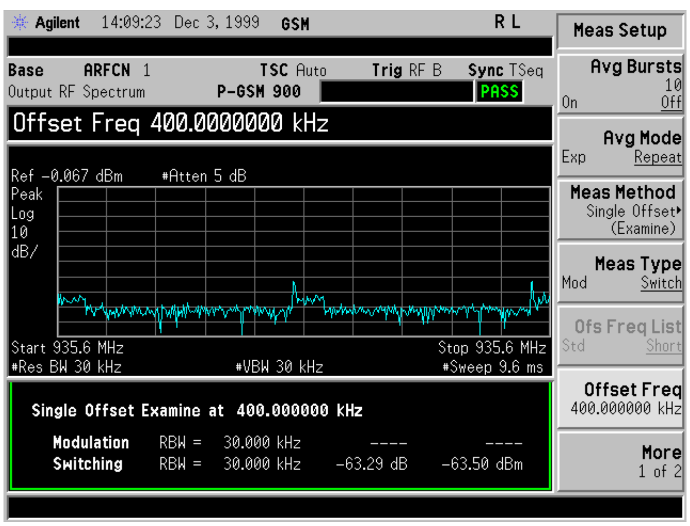


Figure 5-11 shows a single offset trace taken during an ORFS due to switching transients measurement. If averaging is turned on, the trace is averaged with previous traces. The peak of the traces is used. The displayed value is the maximum of all points for all traces (Max or Peak) over the entire frame.

Figure 5-12 **Output RF Spectrum (ORFS) Due To Switching Transients: Multiple Offset Measurement**

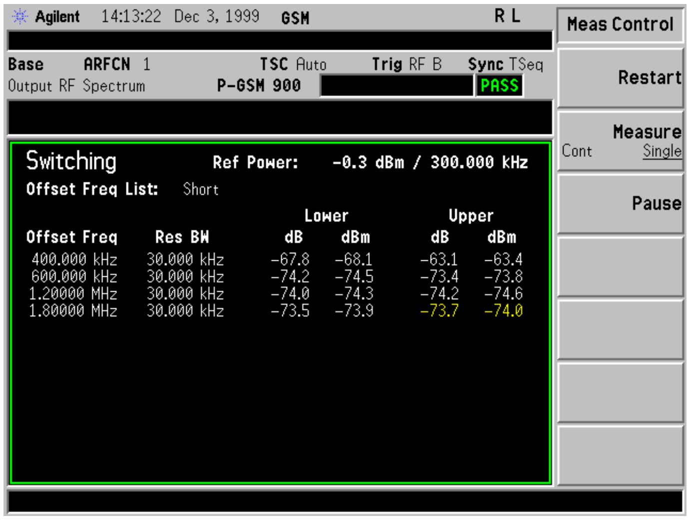


Figure 5-12 shows a table of multiple offset measurements taken during an ORFS due to switching transients measurement.

Figure 5-13 **Output RF Spectrum (ORFS) Due To Switching Transients: Swept Measurement**

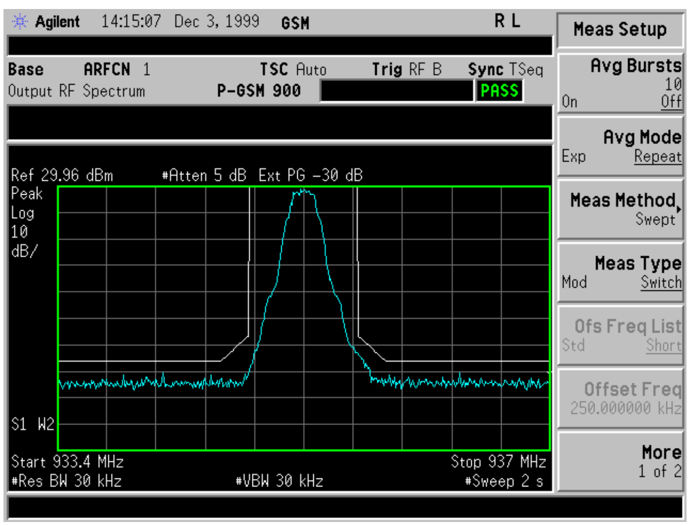


Figure 5-13 shows a trace of a swept measurement taken during an ORFS due to switching transients measurement. If averaging is turned on, the display is averaged over successive sweeps until the required number of sweeps has been reached. It then starts again with a fresh display.

GMSK Phase and Frequency Error Measurement

Purpose

Phase and frequency error measures the modulation quality of GSM systems. Since GSM systems use relative phase to transmit information, phase and frequency accuracy of the GSM transmitter is critical to the system's performance and ultimately affects range.

GSM receivers rely on the phase and frequency quality of the 0.3 GMSK signal in order to achieve the expected carrier to noise performance. A transmitter with high phase and frequency error can often still support phone calls during a functional test. However, it will tend to provide difficulty for mobiles trying to maintain service at the edges of the cell, with low signal levels or under difficult fading and Doppler conditions.

Measurement Method

The phase error of the test signal is measured by computing the difference between the phase of the transmitted signal and the phase of a theoretically perfect signal.

The instrument samples the transmitter output in order to capture the actual phase trajectory. This is then demodulated and the ideal phase trajectory is mathematically derived. Subtracting one from the other results in an error signal.

There are two ways of showing the measurement results. The I/Q Quad View (Figure 5-14) displays the numeric results and three graphical displays of the same data - Phase Error, Phase Error with Frequency and RF Envelope. The I/Q Measured View (Figure 5-15) displays the numeric results and a graphical display of the I/Q Measured Polar Vector.

Results

Figure 5-14 Phase and Frequency Error Result - I/Q Quad view

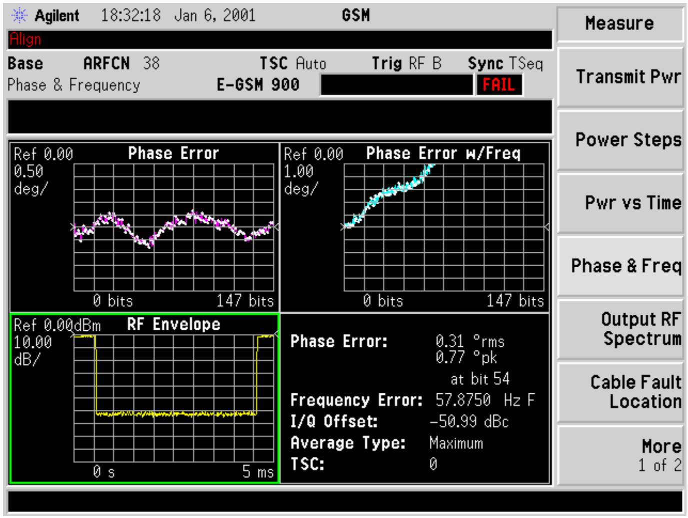
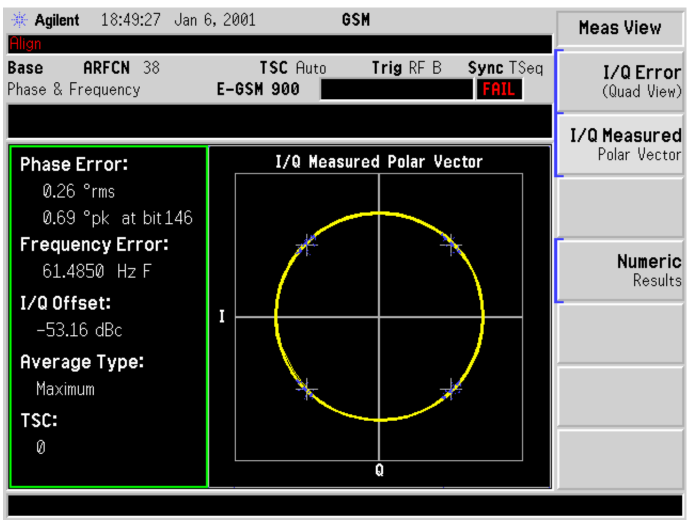


Figure 5-15 Phase and Frequency Error Result - I/Q Measured view



Concepts

GMSK Power Versus Time Measurement

Purpose

Power versus Time measures the mean transmit power during the “useful part” of GSM bursts and verifies that the bursts fit within the defined mask. This can be used to test that other adjacent timeslots are not experiencing interference. Power vs Time also lets you view more than one burst at a time up to an entire frame.

Measurement Method

The Power vs Time measurement provides masks for both BTS (Base Transceiver Station) and MS (mobile station). The timings are referenced to the transition from bit 13 to bit 14 of the midamble training sequence. The 0 dB reference is determined by measuring the mean transmitted power during the “useful part” of the burst. You can also define a user configurable limit mask to apply to the measured burst.

The GSM specification defines the “useful part” of the normal GSM burst as being the 147 bits centered on the transition from bit 13 to bit 14 of the midamble (the “T0” time point).

The instrument acquires a GSM signal in the time domain. The “T0” point and the useful part are computed. If Burst Sync is set to **Training Seq**, a GSM demodulation is performed to find “T0”. If Burst Sync is set to **RF Amptd**, an approximation of “T0” will be used without performing a demodulation. The average power in the useful part is then computed and displayed, and the GSM limit mask is applied. The measurement displays Pass when the burst fits within the bounds of the mask.

Results

Figure 5-16 Power versus Time Measurement Result - Mask View

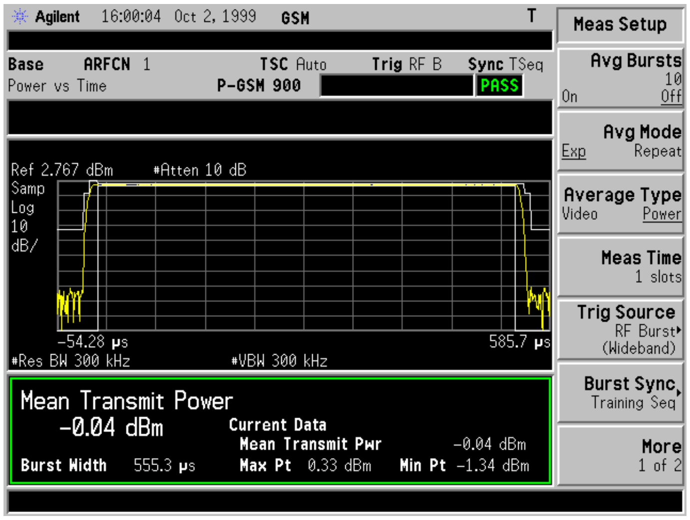
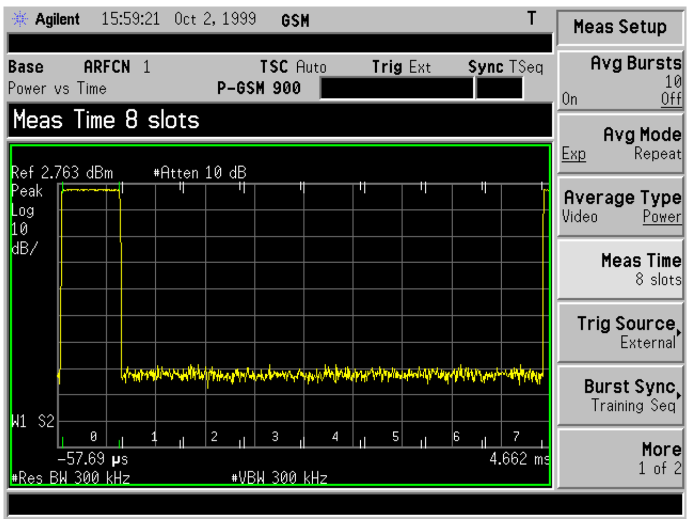


Figure 5-17 Power versus Time Measurement Result - Monitor View



Concepts

Power Steps Measurement

Purpose

The power steps measurement uses long sweep times to display the different power steps resulting from adaptive control. It measures the dynamics of the power step changes. Use the more accurate mean carrier power measurement to make power measurements on carriers with a static power level. The power steps measurement checks the maximum power of all 8 timeslots.

SFH mode is available for this measurement.

An external frame trigger is not required for this measurement

Measurement Method

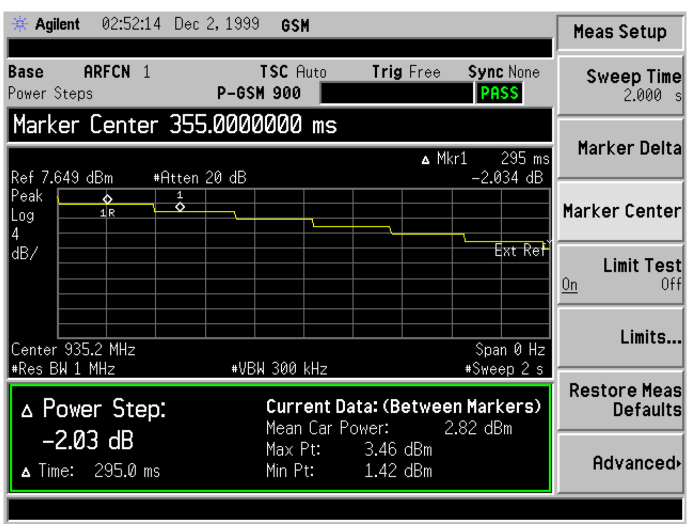
Markers are placed on the trace and the marker mode set to delta. The marker delta readings give the difference in amplitude and time between the power levels of the markers.

Averaging is not enabled for the power steps measurement—it is not appropriate due to the long sweep time and manual power steppings.

Results

An example screen from a Power Steps measurement is shown below in Figure 5-18

Figure 5-18 Power Steps Measurement



Concepts

Transmitter Power Measurement

Purpose

Transmitter Power is the measure of in-channel power for GSM systems. Mobile stations and base transceiver stations must transmit enough power, with sufficient modulation accuracy, to maintain a call of acceptable quality without leaking into frequency channels or timeslots allocated for others. GSM systems use dynamic power control to ensure that each link is maintained with minimum power. This gives two fundamental benefits: overall system interference is kept to a minimum and, in the case of mobile stations, battery life is maximized.

The Transmitter Power measurement determines the average power for a RF signal burst at or above a specified threshold value. The threshold value may be absolute, or relative to the peak value of the signal.

At the base transceiver station, the purpose of the Transmitter Power measurement is to determine the power delivered to the antenna system on the radio-frequency channel under test. The Transmitter Power measurement verifies the accuracy of the mean transmitted RF carrier power. This can be done across the frequency range and at each power step.

Measurement Method

The instrument acquires a GSM signal in the time domain. The average power level above the threshold is then computed and displayed. This measurement uses the “power-above-threshold” method instead of the “useful part of the burst” method defined in the GSM standards. The measured Transmitter Carrier Power will be very nearly the same for these two methods. The power-above-threshold method has the advantages of being faster and allows power measurements to be made at somewhat lower power levels. It also has the advantage of not requiring the carrier to have a valid TSC (Training Sequence Code).

