GSM Programming Commands

Agilent Technologies E4406A VSA Series Transmitter Tester

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These commands are only available when the GSM mode has been selected using INSTrument:SELect. If GSM mode is selected, commands that are unique to another mode are not available.

SCPI Command Subsystems

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.

Query the Current Measurement Status

:CALCulate:CLIMits:FAIL?

Checks if the current measurement is outside its limits. It returns a 0 (zero) if it is passing or a 1 (one) if it is failing.

Front Panel Access: None

Data Query

:CALCulate:DATA[n]?

Returns the designated measurement data for the currently selected measurement and sub-opcode.

n = any valid sub-opcode for the current measurement. See the "MEASure Group of Commands" on page 24 for information on the data that can be returned for each measurement.

Calculate/Compress Trace Data Query

:CALCulate:DATA[n]:COMPress?
MAXimum|MEAN|MINimum|RMS|SAMPle|SDEViation|CFIT
{,<soffset>}{,<length>}{,<roffset>}

Returns the designated trace data for the currently selected measurement. The command can be used with sub-opcodes (*n*) for measurement results that are trace data. See the following table.

This command is used to compress/decimate a long trace to extract the desired data and only return to the computer the necessary data. A typical example would be to acquire N bursts of GSM data and return the mean power of each burst.

The command can also be used to identify the best curve fit for the data.

Curve Fit - applies curve fitting routines to the data. Where <soffset> and <length> are required, and <roffset> is an optional parameter for the desired order of the curve equation. The query will

return the following values: the x-offset (in points) and the curve coefficients ((order + 1) values).

<Start offset> - is an optional integer. It specifies the amount of data, at the beginning of the trace, that will be ignored before the decimation process starts. It is an integer index (that starts counting at zero) for all the elements in the trace. The default value is zero.

<Length> - is an optional integer that defines how many trace elements will be compressed into one value. This parameter has a default value equal to the current trace length.

<Repeat offset> - is an optional real number. It defines the beginning of the next field of trace elements to be compressed. This is relative to the beginning of the previous field. This parameter has a default value equal to the <length> variable. Select a number such that repeated additions will round to the correct starting index.

Example: To query the mean power of a set of GSM bursts:

1. Set the waveform measurement sweep time to acquire the required number of bursts.
2. Set the triggers such that acquisition happens at a known position relative to a burst.
3. Then query the mean burst levels using, **`CALC:DATA2:COMP? MEAN,62,1315,1442.3`** (These parameter values correspond to GSM signals.)

Remarks: The optional parameters must be entered in the specified order. If you want to specify <length>, you must also specify <soffset> or it's default. (e.g. **`CALC:DATA2:COMP? MEAN,62,1315`**

This command uses the data setting specified by the FORMat:DATA command and can return binary or ascii data.

History: Added in revision A.03.00 and later

Measurement	Available Traces	Markers Available?
ORFSpectrum - output RF spectrum (GSM mode)	RFEModulation (*n*=2)[a] RFESwitching (*n*=3)[a]	no markers
PFERror - phase and frequency error (GSM mode)	PERRor (*n*=2)[a] PFERror (*n*=3)[a] RFENvelope (*n*=4)[a]	yes

Measurement	Available Traces	Markers Available?
PVTime - power versus time (GSM, Service modes)	RFENvelope (*n*=2)[a] UMASK (*n*=3)[a] LMASK (*n*=4)[a]	yes
TSPur - transmit band spurs (GSM mode)	SPECtrum (*n*=2)[a] ULIMit (*n*=3)[a]	yes
TXPower - transmit power (GSM mode)	RFENvelope (*n*=2)[a] IQ (*n*=8)[a]	yes
SPECtrum - (frequency domain) (all modes)	RFENvelope (*n*=2)[a] for Service mode IQ (*n*=3)[a] SPECtrum (*n*=4)[a] ASPectrum (*n*=7)[a]	yes
WAVEform - (time domain) (all modes)	RFENvelope (*n*=2)[a] IQ (*n*=8)[a]	yes

a. The *n* number indicates the sub-opcode that corresponds to this trace. Detailed descriptions of the trace data can be found in the MEASure subsystem documentation by looking up the sub-opcode for the appropriate measurement.

Calculate Peaks of Trace Data

:CALCulate:DATA[n]:PEAKs?
<threshold>,<excursion>[,AMPLitude|FREQuency|TIME]

Returns a list of peaks for the designated trace data *n* for the currently selected measurement. The peaks must meet the requirements of the peak threshold and excursion values.

The command can be used with sub-opcodes (*n*) for any measurement results that are trace data. See the table above. Subopcode *n*=0, raw trace data cannot be searched for peaks. Both real and complex traces can be searched, but complex traces are converted to magnitude in dBm.

Threshold - is the level below which trace data peaks are ignored

Excursion - To be defined as a peak, the signal must rise above the

threshold by a minimum amplitude change. Excursion is measured from the lowest point above the threshold (of the rising edge of the peak), to the highest signal point that begins the falling edge.

Amplitude - lists the peaks in order of descending amplitude, so the highest peak is listed first. This is the default peak order listing if the optional parameter is not specified.

Frequency - lists the peaks in order of occurrence, left to right across the x-axis

Time - lists the peaks in order of occurrence, left to right across the x-axis

Example: Select the spectrum measurement.

Use **CALC:DATA4:PEAK? -40,10,FREQ** to identify the peaks above -40 dBm, with excursions of at least 10 dB, in order of increasing frequency.

Query Results: Returns a list of floating-point numbers. The first value in the list is the number of peak points that follow. A peak point consists of two values: a peak amplitude followed by the its corresponding frequency (or time).

If no peaks are found the peak list will consist of only the number of peaks, (0).

The peak list is limited to 100 peaks. Peaks in excess of 100 are ignored.

Remarks: This command uses the data setting specified by the FORMat:DATA command and can return real 32-bit, real 64-bit, or ASCII data. The default data format is ASCII.

History: Added in revision A.03.00 and later

CALCulate:MARKers Subsection

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 Mode - <measurement> key words

- ORFSpectrum - markers available
- PFERror - markers available
- PVTime - no markers
- SPECtrum - markers available
- TSPur - markers available
- TXPower - no markers
- WAVeform - markers available

Example:

Suppose you are using the Spectrum measurement. 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. Using the MEASure or READ command, before the marker command, 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.

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 Function

:CALCulate:<measurement>:MARKer[1]|2|3|4:FUNCtion BPOWer|NOISe|OFF

:CALCulate:<measurement>:MARKer[1]|2|3|4:FUNCtion?

Selects the type of marker for the specified marker. A particular measurement may not have all the types of markers that are commonly available.

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.

Band Power – is the integrated power between the two markers for traces in the frequency domain and is the mean power between the two markers for traces in the time domain.

Noise – is the noise power spectral density in a 1 Hz bandwidth. It is averaged over 32 horizontal trace points.

Off – turns off the marker functions

Example: **CALC:SPEC:MARK3:FUNC Noise**

Remarks: The keyword for the current measurement must be specified in the command. (Some examples include: SPECtrum, WAVeform)

Front Panel Access: **Marker, Marker Function**

Marker Function Result

:CALCulate:<measurement>:MARKer[1]|2|3|4:FUNCtion:RESult?

Quires the result of the currently active marker function. The measurement must be completed before querying the marker.A particular measurement may not have all the types of markers available.

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:SPEC:MARK:FUNC:RES?**

Remarks: The keyword for the current measurement must be specified in the command. (Some examples include: SPECtrum, WAVeform)

Front Panel Access: **Marker, Marker Function**

Marker Peak (Maximum) Search

:CALCulate:<measurement>:MARKer[1]|2|3|4:MAXimum

Places the selected marker on the highest point on the trace that is assigned to that particular marker number.

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:SPEC:MARK1:MAX**

Remarks: The keyword for the current measurement must be specified in the command. (Some examples include: SPECtrum, WAVeform)

Front Panel Access: **Search**

Marker Peak (Minimum) Search

:CALCulate:<measurement>:MARKer[1]|2|3|4:MINimum

Places the selected marker on the lowest point on the trace that is assigned to that particular marker number.

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:SPEC:MARK2:MIN**

Remarks: The keyword for the current measurement must be specified in the command. (Some examples include: SPECtrum, WAVeform)

Front Panel Access: None

Marker Mode

:CALCulate:<measurement>:MARKer[1]|2|3|4:MODE

POSition|DELTa

:CALCulate:<measurement>:MARKer[1]|2|3|4:MODE?

Selects the type of marker to be a normal position-type marker or a delta marker.A specific measurement may not have both types of markers. For example, several measurements only have position markers.

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:SPEC:MARK:MODE DELTA**

Remarks: For the delta mode only markers 1 and 2 are valid.

The keyword for the current measurement must be specified in the command. (Some examples include: SPECtrum, WAVeform)

Front Panel Access: **Marker, Marker [Delta]**

Marker On/Off

: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:SPEC:MARK2: on**

Remarks: The keyword for the current measurement must be specified in the command. (Some examples include: SPECtrum, AREFerence, WAVeform)

The WAVeform measurement only has two markers available.

Front Panel Access: M**arker, Select** then **Marker Normal** or **Marker On Off**

Marker to Trace

:CALCulate:<measurement>:MARKer[1]|2|3|4:TRACe <trace_name>

:CALCulate:<measurement>:MARKer[1]|2|3|4:TRACe?

Assigns the specified marker to the designated trace. Not all types of measurement data can have markers assigned to them.

Example: With the WAVeform measurement selected, a valid command is **CALC:SPEC:MARK2:TRACE rfenvelope**.

Range: The names of valid traces are dependent upon the selected measurement. See the following table for the available trace names. The trace name assignment is independent of the marker number.

Remarks: The keyword for the current measurement must be specified in the command. (Some examples include: SPECtrum, WAVeform)

Front Panel Access: **Marker, Marker Trace**

Measurement	Available Traces	Markers Available?
ORFSpectrum - output RF spectrum (GSM mode)	RFEModulation (*n*=2)[a] RFESwitching (*n*=3)[a]	no markers
PFERror - phase and frequency error (GSM mode)	PERRor (*n*=2)[a] PFERror (*n*=3)[a] RFENvelope (*n*=4)[a]	yes
PVTime - power versus time (GSM, Service modes)	RFENvelope (*n*=2)[a] UMASK (*n*=3)[a] LMASK (*n*=4)[a]	yes
TSPur - transmit band spurs (GSM mode)	SPECtrum (*n*=2)[a] ULIMit (*n*=3)[a]	yes
TXPower - transmit power (GSM mode)	RFENvelope (*n*=2)[a] IQ (*n*=8)[a]	yes
SPECtrum - (frequency domain) (all modes)	RFENvelope (*n*=2)[a] for Service mode IQ (*n*=3)[a] SPECtrum (*n*=4)[a] ASPectrum (*n*=7)[a]	yes

Measurement	Available Traces	Markers Available?
WAVEform - (time domain) (all modes)	RFENvelope (*n*=2)[a] IQ (*n*=8)[a]	yes

a. The *n* number indicates the sub-opcode that corresponds to this trace. Detailed descriptions of the trace data can be found in the MEASure subsystem documentation by looking up the sub-opcode for the appropriate measurement.

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 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.

The query returns the current X value of the designated marker. The measurement must be completed before querying the marker.

Example: **CALC:SPEC:MARK2:X 1.2e6 Hz**

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: SPECtrum, WAVeform)

Front Panel Access: **Marker, <active marker>, RPG**

Marker X Position

:CALCulate:<measurement>:MARKer[1]|2|3|4:X:POSition <integer>

:CALCulate:<measurement>:MARKer[1]|2|3|4:X:POSition?

Position the designated marker on its assigned trace at the specified X position. A trace is composed of a variable number of measurement points. This number changes depending on the current measurement conditions. The current number of points must be identified before

using this command to place the marker at a specific location.

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.

The query returns the current X position for the designated marker. The measurement must be completed before querying the marker.

Example: **CALC:SPEC:MARK:X:POS 500**

Range: 0 to a maximum of (3 to 920,000)

Remarks: The keyword for the current measurement must be specified in the command. (Some examples include: SPECtrum, WAVeform)

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 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.

The measurement must be completed before querying the marker.

Example: **CALC:SPEC:MARK1:Y -20 dB**

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: SPECtrum, WAVeform)

Transmit Band Spurs Define Limits

:CALCulate:TSPur:LIMit[:UPPer][:DATA] <power>

:CALCulate:TSPur:LIMit[:UPPer][:DATA]?

Set the value for the test limit. This command does not accept units. Use CALCulate:TSPur:LIMit:TEST to select the units dBm (absolute) or dB (relative).

Factory Preset and *RST: –36

Range: –200 to 100

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

History: Version A.03.00 or later

Front Panel Access: **Meas Setup, Limit**

Transmit Band Spurs Type of Limit Testing

:CALCulate:TSPur:LIMit:TEST ABSolute|RELative

:CALCulate:TSPur:LIMit:TEST?

Select the limit testing to be done using either absolute or relative power limits.

Factory Preset and *RST: Absolute

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

History: Version A.03.00 or later

Front Panel Access: **Meas Setup, Limit**

CONFigure Subsystem

:CONFigure:<measurement>

The CONFigure commands are used with several other commands and are documented in the section on the “MEASure Group of Commands” on page 24.

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.

Spectrum Measurement Y-Axis Reference Level

:DISPlay:SPECtrum[n]:WINDow[m]:TRACe:Y[:SCALe]:RLEVel <power>

:DISPlay:SPECtrum[n]:WINDow[m]:TRACe:Y[:SCALe]:RLEVel?

Sets the amplitude reference level for the y-axis.

n – selects the view, the default is Spectrum.

— n=1, Spectrum

— n=2, I/Q Waveform

— n=3, numeric data (service mode)

— n=4, RF Envelope (service mode)

m – selects the window within the view. The default is 1.

Factory Preset and *RST:	0 dBm, for Spectrum
Range:	–250 to 250 dBm, for Spectrum
Default Unit:	dBm, for Spectrum
Remarks:	May affect input attenuator setting. To use this command, the appropriate mode should be selected with INSTrument:SELect.
Front Panel Access:	When in Spectrum measurement: **Amplitude Y Scale, Ref Level**

Turn a Trace Display On/Off

:DISPlay:TRACe[n][:STATe] OFF|ON|0|1

:DISPlay:TRACe[n][:STATe]?

Controls whether the specified trace is visible or not.

n is a sub-opcode that is valid for the current measurement. See the "MEASure Group of Commands" on page 24 for more information about sub-opcodes.

Factory Preset and *RST: On

Range: The valid traces and their sub-opcodes are dependent upon the selected measurement. See the following table.

The trace name assignment is independent of the window number.

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Front Panel Access: **Display, Display Traces**

Measurement	Available Traces	Markers Available?
ORFSpectrum - output RF spectrum (GSM mode)	RFEModulation (*n*=2)[a] RFESwitching (*n*=3)[a]	no markers
PFERror - phase and frequency error (GSM mode)	PERRor (*n*=2)[a] PFERror (*n*=3)[a] RFENvelope (*n*=4)[a]	yes
PVTime - power versus time (GSM, Service modes)	RFENvelope (*n*=2)[a] UMASK (*n*=3)[a] LMASK (*n*=4)[a]	yes
TSPur - transmit band spurs (GSM mode)	SPECtrum (*n*=2)[a] ULIMit (*n*=3)[a]	yes
TXPower - transmit power (GSM mode)	RFENvelope (*n*=2)[a] IQ (*n*=8)[a]	yes
SPECtrum - (frequency domain) (all modes)	RFENvelope (*n*=2)[a] for Service mode IQ (*n*=3)[a] SPECtrum (*n*=4)[a] ASPectrum (*n*=7)[a]	yes
WAVEform - (time domain) (all modes)	RFENvelope (*n*=2)[a] IQ (*n*=8)[a]	yes

a. The *n* number indicates the sub-opcode that corresponds to this trace. Detailed descriptions of the trace data can be found in the MEASure subsystem documentation by looking up the sub-opcode for the appropriate measurement.

Waveform Measurement Y-Axis Reference Level

:DISPlay:WAVEform[n]:WINDow[m]:TRACe:Y[:SCALe]:RLEVel <power>

:DISPlay:WAVEform[n]:WINDow[m]:TRACe:Y[:SCALe]:RLEVel?

Sets the amplitude reference level for the y-axis.

n, selects the view, the default is RF envelope.

n=1, RF envelope

n=2, I/Q waveform

m, selects the window within the view. The default is 1.