Note that this measurement does not provide a way to specify which timeslot is to be measured. Therefore if multiple timeslots are on, they should all be set at the same power level, or the levels of those timeslots to be excluded need to be kept below the threshold level. If you want to measure Transmitter Carrier Power using the GSM specified useful part of the burst method, use the Power vs Time measurement, which also measures the power ramping of the burst.

Results

Figure 5-19 Transmitter Power Result - Single Burst

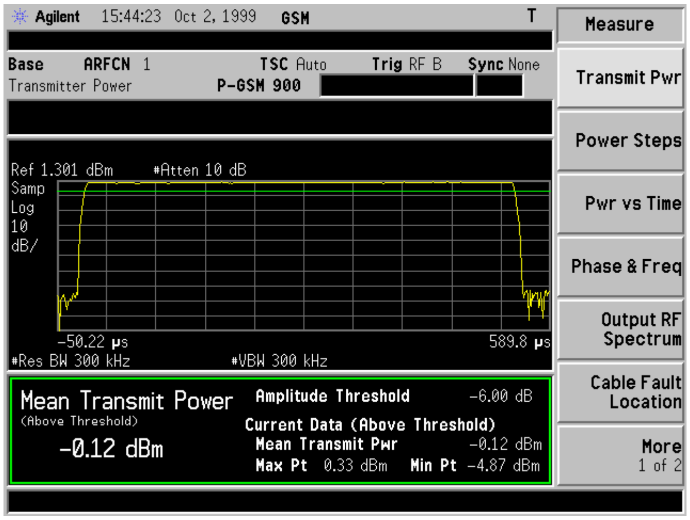
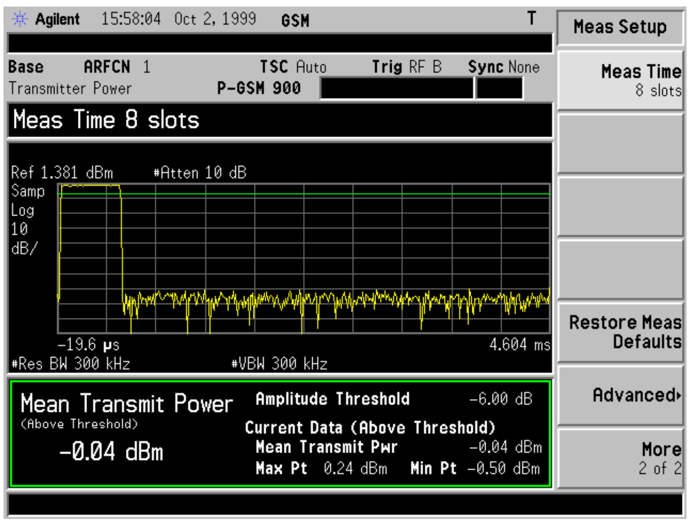


Figure 5-20 Transmitter Power Result - Multiple Bursts



Concepts

Monitor Band/Channel Measurement

Purpose

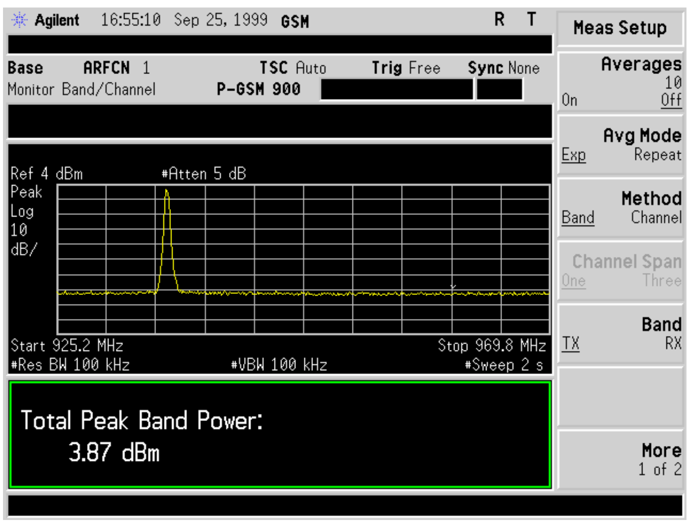
This measurement verifies the GSM band and channels are free of interference by measuring the spurious signals in the bands and channels specified by the selected standard and tuning plan.

Measurement Method

This procedure scans the specified band or channels and by placing markers on the trace it is possible to check the band/channels for interference. A Max Hold function enables monitoring over time. This is useful when the interference is intermittent.

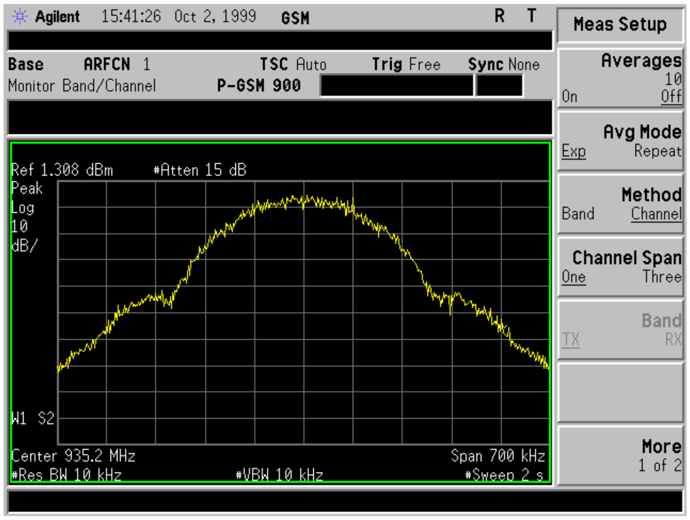
Results

Figure 5-21 Monitor Band/Channel Measurement Results—Band Method



Concepts

Figure 5-22 Monitor Band/Channel Measurement Results—Channel Method



Out-of-Band Spurious Measurement

Purpose

This measurement verifies the operation of the transmitter by measuring the spurious signals created outside of the transmitter band specified by the selected standard and tuning plan.

Measurement Method

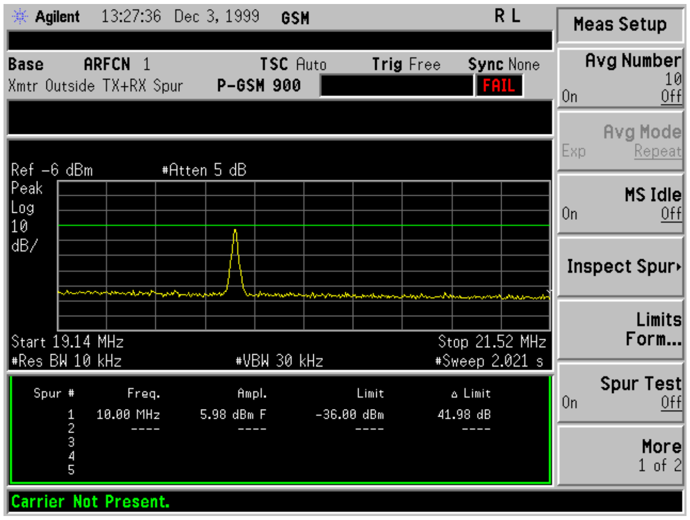
This out-of-band spurious measurement first measures the channel power as defined by the selected standard and tuning plan. Then out of band frequencies are scanned and spurious responses are measured in accordance with the standards documents. If a carrier is not present, the measurement runs and the message “Carrier Not Present” is displayed.

Although the standards documents specify that frequencies up to 12.75 GHz are scanned, not all ESA models are equipped to measure at these frequencies. In such cases, frequencies up to the maximum range of the analyzer are used.

NOTE Care needs to be taken if you are making measurements with a carrier power close to or above 30 dBm. We recommend that you use a fixed attenuator and a 1 dB step attenuator and use the step attenuator to optimize the noise floor to the limit line margin.

Results

Figure 5-23 Out-of-Band Spurious Measurement Results



NOTE Results are shown in tabular format beneath the trace. To view this section of the window in its entirety, press the **Next Window** menu key until it is highlighted, then press the **Zoom** menu key.

Concepts

Transmitter Receive (Rx) Band Spurious Measurement

Purpose

The receive band spurious measurement checks a transmitter's receive band for conformance to the ETSI specification:

Table 5-4 ETSI Specification: Maximum Permissible Measured Power (dB)

	GSM 450	GSM 480	GSM 850	P-GSM 900	E-GSM 900	R-GSM 900	DCS 1800	PCS 1900
MS	-67.0	-67.0	-79.0	–79.0	–67.0	–60.0	–71.0	–71.0
BTS	–98.0	–98.0	–98.0	–98.0	–98.0	–89.0	–98.0	–98.0
BTS M1	-91.0	-91.0	-91.0	–91.0	–91.0	–91.0	–96.0	–96.0
BTS M2	–86.0	–86.0	–86.0	–86.0	–86.0	–86.0	–91.0	–91.0
BTS M3	-70.0	-70.0	-70.0	–81.0	–81.0	–81.0	–86.0	–86.0
PBTS M1	–70.0	–70.0	–70.0	–70.0	–70.0	–70.0	–80.0	–80.0

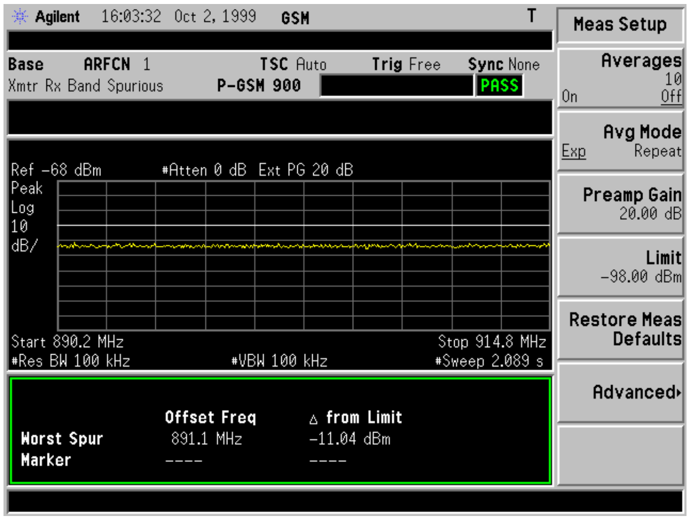
NOTE For MS mode, the limits for E-GSM900 and R-GSM900 apply only to the part of the limit that does not overlap with other bands. The P-GSM900 limit takes priority for the upper portion followed by E-GSM900 and then R-GSM900, if appropriate. This means that up to three limits may be in force at once in MS mode.

Measurement Method

The measurement sweeps in the receive band of the current device and checks the trace for any spurs which exceed the maximum permissible transmitter power (shown above in Table 5-4).

Results

Figure 5-24 Transmitter Rx Band Spurious Measurement Results



Transmitter Transmit (Tx) Band Spurious Measurement

Purpose

The transmit band spurious measurement checks a transmitter's transmit band for conformance to the ETSI specification: (see Table 4-3 below).

Table 5-5 ETSI Specification: Maximum Permissible Measured Power (dBm)

	GSM 450	GSM 480	GSM 850	P-GSM 900	E-GSM 900	R-GSM 900	DCS 1800	PCS 1900
MS (idle)	–57.0	–57.0	–57.0	–59.0	–59.0	–59.0	–53.0	–53.0
MS (active)	–36.0	–36.0	–36.0	–36.0	–36.0	–42.0	–36.0	36.0
BTS	–36.0	–36.0	–36.0	–36.0	–36.0	–36.0	–36.0	36.0

NOTE Although the Idle Mode parameter has no effect when testing in BTS mode, the parameter should always be set to the relevant setting (Idle Mode = ON or OFF) so that the measurement knows which limit to use.

Measurement Method

The measurement splits the transmit band into four segments (or less if the currently selected ARFCN is at the edge of the band) and allocates analyzer parameters for each segment.

Two measurement modes are provided:

- Full: Each segment is swept and the peak trace point amplitude and frequency stored. The maximum of these peaks is taken as the worst spur and checked against a user definable limit parameter to see whether or not the spur fails the test.
- Examine: A single full measurement is performed, the measurement then parking on the segment containing the worst spur.

NOTE If the measurement is set to sweep mode single, or if the measurement mode is examine, you can examine each segment individually using the View menu keys.

Concepts

Making the Measurement

1. Press the **Measure** key.
2. Press the **Tx Band Spur** key.

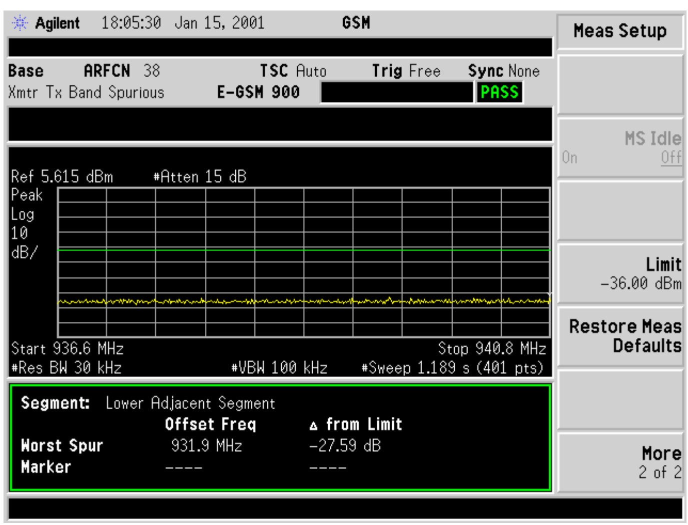
Factory default parameter settings provide a GSM compliant measurement. For special requirements, you may need to change default settings:

- Mode setup and frequency/channel parameters.
  Use the **Mode Setup** and **Frequency Channel** keys to change these parameters for all measurements made within the current mode. For further information refer to Chapter 1 of this document.
- Measurement setup parameters.
  These are measurement specific parameters changed using the Measurement setup (**Meas Setup**) menu. Parameters can be returned to default settings at any time by pressing **Meas Setup** and **Restore Meas Defaults**.

NOTE Parameters that exist under the **Meas Setup Advanced** key seldom need to be changed. Any changes from the default values may result in invalid measurement data.

Results

Figure 5-25 Transmitter Tx Band Spurious Measurement Results



Cable Fault Location Measurements

Purpose

A cable fault location measurement displays the reflected signal of a transmission line as a function of the distance down the line. This complements the return loss measurement described in the next section: if a cable under test fails a return loss measurement, a cable fault location measurement can be used to identify the location of the fault. The measurement is particularly useful when a base station and antenna are connected by a long length of cable.