Factory Preset and *RST:	0 dBm, for RF envelope
Range:	–250 to 250 dBm, for RF envelope
Default Unit:	dBm, for RF envelope
Remarks:	May affect input attenuator setting. To use this command, the appropriate mode should be selected with INSTrument:SELect.
Front Panel Access:	When in Waveform measurement: **Amplitude Y Scale, Ref Level**

FETCh Subsystem

:FETCh:<measurement>[n]?

The FETCh? commands are used with several other commands and are documented in the section on the "MEASure Group of Commands" on page 24.

MEASure Group of Commands

This group includes commands used to make measurements and return results. The different commands can be used to provide fine control of the overall measurement process. Most measurements should be done in single measurement mode, rather than doing the measurement continuously.

Each measurement sets the instrument state that is appropriate for that measurement. Other commands are available for each **Mode** to allow changing settings, view, limits, etc. Refer to:

SENSe:<measurement>, SENSe:CHANnel, SENSe:CORRection, SENSe:FREQuency, SENSe:POWer, SENSe:RADio, SENSe:SNYC
CALCulate:<measurement>, CALCulate:CLIMits/DATA
DISPlay:<measurement>
TRIGger

Measure Commands

:MEASure:<measurement>[n]?

This is a fast single-command way to make a measurement using the factory default instrument settings. These are the settings and units that conform to the Standard.

- Stops the current measurement and sets up the instrument for the specified measurement using the factory defaults
- Initiates the data acquisition for the measurement
- Blocks other SCPI communication, waiting until the measurement is complete before returning results.
- After the data is valid it returns the scalar results, or the trace data, for the specified measurement.

  If the optional [n] value is not included, or is set to 1, the scalar measurement results will be returned. If the [n] value is set to a value other than 1, the selected trace data results will be returned. See each command for details of what types of scalar results or trace data results are available. The binary data formats should be used for handling large blocks of data since they are smaller and faster then the ASCII format.

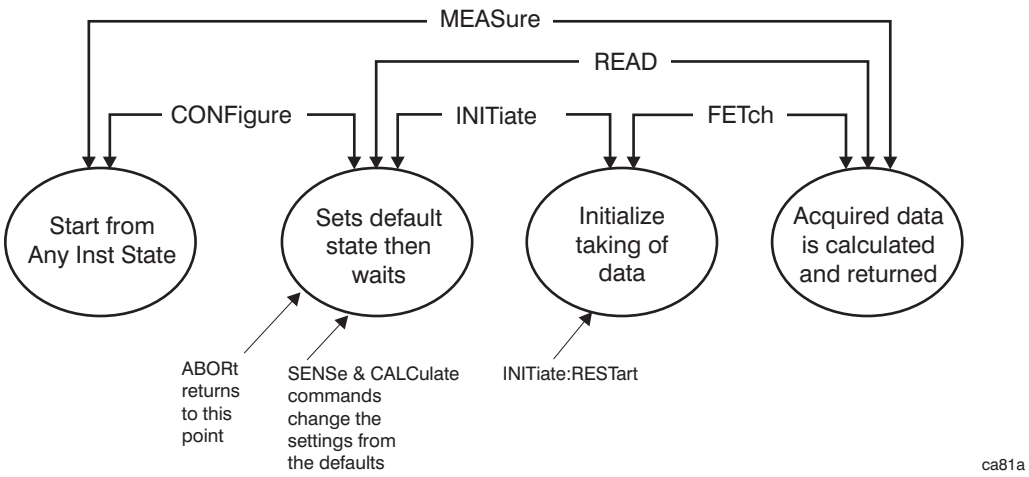
If you need to change some of the measurement parameters from the factory default settings you can set up the measurement with the CONFigure command. Use the commands in the SENSe:<measurement> and CALCulate:<measurement> subsystems to change the settings. Then you can use the READ? command, or the INITiate and FETCh? commands, to initiate the measurement and

query the results. See Figure 1-1.

If you need to repeatedly make a given measurement with settings other than the factory defaults, you can use the commands in the SENSe:<measurement> and CALCulate:<measurement> subsystems to set up the measurement. Then use the READ? command or INITiate and FETCh? commands, to initiate the measurement and query results.

Measurement settings persist if you initiate a different measurement and then return to a previous one. Use READ:<measurement>? if you want to use those persistent settings. If you want to go back to the default settings, use MEASure:<measurement>?.

Figure 1-1 Measurement Group of Commands



Configure Commands

:CONFigure:<measurement>

This command sets up the instrument for the specified measurement using the factory default instrument settings and stops the current measurement. It does not initiate the taking of measurement data.

The CONFigure? query returns the current measurement name.

Fetch Commands

:FETCh:<measurement>[n]?

This command puts valid data into the output buffer, but does not initiate data acquisition. Use the INITiate[:IMMediate] command to acquire data before you use the FETCh command. You can only fetch results from the measurement that is currently selected.

If the optional [n] value is not included, or is set to 1, the scalar measurement results will be returned. If the [n] value is set to a value

other than 1, the selected trace data results will be returned. See each command for details of what types of scalar results or trace data results are available. The binary data formats should be used for handling large blocks of data since they are smaller and faster then the ASCII format.

Read Commands

:READ:<measurement>[n]?

- Does not preset the measurement to the factory defaults. (The MEASure? command does preset.) It uses the settings from the last measurement.
- Initiates the measurement and puts valid data into the output buffer. If a measurement other than the current one is specified, the instrument will switch to that measurement before it initiates the measurement and returns results.
- Blocks other SCPI communication, waiting until the measurement is complete before returning the results

  If the optional [n] value is not included, or is set to 1, the scalar measurement results will be returned. If the [n] value is set to a value other than 1, the selected trace data results will be returned. See each command for details of what types of scalar results or trace data results are available. The binary data formats should be used when handling large blocks of data since they are smaller and faster then the ASCII format.

Measurement settings persist if you initiate a different measurement and then return to a previous one. Use READ:<measurement>? if you want to use those persistent settings. If you want to go back to the default settings, use MEASure:<measurement>?.

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. Use `[:SENSe]:ORFSpectrum:LIST:SWITch CUSTom` to select a customized set of offsets. Use `[:SENSe]:ORFSpectrum:TYPE MSWitching` to measure switching in addition to measuring modulation. (The measurement will take longer when measuring switching transients.

Measurement Method	n	Results Returned
	0	Returns unprocessed I/Q trace data, as a series of comma-separated trace points, 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.

Measurement Method	n	Results Returned
Multiple offsets	not specified or n=1	Returns a list of comma-separated 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 1 - switching transients measurement values . . . Offset 14- switching transients measurement values 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
Single offset	not specified or n=1	Returns 4 comma-separated 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
Single offset	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.

Measurement Method	n	Results Returned
Single offset	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.

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	
0	Returns unprocessed I/Q trace data, as a series of comma-separated trace points, 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,

n	
not specified or n=1	Returns the following comma-separated scalar results: 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 measurements. 2. **Peak phase error** is a floating point number (in degrees) of the peak phase error of all the symbol decision points. rms averaging does not affect this calculation. 3. **Peak phase symbol** is a floating point number (in symbols) representing the symbol 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. 5. **I/Q origin offset** is a floating point number (in dB) of the I and Q error (magnitude squared) offset from the origin. 6. **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. **Bit 0 offset** is an integer number for the sample point in a phase error vector trace that represents the bit 0 (zero) decision point. The sample points in the trace are numbered 0 to N. 8. **Sync start** is an integer number for the bit number, within the data bits trace, that represents the start of the sync word. 9. **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.
2, and **Multi View** is the selected view	Returns a series of floating point numbers (in degrees) that represent each sample in the phase error trace. The first number is the symbol 0 decision point and there are 10 points per symbol. Therefore, decision points are at 0, 10, 20, etc.
3, and **Multi View** is the selected view	Returns a series of floating point numbers (in degrees) that represent each sample in the phase error with frequency trace. Phase error with frequency is the error vector between the measured phase (that has not had frequency compensation) and the ideal reference phase. The calculation is based on symbol decision points and points halfway between symbol decision points (i.e. 2 points/symbol). The first number is the symbol 0 decision point and there are 10 points per symbol. Therefore, decision points are at 0, 10, 20, etc.
4, and **Multi View** is the selected view	Returns a series of floating point numbers that represent each sample in the log magnitude trace of the original time record. Each number represents a value (in dBm) of the time record.

n	
5, and **IQ Measured Polar Vector** is the selected view	Returns a series of floating point numbers that alternately represent I and Q pairs of the corrected measured trace. 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 rms phase error, there are ten points per symbol, so that: 1st number = I of the symbol 0 decision point 2nd number = Q of the symbol 0 decision point . . . 10th number = Q of the symbol 0 decision point 11th number = I of the symbol 1 decision point 12th number = Q of the symbol 1 decision point . . . 10 × Nth number = Q of the symbol N decision point
6, and **Multi View** is the selected view	Returns a series of logical values (0 or 1) that represent the demodulated bit value of the measured waveform. The first number is the symbol 0 decision point and there are 10 points per symbol. Therefore, decision points are at 0, 10, 20, etc.

Power versus 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 the GSM or Service 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.

Measurement Results Available

n	Results Returned
0	Returns unprocessed I/Q trace data, as a series of comma-separated trace points, 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.

n	Results Returned
not specified or n=1	Returns the following comma-separated 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 8. **Burst width** 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 $\mathbf{T}_0$ values. (e.g. for *n*=2, Start (for the IQ trace data) = Start + IQ_point_delta)
2	Returns comma-separated trace points of the entire captured I/Q trace 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**.
3	Returns comma-separated points representing the upper mask (in dBm).
4	Returns comma-separated points representing the lower mask (in dBm).

Spectrum (Frequency Domain) Measurement

This measures the amplitude of your input signal with respect to the frequency. It provides spectrum analysis capability using FFT (fast Fourier transform) measurement techniques. You must select the appropriate mode using INSTrument:SELect, to use these commands.

The general functionality of CONFigure, FETCh, MEASure, and READ are described at the beginning of this section. See the SENSe:SPECtrum commands for more measurement related commands.

:CONFigure:SPECtrum

:FETCh:SPECtrum[n]?

:READ:SPECtrum[n]?

:MEASure:SPECtrum[n]?

Front Panel Access: **Measure, Spectrum (Freq Domain)**

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 series of comma-separated trace points, 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.

n	Results Returned
not specified or n=1	Returns the following comma-separated scalar results: 1. **FFT peak** is the FFT peak amplitude. 2. **FFT frequency** is the FFT frequency of the peak amplitude. 3. **FFT points** is the Number of points in the FFT spectrum. 4. **First FFT frequency** is the frequency of the first FFT point of the spectrum. 5. **FFT spacing** is the frequency spacing between the FFT points of the spectrum. 6. **Time domain points** is the number of points in the time domain trace used for the FFT. 7. **First time point** is the time of the first time domain point, where time zero is the trigger event. 8. **Time spacing** is the time spacing between the time domain points. 9. **Time domain** returns a 1, if time domain is complex (I/Q), or 0 if it is real. (raw ADC samples) 10. **Scan time** is the total scan time of the time domain trace used for the FFTThe total scantime = (time spacing) x (time domain points – 1) 11. **Current average count** is the current number of data measurements that have already been combined, in the averaging calculation.
2, **Service** mode only	Returns the trace data of the log-magnitude versus time. (That is, the RF envelope.)
3	Returns the I and Q trace data. It is represented by I and Q pairs (in volts) versus time.
4	Returns spectrum trace data. That is, the trace of log-magnitude versus frequency. (The trace is computed using a FFT.)
5, **Service** mode only	Returns the averaged trace data of log-magnitude versus time. (That is, the RF envelope.)
6	Not used.
7	Returns the averaged spectrum trace data. That is, the trace of the averaged log-magnitude versus frequency.
8	Not used.
9, **Service** mode only	Returns a trace containing the shape of the FFT window.
10, **Service** mode only	Returns trace data of the phase of the FFT versus frequency.

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
0	Returns unprocessed I/Q trace data, as a series of comma-separated trace points, 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.
not specified or n=1	Returns 3 comma-separated scalar results: 1. The worst spur's frequency difference from channel center frequency (in MHz) 2. The worst spur's amplitude difference from the limit (in dB) 3. The worst spur's amplitude difference from the mean transmit power (in dB)
2	Returns trace of the segment containing the worst spur.

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
0	Returns unprocessed I/Q trace data, as a series of comma-separated trace points, 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.

n	Results Returned
not specified or n=1	Returns the following comma-separated 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).
2	Returns comma-separated trace points of the entire captured trace 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**.

Waveform (Time Domain) Measurement

This measures the power in your input signal with respect to time and is equivalent to zero-span operation in a traditional spectrum analyzer. You must select the appropriate mode using INSTrument:SELect, to use these commands.

The general functionality of CONFigure, FETCh, MEASure, and READ are described at the beginning of this section. See the SENSe:WAVeform commands for more measurement related commands.

:CONFigure:WAVeform

:FETCh:WAVeform[n]?

:READ:WAVeform[n]?

:MEASure:WAVeform[n]?

Front Panel Access: **Measure, Waveform (Time Domain)**

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 series of comma-separated trace points, 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.

n	Results Returned
not specified or n=1	Returns the following comma-separated 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. **Mean power** is the mean power (in dBm). This is either the power across the entire trace, or the power between markers if the markers are enabled. If averaging is on, the power is for the latest acquisition. 3. **Mean power averaged** is the power (in dBm) for N averages, if averaging is on. This is either the power across the entire trace, or the power between markers if the markers are enabled. If averaging is on, the power is for the latest acquisition. If averaging is off, the value of the mean power averaged is the same as the value of the mean power. 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. **Peak-to-mean ratio** has units of dB. This is the ratio of the maximum signal level to the mean power. Valid values are only obtained with averaging turned off. If averaging is on, the peak-to-mean ratio is calculated using the highest peak value, rather than the displayed average peak value. 6. **Maximum value** is the maximum of the most recently acquired data (in dBm). 7. **Minimum value** is the minimum of the most recently acquired data (in dBm).
2	Returns comma-separated trace points of the entire captured trace 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**.

READ Subsystem

:READ:<measurement>[n]?

The READ? commands are used with several other commands and are documented in the section on the “MEASure Group of Commands” on page 24.

SENSe Subsystem

Sets the instrument state parameters so that you can measure the input signal.

Select the ARFCN - Absolute RF Channel Number

[:SENSe]:CHANnel:ARFCn|RFCHannel <integer>

[:SENSe]:CHANnel:ARFCn|RFCHannel?

Set the analyzer to a frequency that corresponds to the ARFCN (Absolute RF Channel Number).

Factory Preset and *RST: 38

Range: 0 to 124, and 975 to 1023 for E-GSM

1 to 124 for P-GSM

0 to 124, and 955 to 974 for R-GSM

512 to 885 for DCS1800

512 to 810 for PCS1900

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

Global to the current mode.

History: Version A.03.00 or later

Front Panel Access: **FREQUENCY Channel, ARFCN**

Select the Lowest ARFCN

[:SENSe]:CHANnel:ARFCn|RFCHannel:BOTTom

Set the analyzer to the frequency of the lowest ARFCN (Absolute RF Channel Number).

Factory Preset and *RST: 975 for E-GSM

1 for P-GSM

955 for R-GSM

512 for DCS1800

512 PCS1900

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

Global to the current mode.

History: Version A.03.00 or later

Front Panel Access: **FREQUENCY Channel, ARFCN**

Select the Middle ARFCN

[:SENSe]:CHANnel:ARFCn|RFCHannel:MIDDle

Set the analyzer to the frequency of the middle ARFCN (Absolute RF Channel Number).

Factory Preset and *RST: 38 for E-GSM

63 for P-GSM

28 for R-GSM

699 for DCS1800

661 for PCS1900

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

Global to the current mode.

History: Version A.03.00 or later

Front Panel Access: **FREQUENCY Channel, ARFCN**

Select the Highest ARFCN

[:SENSe]:CHANnel:ARFCn|RFCHannel:TOP

Set the analyzer to the frequency of the highest ARFCN (Absolute RF Channel Number).

Factory Preset and *RST: 124 for E-GSM

124 for P-GSM

124 for R-GSM

885 for DCS1800

810 for PCS1900

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

Global to the current mode.

History: Version A.03.00 or later

Front Panel Access: **FREQUENCY Channel, ARFCN**

Channel Burst Type

[:SENSe]:CHANnel:BURSt NORMal|SYNC|ACCess

[:SENSe]:CHANnel:BURSt?

Set the training sequence code that the analyzer will search for and sync to. This only applies with normal burst selected.

Normal: Traffic Channel (TCH) and Control Channel (CCH)

Sync: Synchronization Channel (SCH)

Access: Random Access Channel (RACH)

Example: info

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, Burst Type**

Slot number

[:SENSe]:CHANnel:SLOT <integer>

[:SENSe]:CHANnel:SLOT?