Trace Points

Changing the number of trace points in the cable fault affects the minimum and maximum measurable distances. As a general rule, the longer the cable, the more trace points you should use. Up to 8192 trace points can be used but due to the computationally intensive FFT, the measurement becomes slower as the number of points used increases. To ensure the fastest possible measurement speed, always use a number of trace points equal to the power of 2—for example 512 or 1024.

FFT Windowing Function

The cable fault location measurement uses an FFT to convert the analyzer frequency trace into a distance trace. To get the best results from the FFT you must apply the most suitable windowing function to the frequency trace before performing the FFT. The following table describes the windowing functions available:

Table 5-6 Windowing Functions Available for the Cable Fault Location Measurement

Function	Description	Max side-lobe level (dB)	Side-lobe roll off (dB/decade)	Max main (dB)
Rectangular	The function results in no windowing.	–13.261	20 dB	–3.9224
Flat Top	The default value. A five term flat top window. A good window to use when making amplitude measurements of relatively pure tones.	–95.1		+/– 0.0020

Concepts

Table 5-6 Windowing Functions Available for the Cable Fault Location Measurement

Function	Description	Max side-lobe level (dB)	Side-lobe roll off (dB/decade)	Max main (dB)
Gaussian	A five term cosine window which resembles a Gaussian window.	–125.4		–0.680056
Hanning	A window which has good frequency resolution and reasonably good side lobe-lobe roll-off, but poor main-lobe flatness and relatively large side-lobe peaks.	–31.46730784	60	–1.423622

Concepts

Return Loss Measurements

NOTE The return loss (VSWR) measurement is not a “one button” measurement. All steps required to make one is fully detailed in the chapter on making measurements.

Purpose

Some of the energy incident upon a device can be reflected back towards the source. A return loss measurement quantifies this reflected energy. Return loss is used to determine the health of an antenna system and its associated cabling by measuring the amount of transmitted power reflected back from the antenna system and therefore not passed over the air interface to the mobile user.

Cables and antennae are often subjected to harsh weather conditions resulting in a performance which deteriorates over time, leading to an eventual failure. By monitoring return loss over time, cable and antennae performance can be monitored and preventive action taken when required.

Loss/Gain Measurements

NOTE The loss/gain measurement is not a “one button” measurement. All steps required to make one is fully detailed in the chapter on making measurements.

Purpose

Loss/gain measurements are used to verify the performance of devices or components as illustrated by the following examples:

- A loss measurement can be used to test the performance of a base station’s cables. Lower than expected base station power measurements could be caused by faulty cables. A cable’s role in the problem can be determined by measuring the loss of the cable and comparing the result to the expected value.
- A gain measurement can be used to test the performance of an amplifier. A lower than expected gain measurement could indicate a fault with the amplifier.

6 Menu Maps

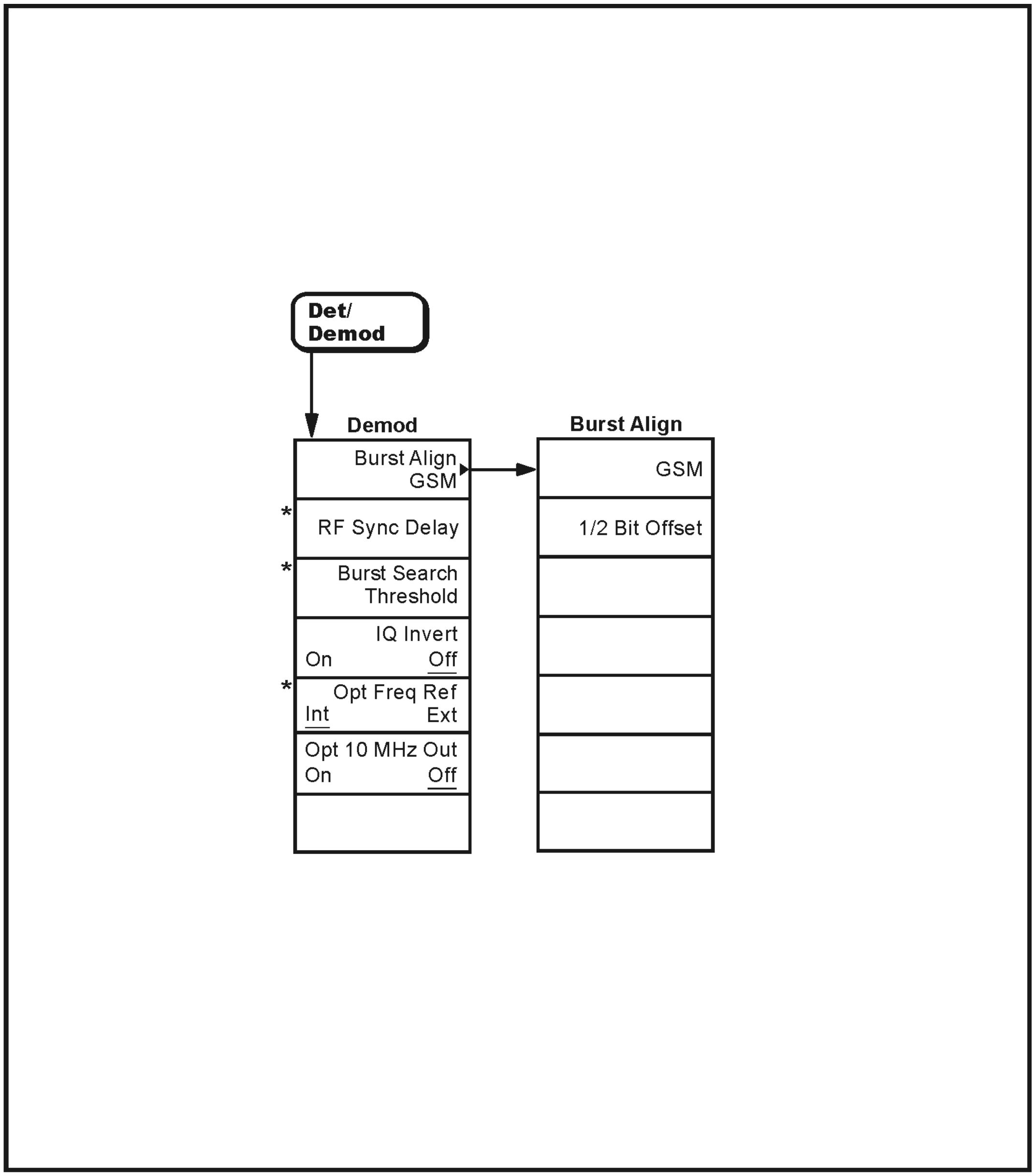
This chapter provides a visual representation of the front panel keys and their associated menu keys. For function key descriptions, refer to Chapter 3 , “Key Reference,”

What You Will Find In This Chapter

This chapter provides menu maps for the front panel keys having associated menus. The key menus appear in alphabetical order as follows:

Menus

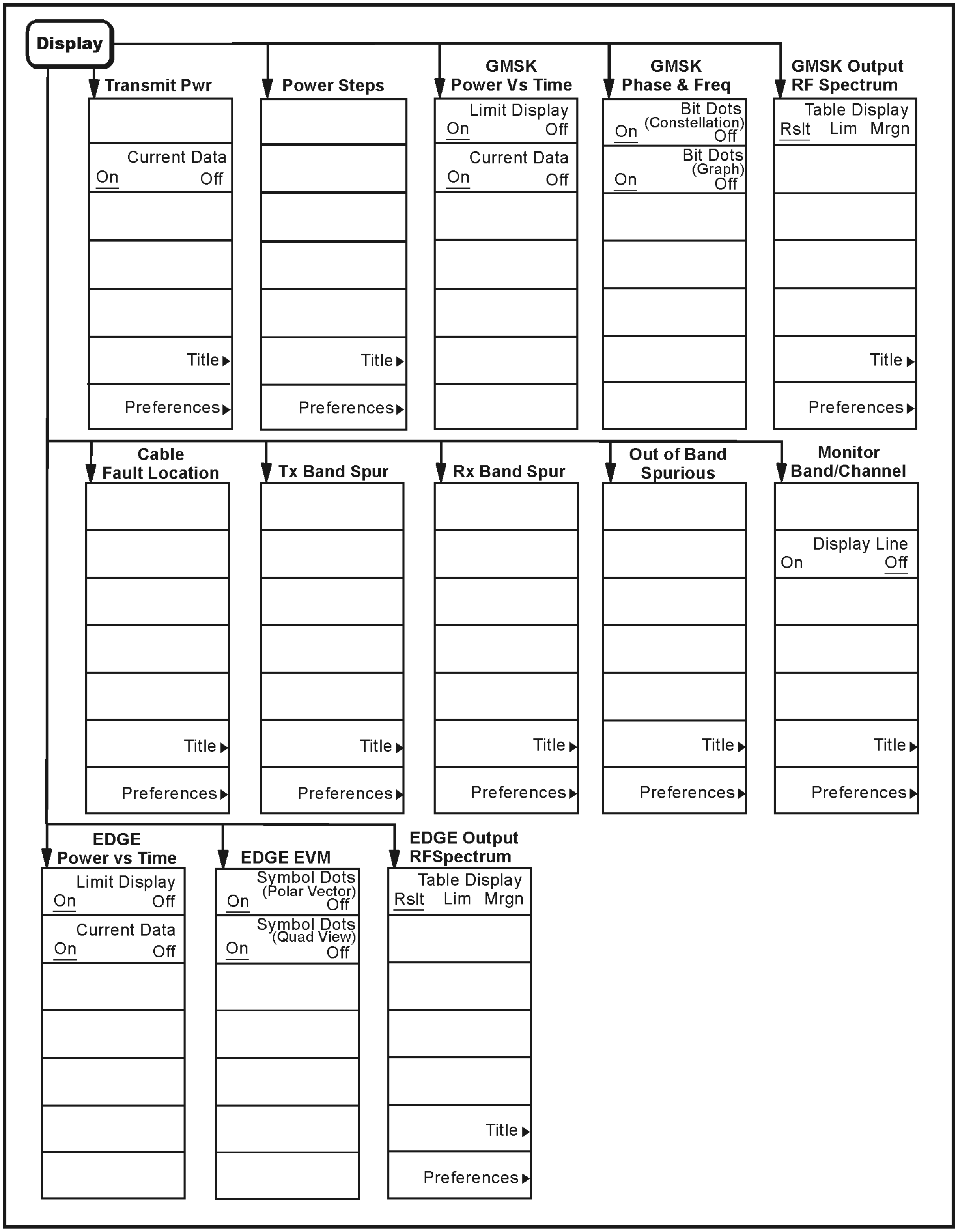
Detector and Demodulation Menu



* An active function that allows data entry

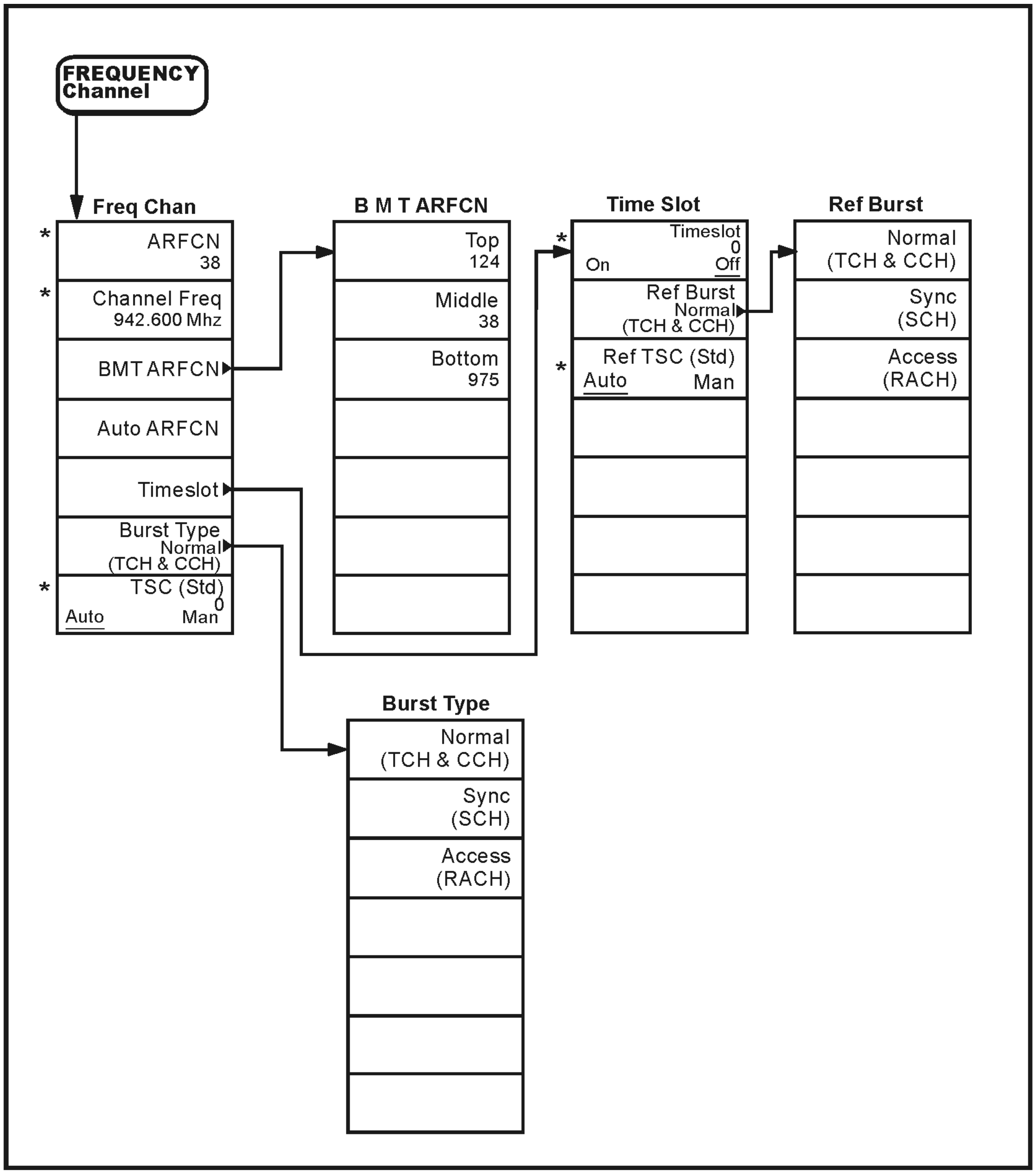
pl721c

Display Menu



PI75c

Frequency/Channel Menu

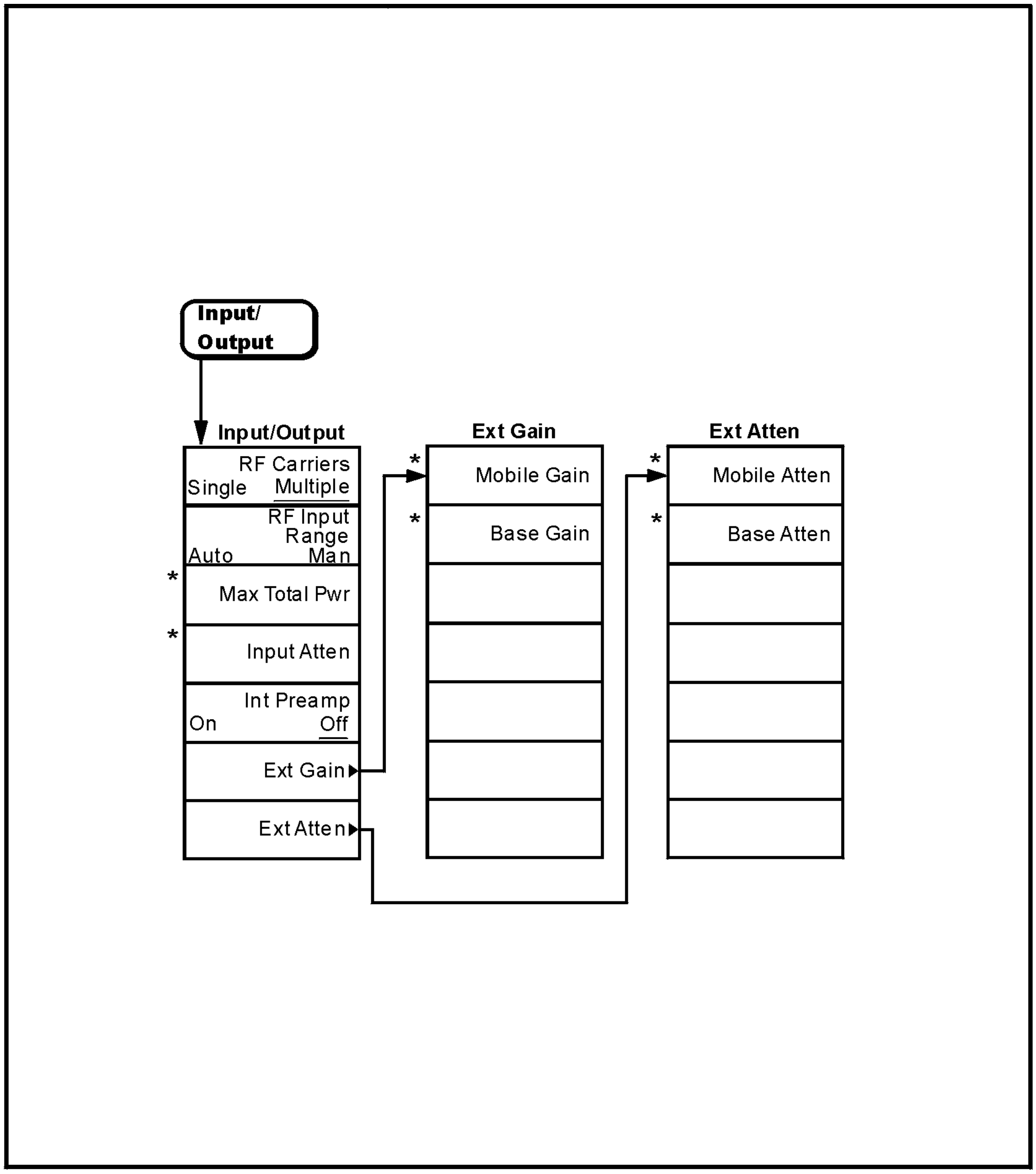


* An active function that allows data entry

pl74c

Menu Maps

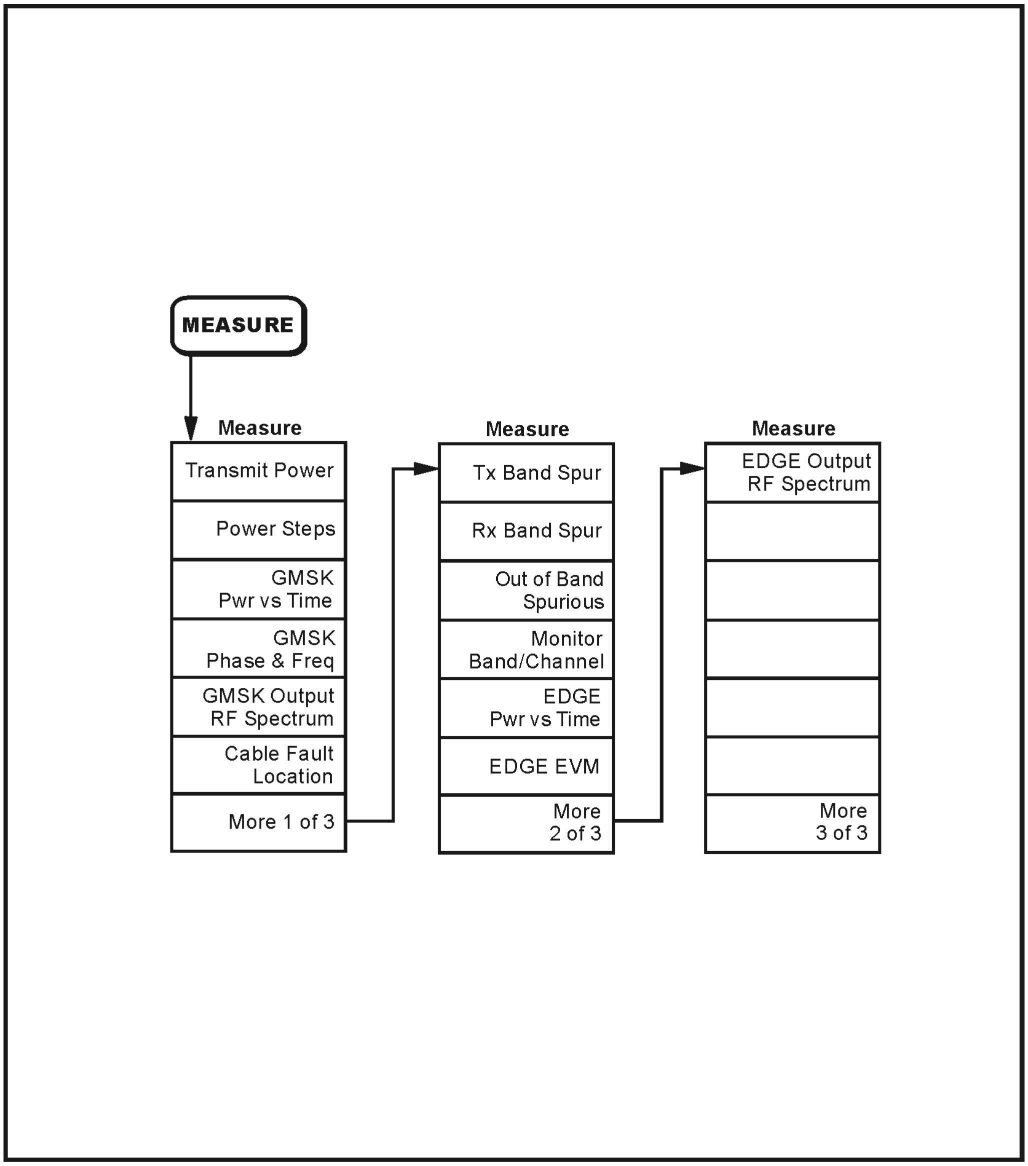
Input/Output Menu



* An active function that allows data entry

pl720c

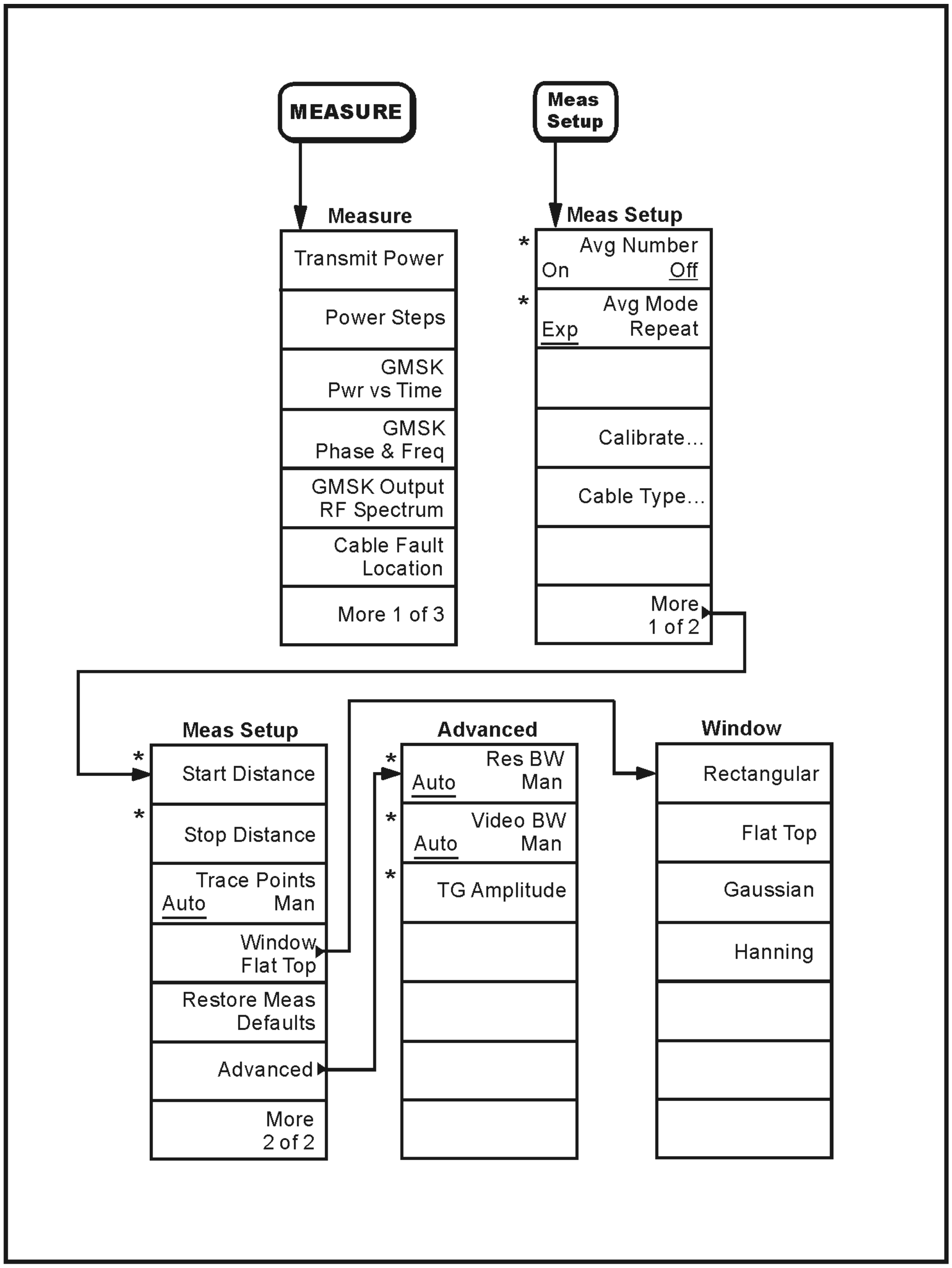
Measure Menu



pl73c

Measurement Setup Menus

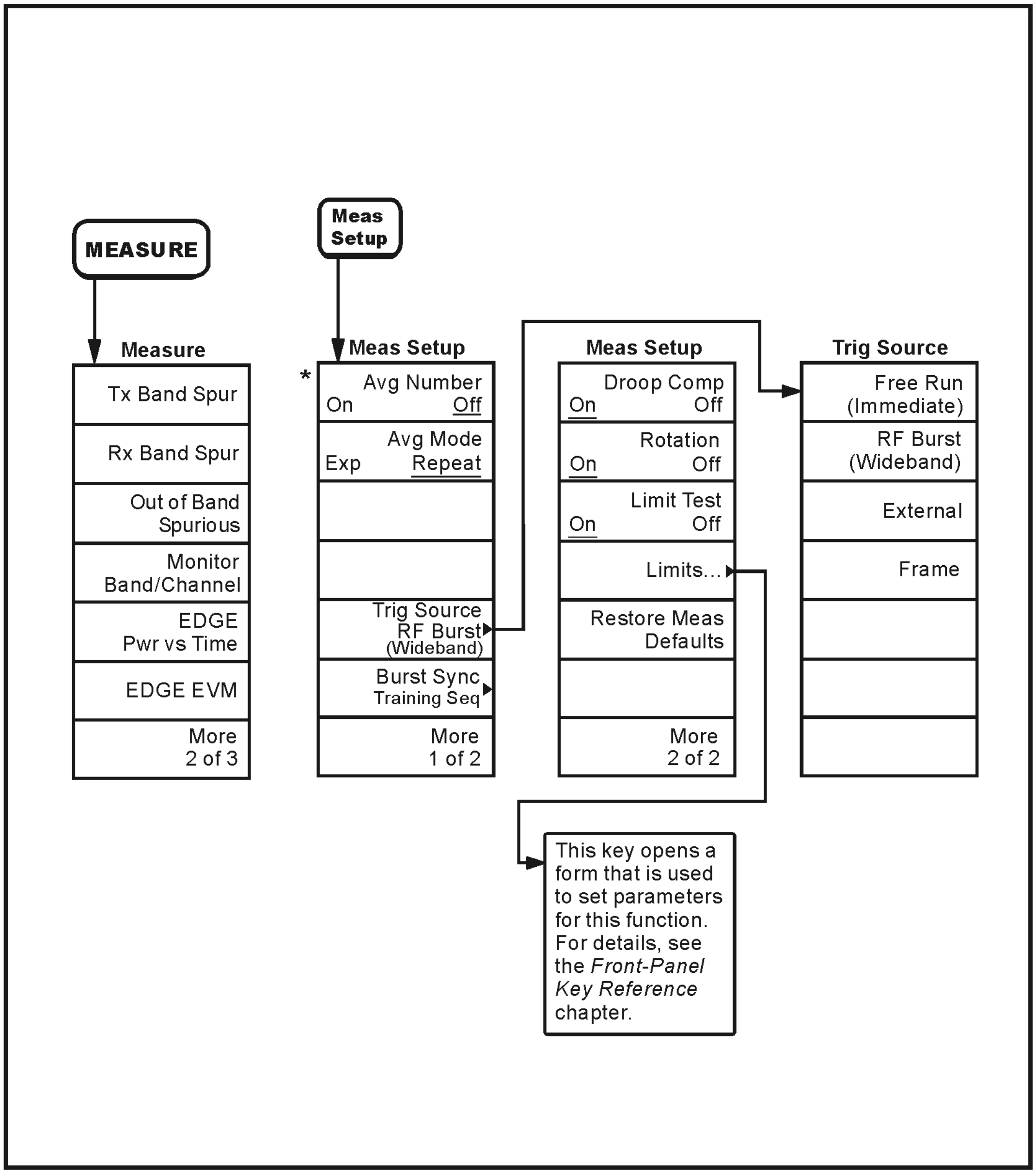
Cable Fault Location Measurement Setup Menu