Select the slot number that you want to measure.

In GSM mode the measurement frame is divided into the eight expected measurement timeslots. Optimum alignment of these measurement timeslots with the actual data timeslots may require some trigger time delay. A trigger delay of about 20 ms is a reasonable offset to use for a typical signal.

Factory Preset and *RST: 0 for GSM, PDC mode

1 for NADC mode

Range: 0 to 5 for PDC mode

1 to 6 for NADC mode

0 to 7 for GSM mode

Remarks: The command is only applicable for mobile station testing, device = MS.

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

Slot Auto

[:SENSe]:CHANnel:SLOT:AUTO OFF|ON|0|1

[:SENSe]:CHANnel:SLOT:AUTO?

Select auto or manual control for slot searching. With auto on, the measurement is made on the first burst found to have one of the valid slots in the range. With auto off, the measurement is made on the 1st burst found to have the slot number that is indicated by the sync word.

Factory Preset and *RST: On, for NADC, PDC mode

Off, for GSM mode

Remarks: The command is only applicable for mobile station testing, device = MS.

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

History: Added GSM mode, version A.03.00 or later

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 and *RST: 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.

History: Version A.03.00 or later

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 and *RST: 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)**

Correction for BTS RF Port External Attenuation

[:SENSe]:CORRection:BTS[:RF]:LOSS <rel_power>

[:SENSe]:CORRection:BTS[:RF]:LOSS?

Set equal to the external attenuation used when measuring base transmit stations.

Factory Preset and *RST: 0 dB

Range: 0 to 100 dB for GSM

–50 to 50 dB for cdma2000, W-CDMA

Default Unit: dB

Remarks: Global to the current mode.

You must be in the GSM, cdma2000, or W-CDMA mode to use this command. Use INSTrument:SELect to set the mode.

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 24. 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 Measurement 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 (terminal control) setting determines the averaging action.

Factory Preset and *RST: 20

Range: 1 to 10,000

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

Output RF Spectrum Measurement Fast Averaging

[:SENSe]:ORFSpectrum:AVERage:FAST[:STATe] OFF|ON|0|1

[:SENSe]:ORFSpectrum:AVERage:FAST[:STATe]?

Make the measurement faster by using an averaging technique different from that defined by the standard. A valid average can be obtained by measuring the power in half the normal number of bursts. You then average the power measured in two different bands within each burst, rather than the usual single band.

This faster averaging is only done when averaging is on and only the modulation results are being measured. If both modulation and switching transients results are being measured, then the measurement uses the default averaging.

Factory Preset and *RST: On

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

Output RF Spectrum Measurement Averaging Type for Modulation Spectrum

[:SENSe]:ORFSpectrum:AVERage:MODulation:TYPE LOG|RMS

[:SENSe]:ORFSpectrum:AVERage:MODulation:TYPE?

Select the type of averaging for measuring the modulation spectrum. 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.

Log - The log of the power is averaged. (This is also known as video averaging.)

RMS - The power is averaged, providing the rms of the voltage.

Factory Preset and *RST: Log power (Video)

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

Output RF Spectrum Measurement Averaging Control

[:SENSe]:ORFSpectrum:AVERage[:STATe] OFF|ON|0|1

[:SENSe]:ORFSpectrum:AVERage[:STATe]?

Turn averaging on or off.

Factory Preset and *RST: On

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

Output RF Spectrum Measurement Resolution BW for the Modulation Spectrum at the Carrier

[:SENSe]:ORFSpectrum:BANDwidth|BWIDth[:RESolution]:MODulation:CARRier <freq>

[:SENSe]:ORFSpectrum:BANDwidth|BWIDth[:RESolution]:MODulation:CARRier?

Brief description text.

Factory Preset and *RST: 30 kHz

Range: 1 kHz to 5 MHz

Default Unit: Hz

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

Output RF Spectrum Measurement Resolution BW for Modulation at Close Offsets

[:SENSe]:ORFSpectrum:BANDwidth|BWIDth[:RESolution]:MODulation:OFFSet:CLOSe <freq>

[:SENSe]:ORFSpectrum:BANDwidth|BWIDth[: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. This parameter is only used with the Standard or Short lists, and not with the Custom list.

Factory Preset and *RST: 30 kHz

Range: 1 kHz to 5 MHz

Default Unit: Hz

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

Output RF Spectrum Measurement Resolution BW for Modulation at Far Offsets

[:SENSe]:ORFSpectrum:BANDwidth|BWIDth[:RESolution]:MODulation:OFFSet:FAR <freq>

[:SENSe]:ORFSpectrum:BANDwidth|BWIDth[: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. This parameter is only used with the Standard or Short lists, and not with the Custom list.

Factory Preset and *RST: 100 kHz

Range: 1 kHz to 5 MHz

Default Unit: Hz

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

Output RF Spectrum Measurement Resolution BW for the Switching Transient Spectrum at the Carrier

[:SENSe]:ORFSpectrum:BANDwidth|BWIDth[:RESolution]:SWITching:CARRier <freq>

[:SENSe]:ORFSpectrum:BANDwidth|BWIDth[:RESolution]:SWITching:CARRier?

Brief description text.

Factory Preset and *RST: 300 kHz

Range: 1 kHz to 5 MHz

Default Unit: Hz

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

Output RF Spectrum Measurement Resolution BW for Switching Transient at Close Offsets

[:SENSe]:ORFSpectrum:BANDwidth|BWIDth[:RESolution] :SWITching:OFFSet:CLOSe <freq>

[:SENSe]:ORFSpectrum:BANDwidth|BWIDth[: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. This parameter is only used with the Standard or Short lists, and not with the Custom list.

Factory Preset and *RST: 30 kHz

Range: 1 kHz to 5 MHz

Default Unit: Hz

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

Output RF Spectrum Measurement Resolution BW for Switching Transient at Far Offsets

[:SENSe]:ORFSpectrum:BANDwidth|BWIDth[:RESolution] :SWITching:OFFSet:FAR <freq>

[:SENSe]:ORFSpectrum:BANDwidth|BWIDth[: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. This parameter is only used with the standard or short lists, and not with the custom list.

Factory Preset and *RST: 30 kHz

Range: 1 kHz to 5 MHz

Default Unit: Hz

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

Output RF Spectrum Measurement Define Custom Modulation Offset Frequency List

[:SENSe]:ORFSpectrum:LIST:MODulation[:FREQuency] <offset freq>{,<offset freq>}

[:SENSe]:ORFSpectrum:LIST:MODulation[:FREQuency]?

Define the custom set of offset frequencies at which the modulation spectrum part of the ORFS measurement will be made. The first offset specified must be 0 Hz for the carrier. For each offset frequency specified, the power will be measured at both the lower and upper offsets. Up to 13 (+ the 0 Hz carrier frequency) offset frequencies may be defined.

Factory Preset and *RST: Same as standard list

Range: 10 kHz to 10 MHz

Default Unit: Hz

Remarks: This command is only valid if SENS:ORFS:MEAS is set to multiple.

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

Output RF Spectrum Measurement Define Custom Modulation Resolution Bandwidth List

[:SENSe]:ORFSpectrum:LIST:MODulation:BANDwidth|BWIDth <res bw>{,<res bw>}

[:SENSe]:ORFSpectrum:LIST:MODulation:BANDwidth|BWIDth?

Define the custom set of resolution bandwidths for the modulation spectrum part of the ORFS measurement. The first bandwidth specified must be 0 Hz, for the carrier. Each resolution bandwidth in this list corresponds to an offset frequency in the modulation offset frequency list. The number of items in each of these lists needs to be the same.

Factory Preset and *RST: Same as standard list

Range: 1 kHz to 5 MHz

Default Unit: Hz

Remarks: This command is only valid if SENS:ORFS:MEAS is set to multiple.

You must be in the GSM mode to use this command.

Use INSTrument:SELect to set the mode.

Output RF Spectrum Measurement Define Custom Modulation Level Offsets

[:SENSe]:ORFSpectrum:LIST:MODulation:LOFFset <level>{,<level>}

[:SENSe]:ORFSpectrum:LIST:MODulation:LOFFset?

Define the custom set of level offsets for the modulation spectrum part of the ORFS measurement. This allows you to modify the limit test by adding a delta amplitude value. The first level offset specified must be 0 dB for the carrier. Each level offset in this list corresponds to an offset frequency in the modulation offset frequency list. The number of items in each of these lists needs to be the same.

Factory Preset and *RST:	Same as standard list
Range:	0 to 50 dB
Default Unit:	dB
Remarks:	This command is only valid if SENS:ORFS:MEAS is set to multiple. You must be in the GSM mode to use this command. Use INSTrument:SELect to set the mode.
History:	Version A.03.00 or later

Output RF Spectrum Measurement Select List

[:SENSe]:ORFSpectrum:LIST:SELect CUSTom|SHORt|STANdard

[:SENSe]:ORFSpectrum:LIST:SELect?

Select the list of settings that will be used to make the ORFS measurement. This specifies standard or customized lists. The lists contain the offset frequencies (and bandwidths) that are used for the modulation spectrum and transient spectrum parts of the ORFS 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 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 and *RST: Short

Remarks: This command is only valid if SENS:ORFS:MEAS is set to multiple.

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

Output RF Spectrum Measurement Define Custom Switching Transient Offset Frequency List

[:SENSe]:ORFSpectrum:LIST:SWITching[:FREQuency] <offset freq>{,<offset freq>}

[:SENSe]:ORFSpectrum:LIST:SWITching[:FREQuency]?

Define the custom set of offset frequencies at which the switching transient spectrum part of the ORFS measurement will be made. The first offset specified must be 0 Hz, for the carrier. For each offset frequency specified, the power will be measured at both the lower and upper offsets. Up to 4 (+ the 0 Hz carrier frequency) offset frequencies may be defined.

Factory Preset and *RST: Same as standard list

Range: 10 kHz to 10 MHz

Default Unit: Hz

Remarks: This command is only valid if SENS:ORFS:MEAS is set to multiple.

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

Output RF Spectrum Measurement Define Custom Switching Transient Resolution Bandwidth List

[:SENSe]:ORFSpectrum:LIST:SWITching:BANDwidth|BWIDth <res bw>{,<res bw>}

[:SENSe]:ORFSpectrum:LIST:SWITching:BANDwidth|BWIDth?

Define the custom set of resolution bandwidths for the switching transient spectrum part of the ORFS measurement. The first bandwidth specified must be 0 Hz, for the carrier. Each resolution bandwidth in this list corresponds to an offset frequency in the switching transient offset frequency list. The number of items in each of these lists needs to be the same.

Factory Preset and *RST: Same as standard list

Range: 1 kHz to 5 MHz

Default Unit: Hz

Remarks: This command is only valid if SENS:ORFS:MEAS is set to multiple.

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

Output RF Spectrum Measurement Define Custom Switching Transient Level Offsets

[:SENSe]:ORFSpectrum:LIST:SWITching:LOFFset <level>{,<level>}

[:SENSe]:ORFSpectrum:LIST:SWITching:LOFFset?

Define the custom set of level offsets for the switching transient spectrum part of the ORFS measurement. This allows you to modify the limit test by adding a delta amplitude value. The first level offset specified must be 0 dB for the carrier. Each level offset in this list corresponds to an offset frequency in the modulation offset frequency list. The number of items in each of these lists needs to be the same.

Factory Preset and *RST: Same as standard list

Range: 0 to 50 dB

Default Unit: dB

Remarks: This command is only valid if SENS:ORFS:MEAS is set to multiple.

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

History: Version A.03.00 or later

Output RF Spectrum Measure Offsets

[:SENSe]:ORFSpectrum:MEASure MULTiple|SINGle

[:SENSe]:ORFSpectrum:MEASure?

Select the measurement to be done at all offsets or at a single offset.

Multiple - the measurement will be done at all offsets in the offset frequency list.

Single - the measurement will be 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.

Factory Preset and *RST: Multiple

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

Output RF Spectrum Measurement 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 and *RST: 250 kHz

Range: –12.0 MHz to +12.0 MHz, step size: steps through the values in the selected offset frequency list

Default Unit: Hz

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

Output RF Spectrum Measurement Trigger Source

[:SENSe]:ORFSpectrum:TRIGger:SOURce EXTernal[1]|EXTernal 2|FRAMe|IF|IMMediate|RFBurst

[:SENSe]:ORFSpectrum: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)

RF Burst - internal wideband RF burst envelope trigger that has

automatic level control for periodic burst signals

Factory Preset and *RST: RF burst

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

Output RF Spectrum Measurement Type

[:SENSe]:ORFSpectrum:TYPE MODulation|MSWitching|SWITching

[:SENSe]:ORFSpectrum:TYPE?

Select the measurement type.

Modulation - only the modulation spectrum is measured.

Modulation & Switching - both modulation and switching transient spectrums are measured.

Switching - only the switching transient spectrum is measured.

Factory Preset and *RST: Modulation

Remarks: You must be in the GSM 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 24. 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 Measurement 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 (terminal control) setting determines the averaging action.

Factory Preset and *RST: 10

Range: 1 to 10,000

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

Phase & Frequency Error Measurement Averaging State

[:SENSe]:PFERror:AVERage[:STATe] OFF|ON|0|1

[:SENSe]:PFERror:AVERage[:STATe]?

Turn averaging on or off.

Factory Preset and *RST: Off

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

Phase & Frequency Error Measurement Averaging Mode

[:SENSe]:PFERror:AVERage:TCONtrol EXPonential|REPeat

[:SENSe]:PFERror:AVERage:TCONtrol?

Select the type of terminal control used for averaging. This determines the averaging action after the specified number of bursts (average count) is reached.

Exponential - Each successive data acquisition after the average count is reached, 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 and *RST: Repeat

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

Phase & Frequency Error Measurement Burst Synchronization Source

[:SENSe]:PFERror:BSYNc:SOURce NONE|RFBurst|TSEQuence

[:SENSe]:PFERror:BSYNc:SOURce?

Select the method of synchronizing the measurement to the GSM bursts.

None - no burst synchronization is used

RF Burst - the RF amplitude burst sync approximates the start and stop of the useful part of the burst without demodulation of the burst.

Training Sequence - 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.

Factory Preset and *RST: Training sequence

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

Phase & Frequency Error Measurement Trigger Source

[:SENSe]:PFERror:TRIGger:SOURce EXTernal[1]|EXTernal 2|FRAMe|IF|IMMediate|RFBurst

[:SENSe]:PFERror: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)

RF Burst - internal wideband RF burst envelope trigger that has automatic level control for periodic burst signals.

Factory Preset and *RST: RF burst

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

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 24. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **Power vs Time** measurement has been selected from the **MEASURE** key menu.

Power vs. Time Measurement 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 (terminal control) setting determines the averaging action.

Factory Preset and *RST: 10

Range: 1 to 10,000

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

Power vs. Time Measurement Averaging State

[:SENSe]:PVTime:AVERage[:STATe] OFF|ON|0|1

[:SENSe]:PVTime:AVERage[:STATe]?

Turn averaging on or off.

Factory Preset and *RST: Off

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

Power vs. Time Measurement Averaging Mode

[:SENSe]:PVTime:AVERage:TCONtrol EXPonential|REPeat

[:SENSe]:PVTime:AVERage:TCONtrol?

Select the type of terminal control used for averaging. This specifies the averaging action after the specified number of bursts (average count) is reached.

Exponential - Each successive data acquisition after the average count is reached, 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 and *RST: Exponential

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

Power vs. Time Measurement Averaging Type

[:SENSe]:PVTime:AVERage:TYPE LOG|MAXimum|MINimum|RMS

[:SENSe]:PVTime:AVERage:TYPE?

Select the type of averaging.

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.

RMS - The power is averaged, providing the rms of the voltage.

Factory Preset and *RST: RMS

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

Power vs. Time Measurement Resolution BW

[:SENSe]:PVTime:BANDwidth|BWIDth[:RESolution] <freq>

[:SENSe]:PVTime: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 and *RST: 500 kHz

Range: 1 kHz to 5 MHz

Default Unit: Hz

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

Power vs. Time Measurement RBW Filter Type

[:SENSe]:PVTime:BANDwidth|BWIDth[:RESolution]:TYPE FLATtop|GAUSsian

[:SENSe]:PVTime:BANDwidth|BWIDth[:RESolution]:TYPE?

Select the type of resolution BW filter. 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.

Flattop - a filter with a flat amplitude response, which provides the best amplitude accuracy.

Gaussian - a filter with Gaussian characteristics, which provides the best pulse response.