* An active function that allows data entry.

pl716c

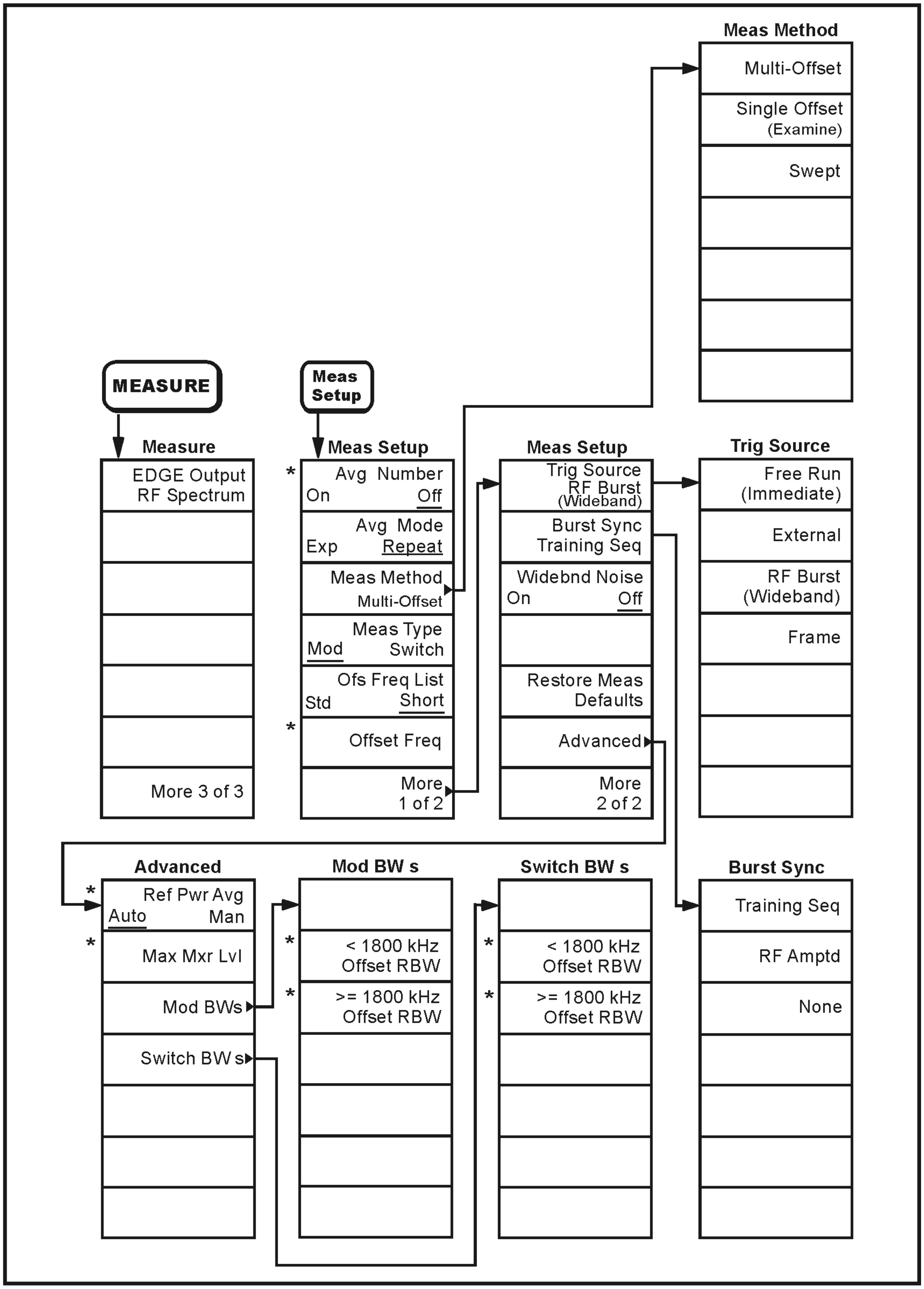
EDGE Error Vector Magnitude Measurement Setup Menu



* An active function that allows data entry

PI81c

EDGE Output RF Spectrum Measurement Setup Menu

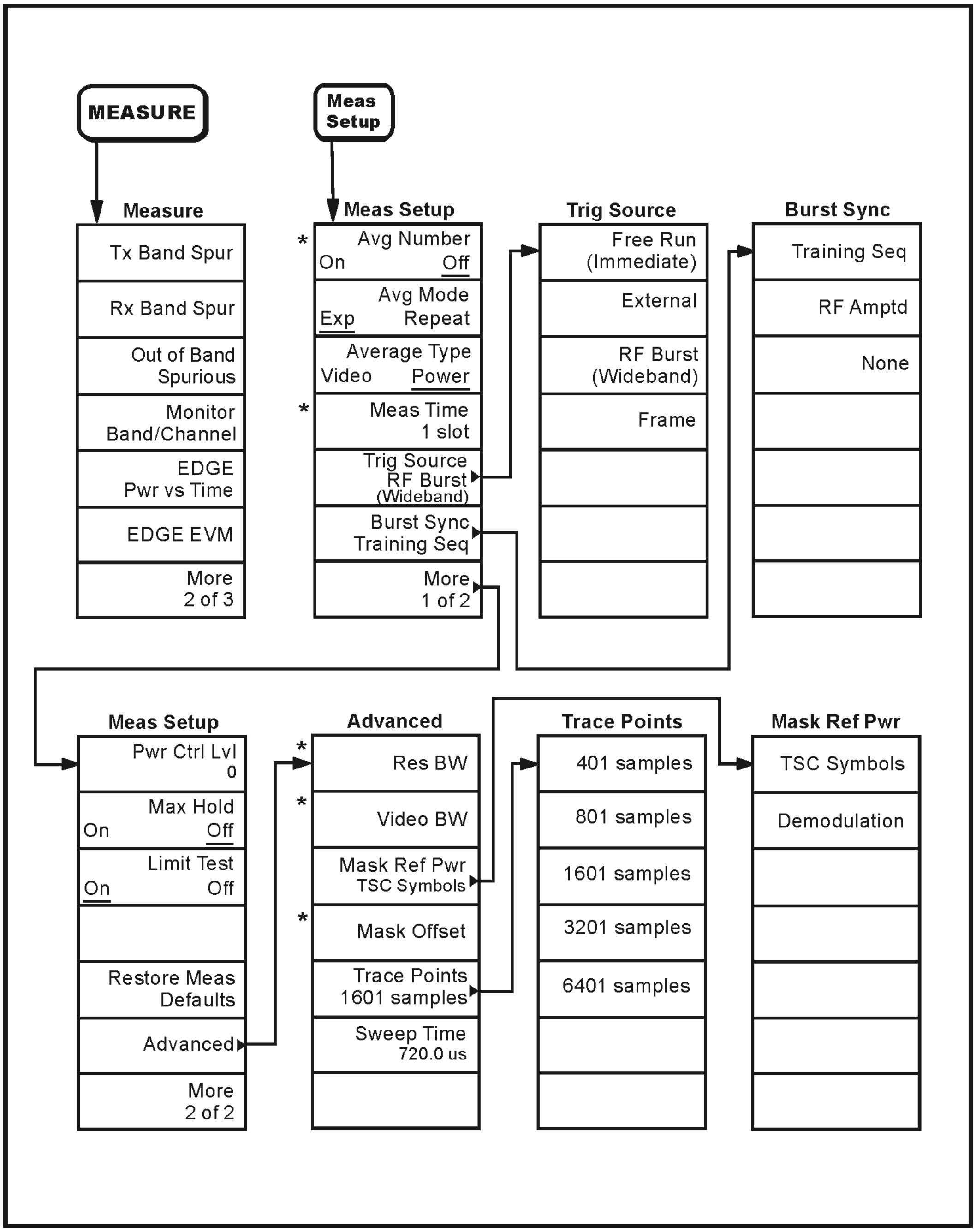


* An active function that allows data entry.

PI82c

Menu Maps

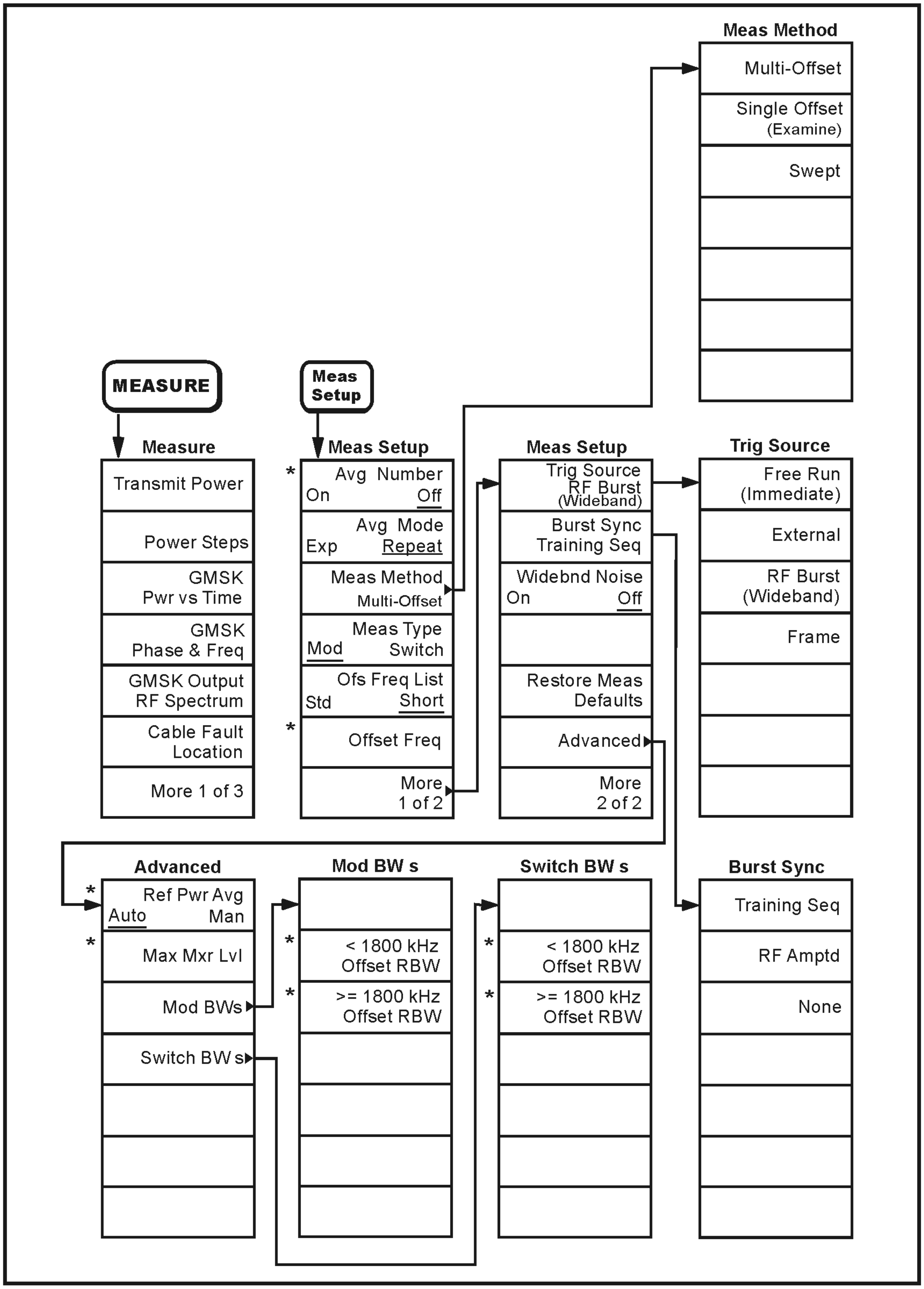
EDGE Power vs Time Measurement Setup Menu



* An active function that allows data entry.

Pl80c

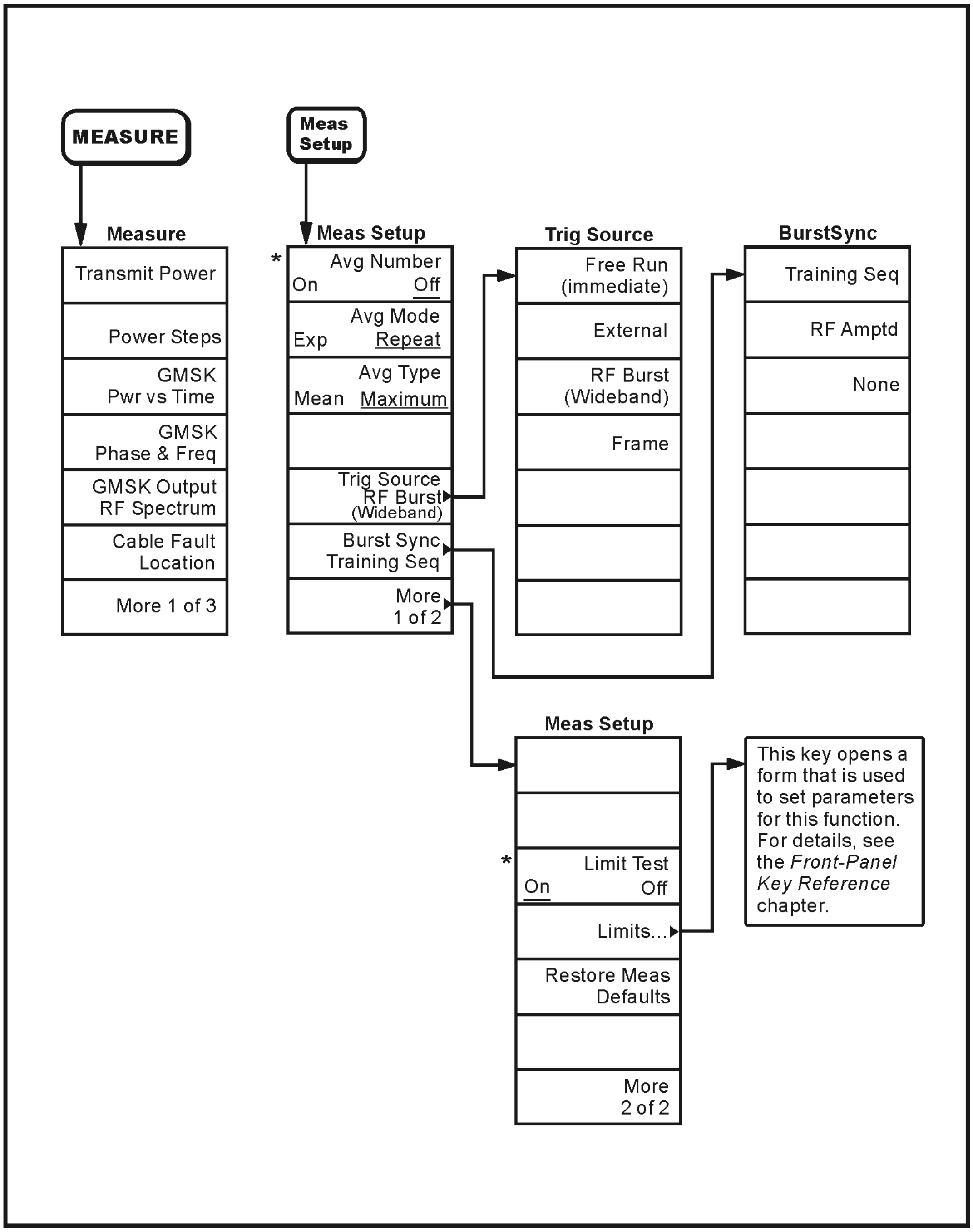
GMSK Output RF Spectrum Measurement Setup Menu



* An active function that allows data entry.

pl710c

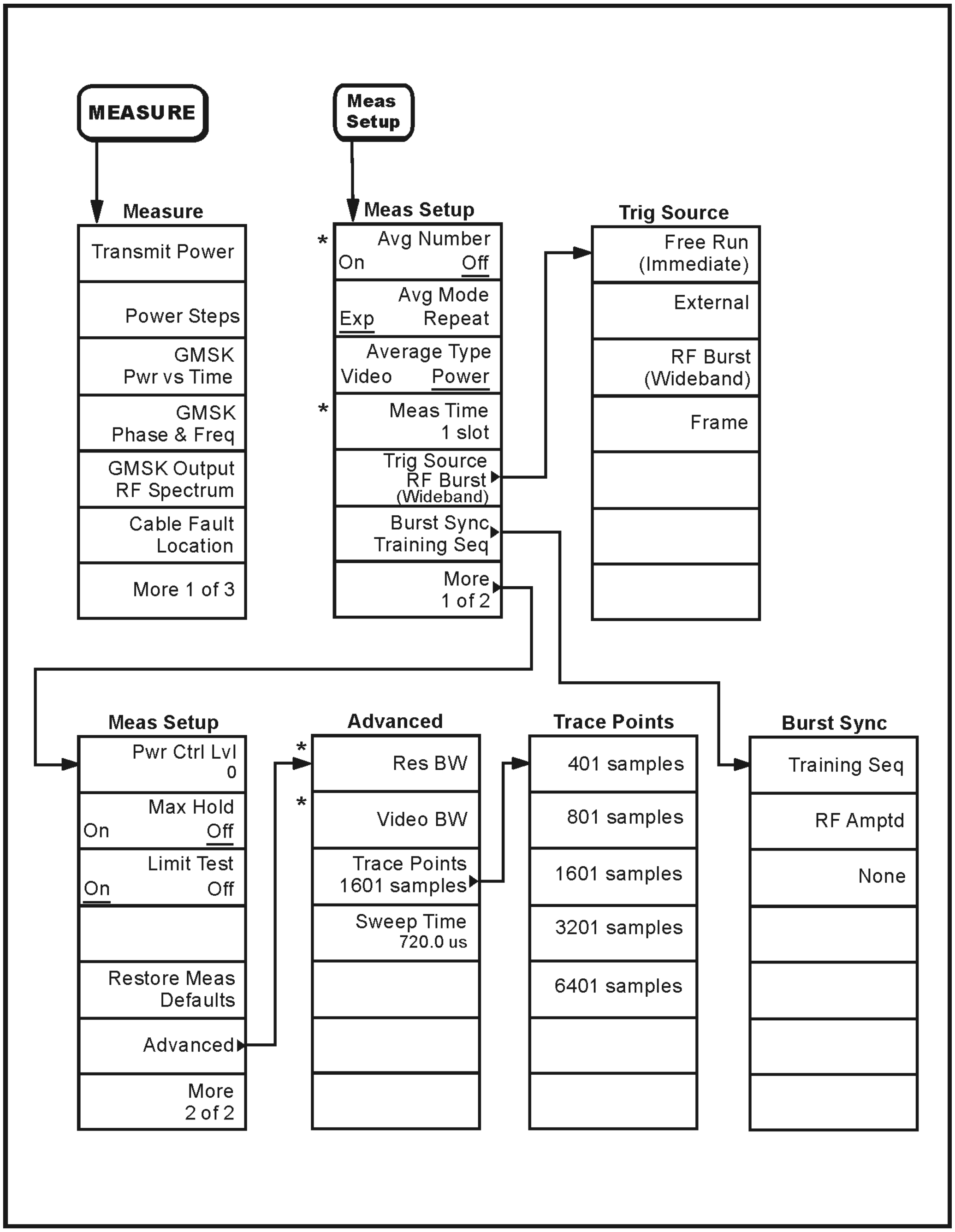
GMSK Phase And Frequency Error Measurement Setup Menu



* An active function that allows data entry

pl715c

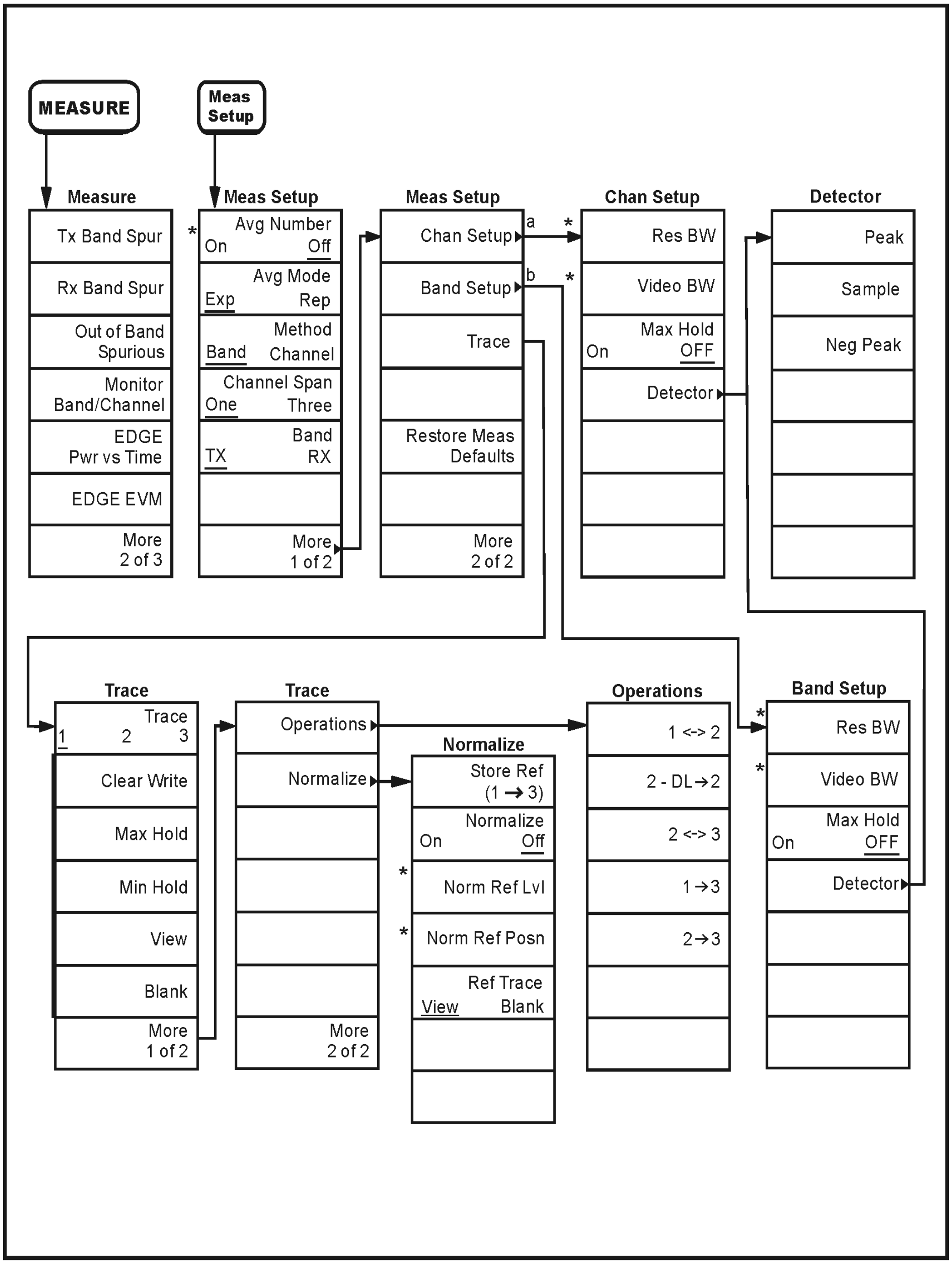
GMSK Power vs Time Measurement Setup Menu



* An active function that allows data entry.

pl79c

Monitor Band/Channel Measurement Setup Menu

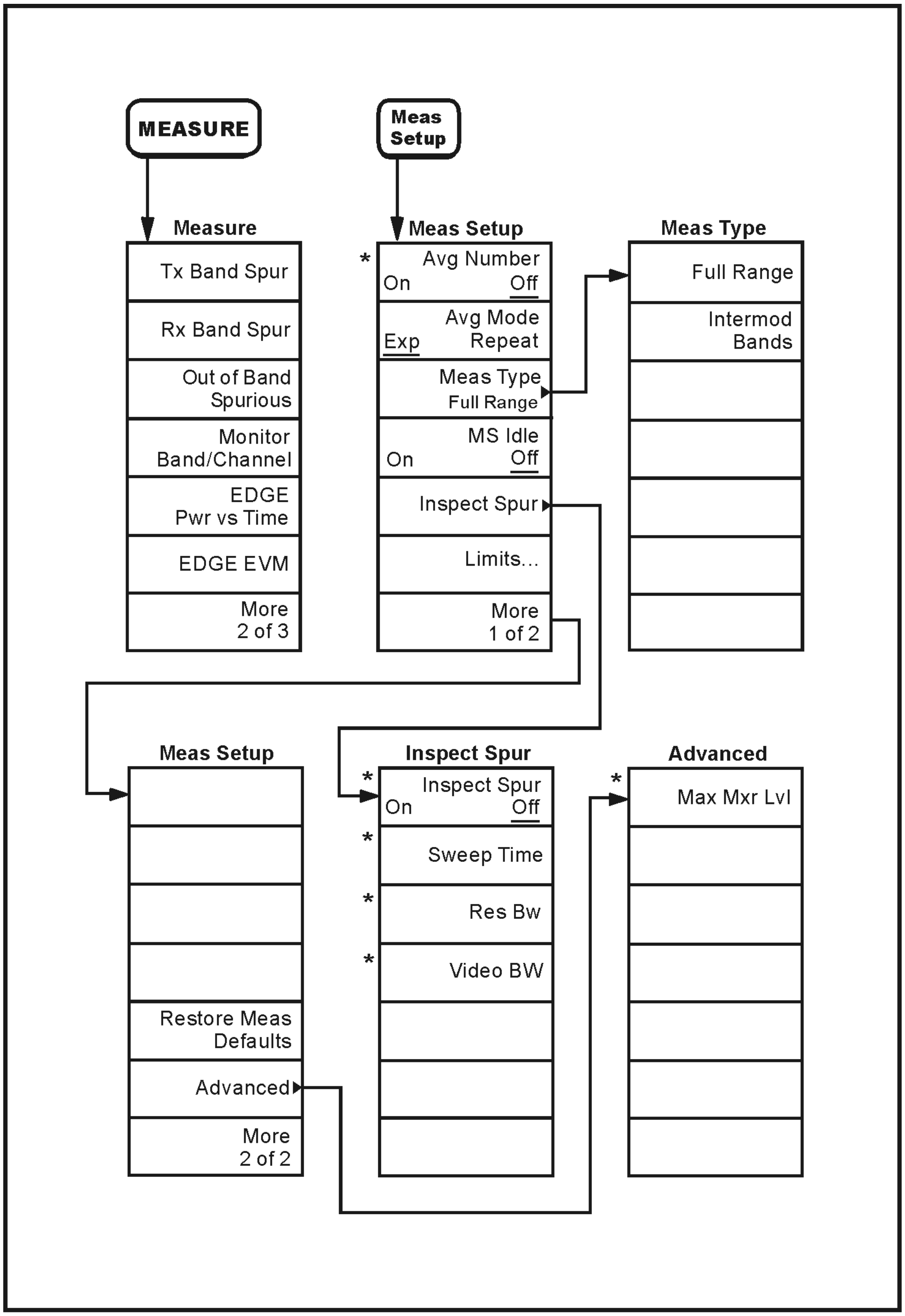


a. If Method is set to **Band** this key is grayed out.
b. If Method is set to **Channel** this key is grayed out.
* An active function that allows data entry.