Factory Preset and *RST: Gaussian

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

Power vs. Time Measurement Burst Synchronization Source

[:SENSe]:PVTime:BSYNc:SOURce RFBurst|TSEQuence

[:SENSe]:PVTime:BSYNc:SOURce?

Select the method of synchronizing the measurement to the GSM bursts.

RF Burst - the RF burst sync approximates the start and stop of the useful part of the burst without digital demodulation of the burst.

Training Sequence - 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.

Factory Preset and *RST: RF burst

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

Power vs. Time Measurement Lower Mask Absolute Amplitude Levels

[:SENSe]:PVTime:MASK:LIST:LOWer:ABSolute <power>{,<power>}

[:SENSe]:PVTime:MASK:LIST:LOWer:ABSolute?

Enter the absolute power level for any of your mask line segments that require absolute limits in addition to their relative limits. The defined relative mask values are normally used as the limits for testing. If the power of the reference level is decreased, all of these relative mask power levels will decrease by the same amount until they reach a defined minimum absolute power. Then that absolute power will be used as the test limit.

Any portion of the signal that has no limit line segment defined for it, will default its to a very low limit (–200 dBm). Because of this, all data in that undefined area will pass the test.

Factory Preset

and *RST: Selected GSM standard

Range: –200 dBm to +100 dBm

Default Unit: dBm

Remarks: You need power values for each of the defined time points. You must put a comma in the SCPI command as a place holder for any points where an absolute power is not specified.

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

History: Revision A.03.00 or later

Power vs. Time Measurement 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 mode to use this command. Use INSTrument:SELect to set the mode.

History: Revision A.03.00 or later

Power vs. Time Measurement Lower Mask Relative Amplitude Levels

[:SENSe]:PVTime:MASK:LIST:LOWer:RELative <rel_power>{,<rel_power>}

[:SENSe]:PVTime:MASK:LIST:LOWer:RELative?

Enter the relative power level for each of the horizontal line segments in the lower limit mask. There should be a power level for each time point entered using [:SENSe]:PVTime:MASK:LIST:LOWer:TIME. 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 mask have been defined, the Reference Power Level is the mid-point between these two limits at time t_0.

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 and *RST: Selected GSM standard

Range: +200 dB to –100 dB, relative to the reference power

Default Unit: dB

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

History: Revision A.03.00 or later

Power vs. Time Measurement Lower Mask Time Points

[:SENSe]:PVTime:MASK:LIST:LOWer:TIME <seconds>{,<seconds>}

[:SENSe]:PVTime:MASK:LIST:LOWer:TIME?

Enter the ending points for the horizontal line segments that define the lower limit mask. All the line segments begin at the time = t_0 reference point at the center of the useful data (usually the center of the burst). For example, all the mask line segments to the right of t_0 will have positive time values that get successively larger, while those to the left get successively more negative. See Figure 1-2 on page 69.

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.

Factory Preset and *RST: 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 the GSM mode to use this command. Use INSTrument:SELect to set the mode.

History: Revision A.03.00 or later

Power vs. Time Measurement 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 and *RST: Standard

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

History: Revision A.03.00 or later

Power vs. Time Measurement Upper Mask Absolute Amplitude Levels

[:SENSe]:PVTime:MASK:LIST:UPPer:ABSolute <power>{,<power>}

[:SENSe]:PVTime:MASK:LIST:UPPer:ABSolute?

Enter the absolute power level for any of your mask line segments that require absolute limits in addition to their relative limits. The defined relative mask values are normally used as the limits for testing. If the power of the reference level is increased, all of these relative mask power levels will increase by the same amount until they reach a defined maximum absolute power. Then that absolute power will be used as the test limit. See Figure 1-2 on page 69.

Any portion of the signal that has no limit line segment defined for it, will default its to a very high limit (100 dBm). Because of this, all data in that undefined area will pass the test.

Example: **PVT:mask:list:upper:abs -68,,0,,,,-68**

Factory Preset and *RST: Selected GSM standard

Range: –200 dBm to +100 dBm

Default Unit: dBm

Remarks: You need power values for each of the defined time points. You must put a comma in the SCPI command as a place holder for any points where an absolute power is not specified.

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

History: Revision A.03.00 or later

Power vs. Time Measurement 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 mode to use this command. Use INSTrument:SELect to set the mode.

History: Revision A.03.00 or later

Power vs. Time Measurement Upper Mask Relative Amplitude Levels

[:SENSe]:PVTime:MASK:LIST:UPPer:RELative

<rel_power>{,<rel_power>}

[:SENSe]:PVTime:MASK:LIST:UPPer:RELative?

Enter the relative power level for each of the horizontal line segments in the upper limit mask. There should be a power level for each time point entered using [:SENSe]:PVTime:MASK:LIST:UPPer:TIME. 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 mask have been defined, the Reference Power Level is the mid-point between these two limits at time t_0. See Figure 1-2 on page 69.

Any portion of the signal that has no limit line segment defined for it, will default to a very high limit (200 dB above the reference power). This will keep the measurement from indicating a failure for that portion of the data.

Example: **PVT:mask:list:upper:rel -43,-25,7,4,4,-32,-48**

Factory Preset and *RST: Selected GSM standard

Range: 200 dB to –100 dB, relative to the reference power

Default Unit: dB

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

History: Revision A.03.00 or later

Power vs. Time Measurement Upper Mask Time Points

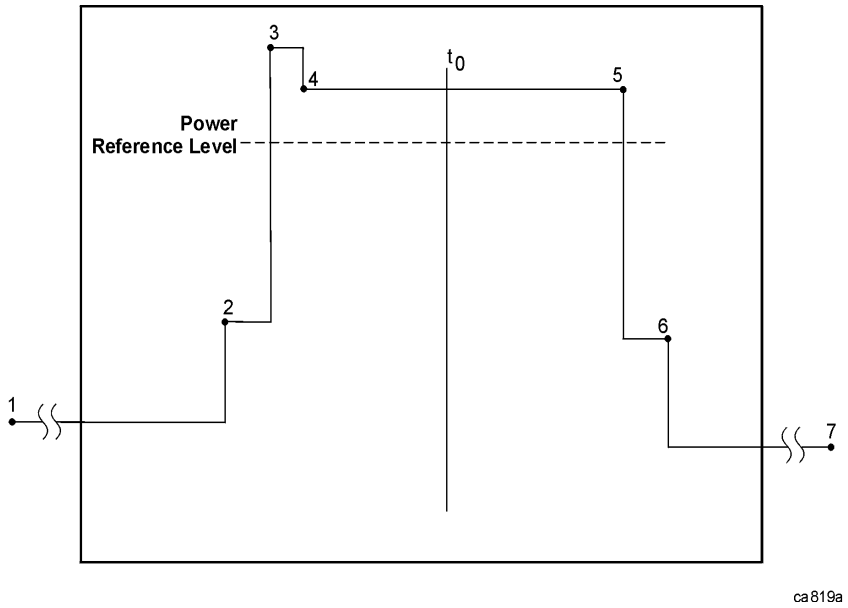
[:SENSe]:PVTime:MASK:LIST:UPPer:TIME <seconds>{,<seconds>}

[:SENSe]:PVTime:MASK:LIST:UPPer:TIME?

Enter the ending points for the horizontal line segments that define the upper limit mask. All the line segments begin at the time = t_0 reference point at the center of the useful data (usually the center of the burst). For example, all the mask line segments to the right of t_0 will have positive time values that get successively larger, while those to the left get successively more negative.

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.

Figure 1-2 Custom Upper Limit Mask Example



Mask Segment	Selected Time Value	Selected Relative Power (with Ref Level = –12 dBm)		Selected Absolute Power	Segment Position on Screen
		Selected Power	Equivalent Absolute Power		
1	–1 sec	–43 dB	–55 dBm	–68 dBm	–55
2	–300 µs	–25 dB	–37 dBm		–37
3	–280 µs	7 dB	–5 dBm	0 dBm[a]	0[a]
4	–270 µs	4 dB	–8 dBm		–8
5	280 µs	4 dB	–8 dBm		–8
6	295 µs	–32 dB	–44 dBm		–44
7	1 sec	–48 dB	–60 dBm	–68 dBm	–60

a. The zero value was selected because the absolute power specifies the lowest allowed value of the mask, in this case 0 dBm.

Example: **PVT:mask:list:upper:time -1, -300e-6, -280e-6, -270e-6, 280e-6, 295e-6, 1**

Factory Preset and *RST: 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 the GSM mode to use this command. Use INSTrument:SELect to set the mode.