pl717c

Menu Maps

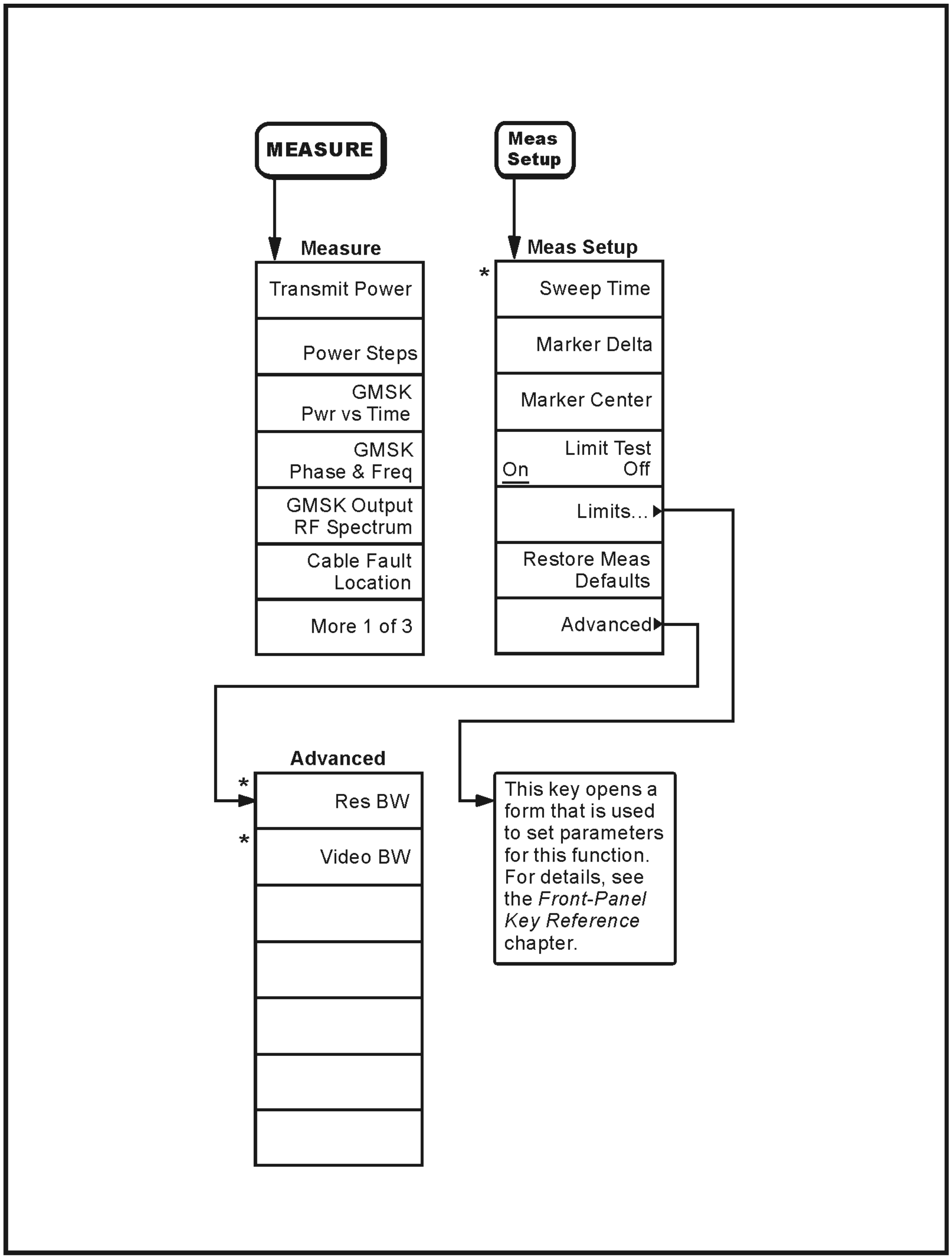
Out Of Band Spurious Measurement Setup Menu



* An active function which allows data entry

pl711c

Power Steps Measurement Setup Menu

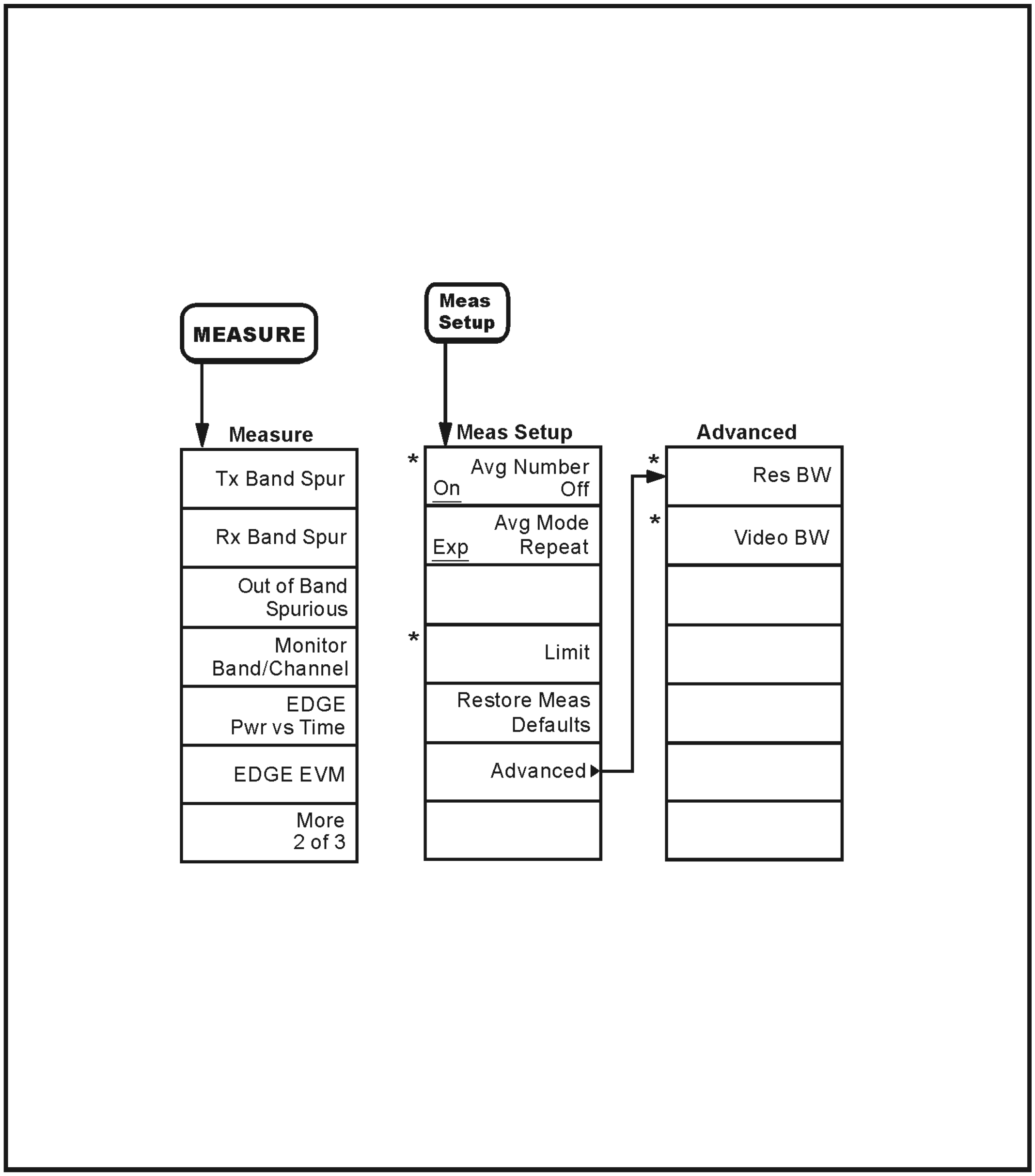


* An active function that allows data entry

pl78c

Menu Maps

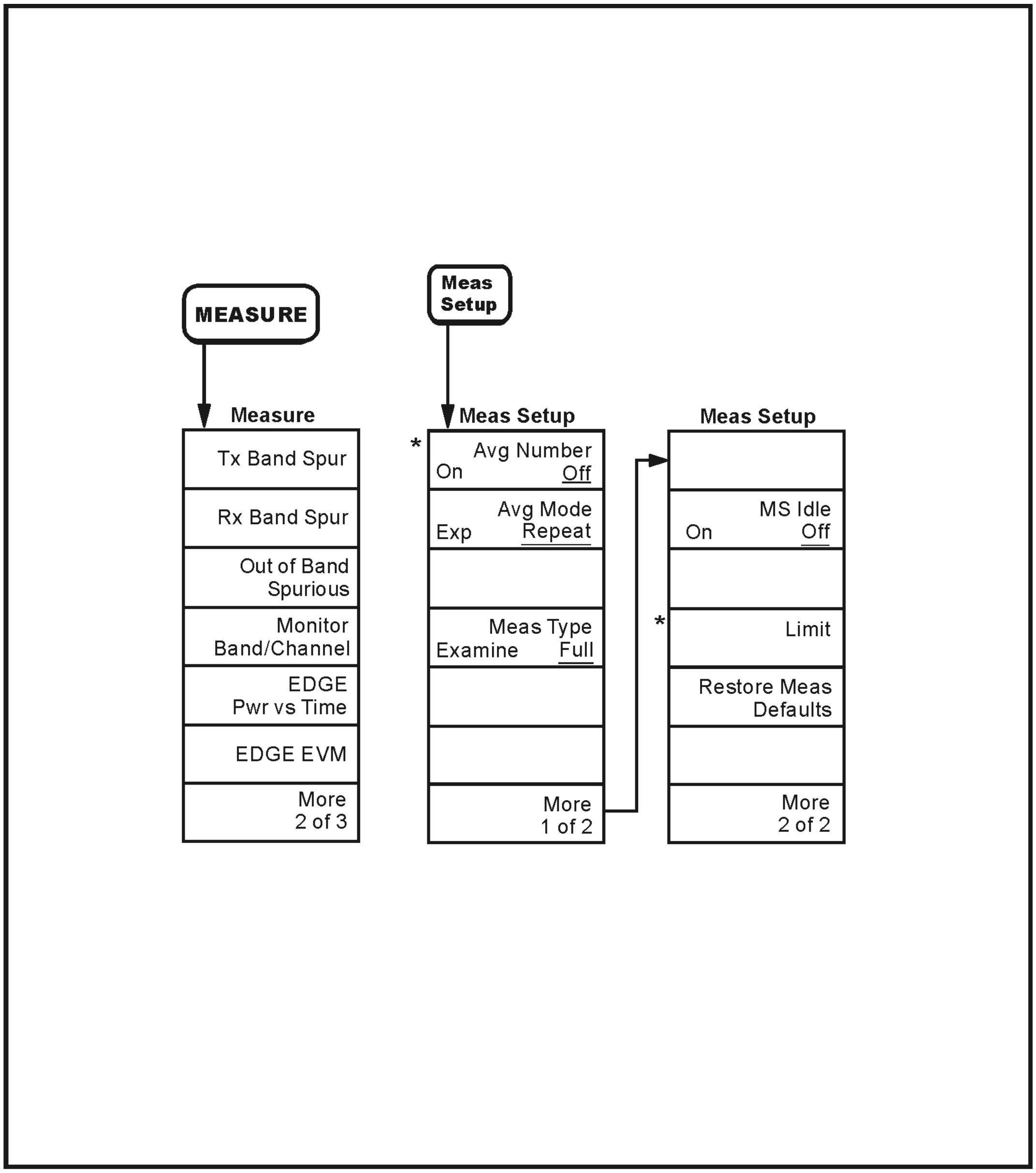
Receive Band Spurious Measurement Setup Menu



* An active function that allows data entry

pl714c

Transmit Band Spurious Measurement Setup Menu

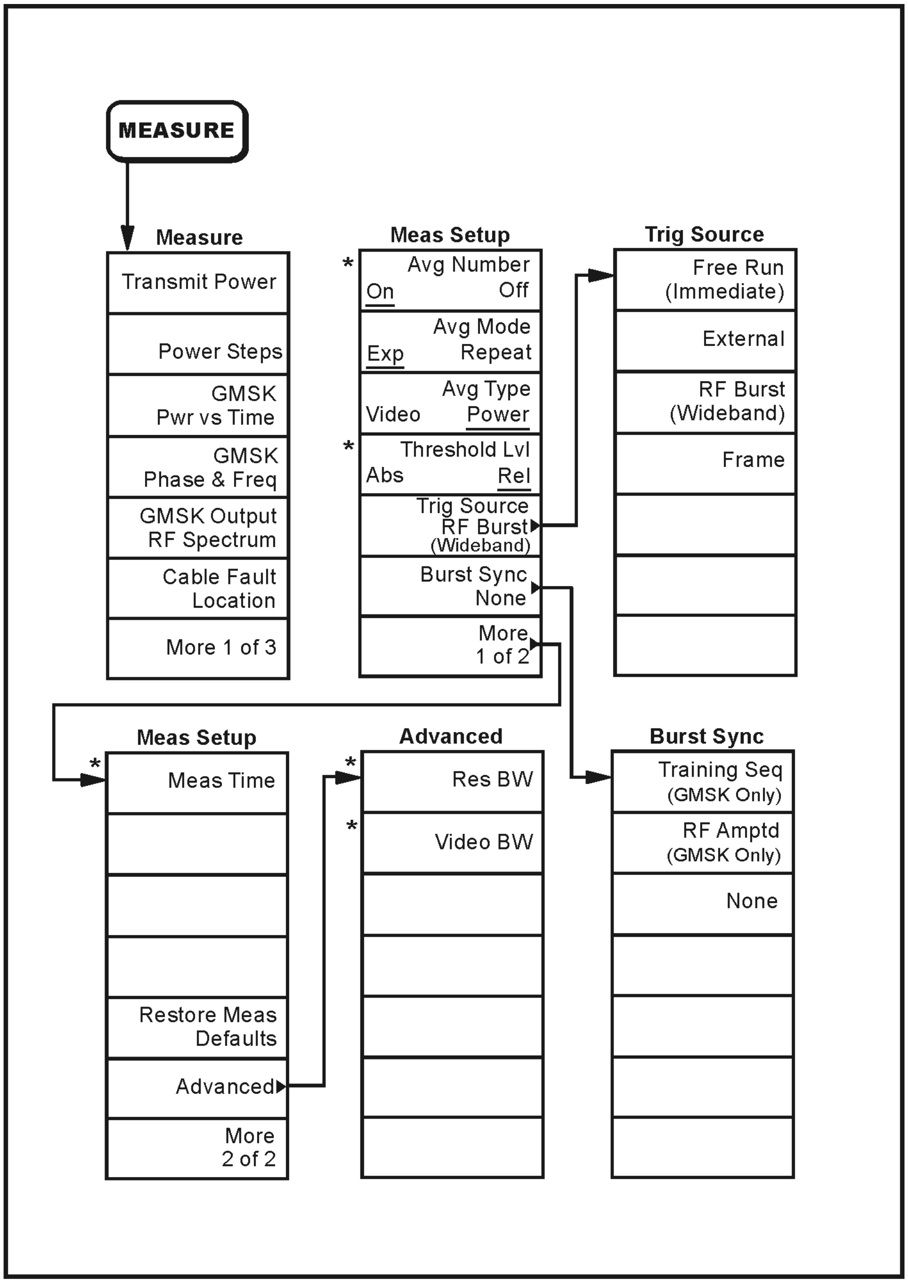


* An active function that allows data entry

pl713c

Menu Maps

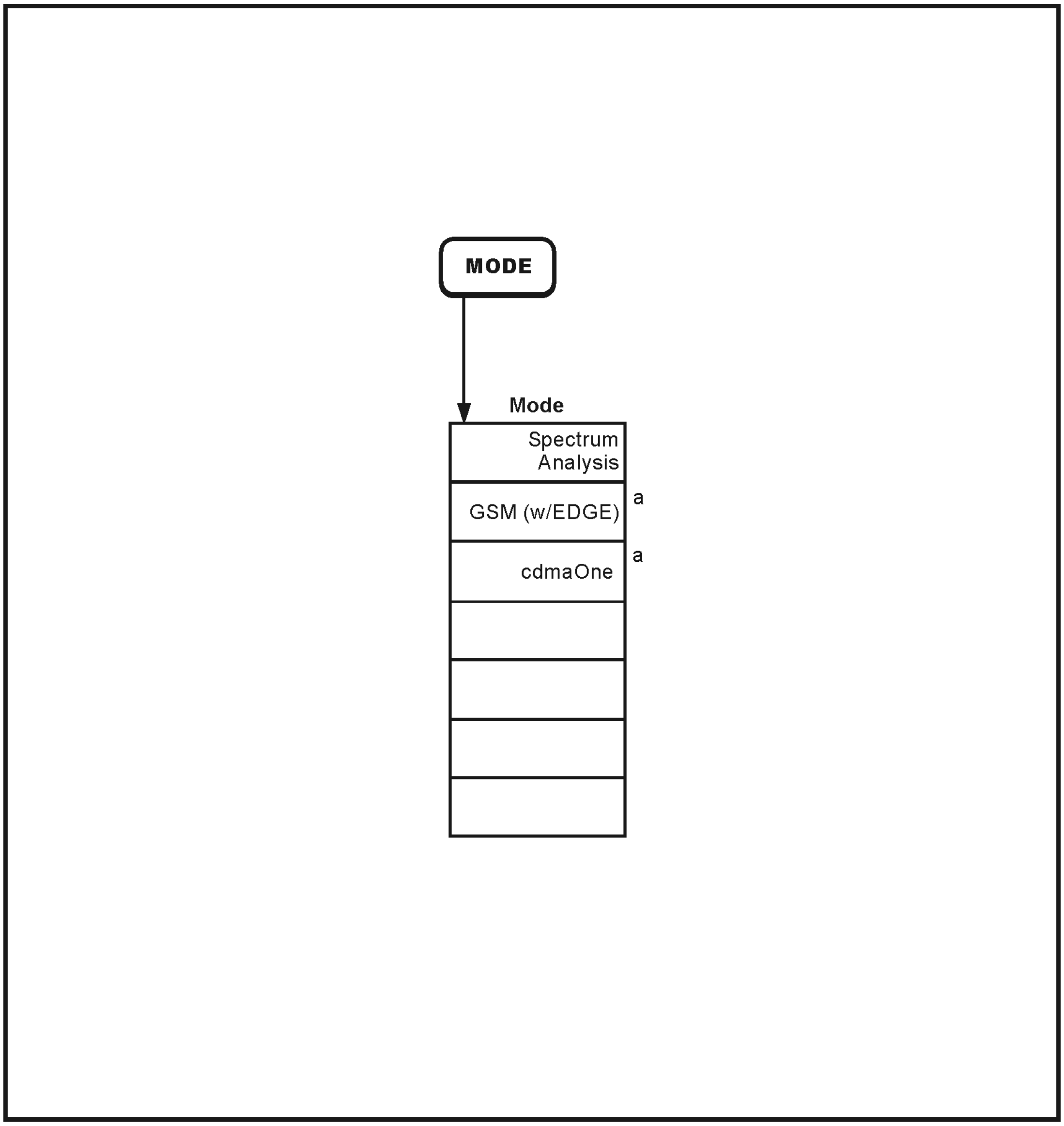
Transmitter Power Measurement Setup Menu



* An active function that allows data entry.

pl718c

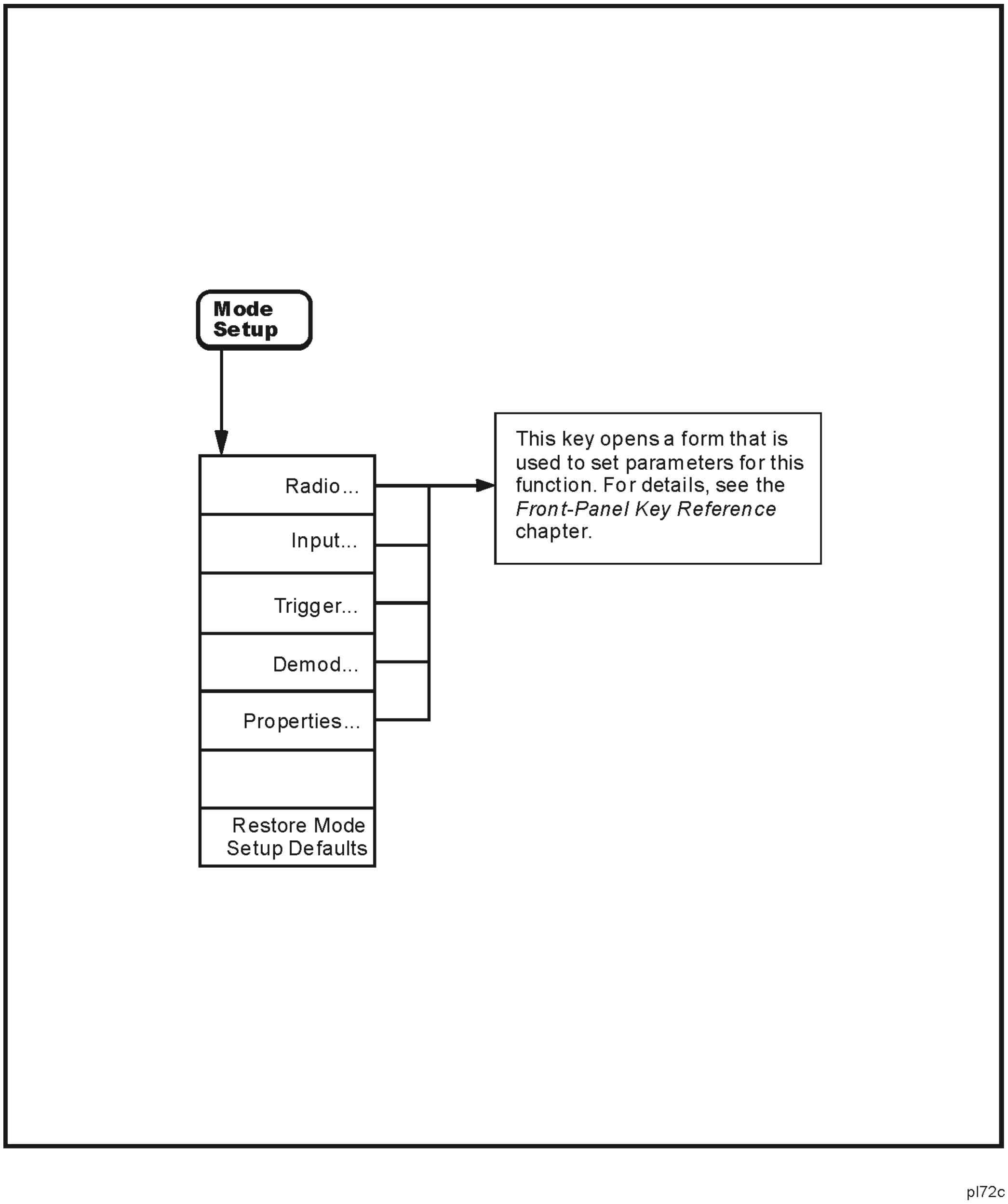
Mode Menu



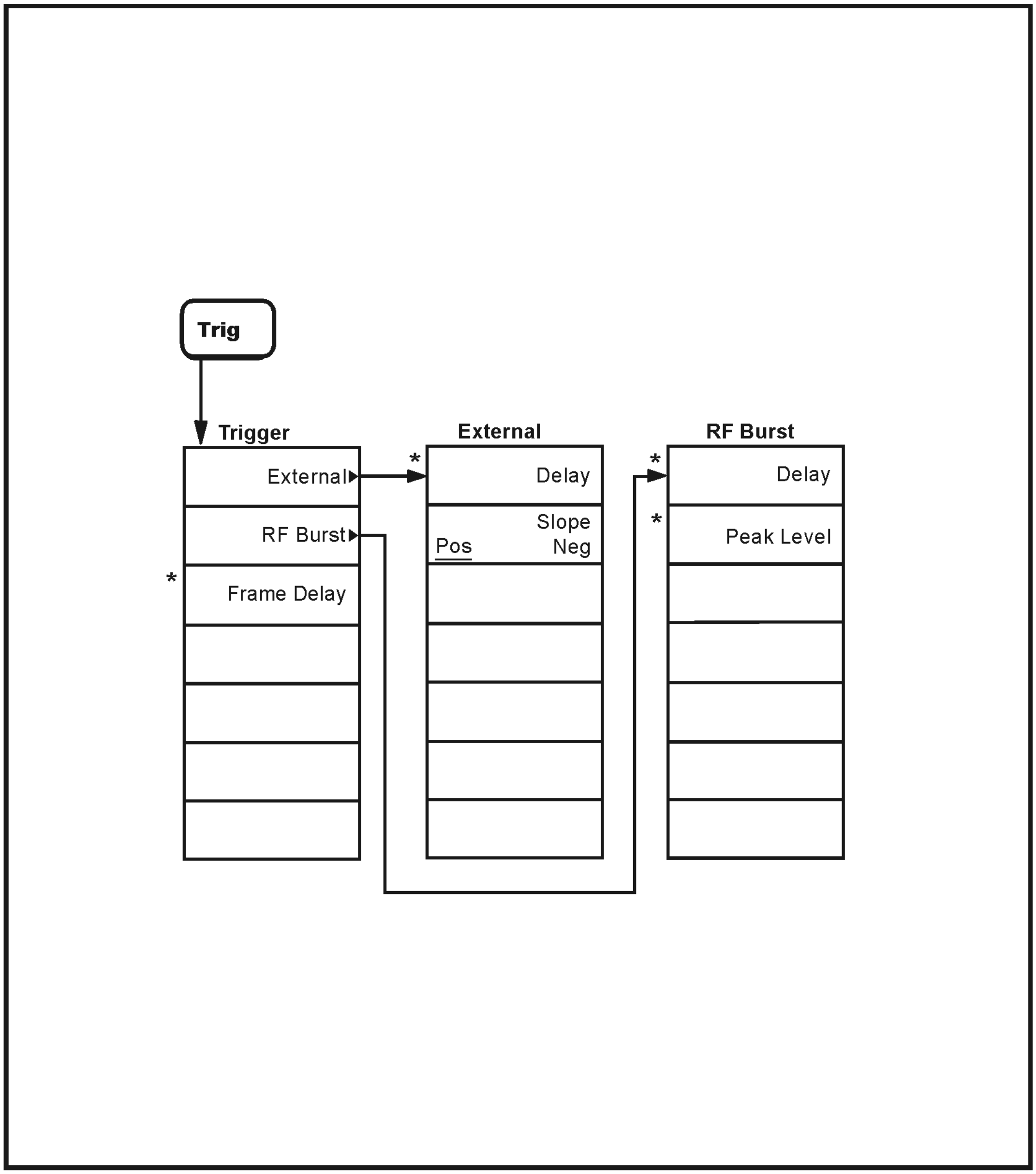
a. These menu items will appear only when the measurement personality option has been installed and the license key has been activated. They may appear in any order.

pl71c

Mode Setup Menu



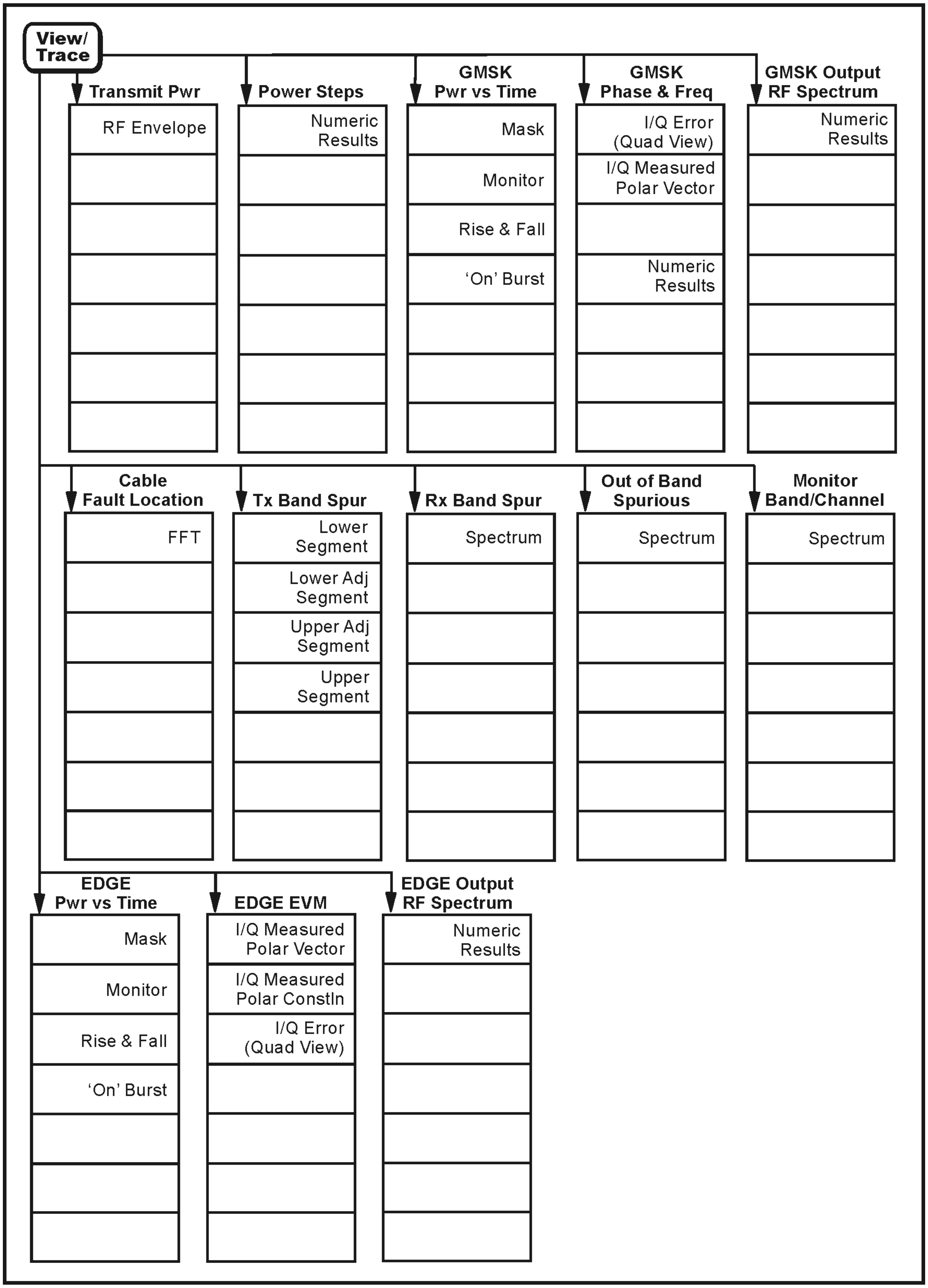
Trigger Menu



* An active function that allows data entry

pl722c

View/Trace Menu



pl76c

Menu Maps

Index

Index

Index

Index

Index

Index