History: Revision A.03.00 or later

Power vs. Time Measurement Sweep Time

[:SENSe]:PVTime:SWEep:TIME <integer>

[:SENSe]:PVTime:SWEep:TIME?

Set the number of slots which are used in each data acquisition. Each slot is approximately equal to 570 ms. The measurement is made for a small additional amount of time (about 130 µs) in order to view the burst edges.

Factory Preset and *RST: 1

Range: 1 to 50 (for resolution BW = 500 kHz)

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

Power vs. Time Measurement Trigger Source

[:SENSe]:PVTime:TRIGger:SOURce EXTernal[1]|EXTernal 2|FRAMe|IF|IMMediate|RFBurst

[:SENSe]:PVTime: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).

RF Burst - internal wideband RF burst envelope trigger that has automatic level control for periodic burst signals.

Factory Preset and *RST: RF burst

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

Radio Carrier Hopping

[:SENSe]:RADio:CARRier:HOP OFF|ON|0|1

[:SENSe]:RADio:CARRier:HOP?

Turns the carrier hopping mode on and off.

Factory Preset and *RST: Off

Remarks: Global to the current mode.

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

History: Version A.03.00 or later

Front Panel Access: **Mode Setup, Radio, Carrier**

Radio Carrier Burst

[:SENSe]:RADio:CARRier[:TYPE] BURSt|CONTinuous

[:SENSe]:RADio:CARRier[:TYPE]?

Select the type of RF carrier on the device to be tested.

Factory Preset and *RST: Burst

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

Global to the current mode.

History: Version A.03.00 or later

Front Panel Access: **Mode Setup, Radio, Carrier**

Radio Standard Band

[:SENSe]:RADio:STANdard:BAND EGSM|PGSM|RGSM|DCS1800|PCS1900

[:SENSe]:RADio:STANdard:BAND?

Select the standard variant that applies to the radio to be tested.

EGSM - Extended GSM in the 900 MHz band

PGSM - Primary 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

Factory Preset and *RST: Extended GSM

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: **Mode Setup, Radio, Band**

Spectrum (Frequency-Domain) Measurement

Commands for querying the spectrum measurement results and for setting to the default values are found in the "MEASure Group of Commands" on page 24. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **Spectrum (Freq Domain)** measurement has been selected from the **MEASURE** key menu.

Spectrum Measurement Data Acquisition Packing

[:SENSe]:SPECtrum:ACQuisition:PACKing AUTO|LONG|MEDium|SHORt

[:SENSe]:SPECtrum:ACQuisition:PACKing?

Select the amount of data acquisition packing. This is an advanced control that normally does not need to be changed.

Factory Preset and *RST: Auto

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Spectrum Measurement ADC Dither

[:SENSe]:SPECtrum:ADC:DITHer[:STATe] AUTO|ON|OFF|2|1|0

[:SENSe]:SPECtrum:ADC:DITHer[:STATe]?

Turn the ADC dither on or off. This is an advanced control that normally does not need to be changed.

Factory Preset and *RST: Auto

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Spectrum Measurement ADC Range

[:SENSe]:SPECtrum:ADC:RANGe AUTO|APEak|APLock|M6|P0|P6|P12|P18|P24|

[:SENSe]:SPECtrum:ADC:RANGe?

Select the range for the gain-ranging that is done in front of the ADC. This is an advanced control that normally does not need to be changed. Auto peak ranging is the default for this measurement. If you are measuring a CW signal please see the description below.

- Auto - automatic range

  For FFT spectrums - auto ranging should not be not be used. An exception to this would be if you know that your signal is

"bursty". Then you might use auto to maximize the time domain dynamic range as long as you are not very interested in the FFT data.

- Auto Peak - automatically peak the range

  For CW signals, the default of auto-peak ranging can be used, but a better FFT measurement of the signal can be made by selecting one of the manual ranges that are available: M6, P0 - P24.
  Auto peaking can cause the ADC range gain to move monotonically down during the data capture. This movement should have negligible effect on the FFT spectrum, but selecting a manual range removes this possibility. Note that if the CW signal being measured is close to the auto-ranging threshold, the noise floor may shift as much as 6 dB from sweep to sweep.

- Auto Peak Lock - automatically peak lock the range

  For CW signals, auto-peak lock ranging may be used. It will find the best ADC measurement range for this particular signal and will not move the range as auto-peak can. Note that if the CW signal being measured is close to the auto-ranging threshold, the noise floor may shift as much as 6 dB from sweep to sweep.
  For "bursty" signals, auto-peak lock ranging should not be used. The measurement will fail to operate, since the wrong (locked) ADC range will be chosen often and overloads will occur in the ADC.

- M6 - manually selects an ADC range that subtracts 6 dB of fixed gain across the range. Manual ranging is best for CW signals.
- P0 to 24 - manually selects ADC ranges that add 0 to 24 dB of fixed gain across the range. Manual ranging is best for CW signals.

Factory Preset and *RST: Auto peak

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Spectrum Measurement Average Clear

[:SENSe]:SPECtrum:AVERage:CLEAr

The average data is cleared and the average counter is reset.

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Spectrum Measurement Number of Averages

[:SENSe]:SPECtrum:AVERage:COUNt <integer>

[:SENSe]:SPECtrum:AVERage:COUNt?

Set the number of 'sweeps' that will be averaged. After the specified number of 'sweeps' (average counts), the averaging mode (terminal control) setting determines the averaging action.

Factory Preset and *RST: 25

Range: 1 to 10,000

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Spectrum Measurement Averaging State

[:SENSe]:SPECtrum:AVERage[:STATe] OFF|ON|0|1

[:SENSe]:SPECtrum:AVERage[:STATe]?

Turn averaging on or off.

Factory Preset and *RST: On

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Spectrum Measurement Averaging Mode

[:SENSe]:SPECtrum:AVERage:TCONtrol EXPonential|REPeat

[:SENSe]:SPECtrum:AVERage:TCONtrol?

Select the type of terminal control used for averaging. This determines the averaging action after the specified number of 'sweeps' (average count) is reached.

Exponential - Each successive data acquisition after the average count is reached, 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 and *RST: Exponential

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Spectrum Measurement Averaging Type

[:SENSe]:SPECtrum:AVERage:TYPE LOG|MAXimum|MINimum|RMS|SCALar

[:SENSe]:SPECtrum:AVERage:TYPE?

Select the type of averaging.

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.

RMS – The power is averaged, providing the rms of the voltage.

Scalar – The voltage is averaged.

Factory Preset and *RST: Log

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Spectrum Measurement pre-ADC Bandpass Filter

[:SENSe]:SPECtrum:BANDwidth|BWIDth:PADC OFF|ON|0|1

[:SENSe]:SPECtrum:BANDwidth|BWIDth:PADC?

Turn the pre-ADC bandpass filter on or off. This is an advanced control that normally does not need to be changed.

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Spectrum Measurement pre-FFT BW Auto

[:SENSe]:SPECtrum:BANDwidth|BWIDth:PFFT:AUTO OFF|ON|0|1

[:SENSe]:SPECtrum:BANDwidth|BWIDth:PFFT:AUTO?

Select auto or manual control of the pre-FFT BW. This is an advanced control that normally does not need to be changed.

Auto - couples the pre-FFT BW to the frequency span.

Manual - the pre-FFT BW is uncoupled from the frequency span.

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Spectrum Measurement pre-FFT BW

[:SENSe]:SPECtrum:BANDwidth|BWIDth:PFFT[:SIZE] <freq>

[:SENSe]:SPECtrum:BANDwidth|BWIDth:PFFT[:SIZE]?

Set the pre-FFT bandwidth. This is an advanced control that normally does not need to be changed.

Frequency span, resolution bandwidth, and the pre-FFT bandwidth settings are normally coupled. If you are not auto-coupled, there can be combinations of these settings that are not valid.

Factory Preset

and *RST: 1.55 MHz

1.25 MHz for cdmaOne

155 kHz, for iDEN mode

Range: 1 Hz to 10 MHz

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Spectrum Measurement Pre-FFT BW Filter Type

[:SENSe]:SPECtrum:BANDwidth|BWIDth:PFFT:TYPE FLAT|GAUSsian

[:SENSe]:SPECtrum:BANDwidth|BWIDth:PFFT:TYPE?

Select the type of pre-FFT filter that is used. This is an advanced control that normally does not need to be changed.

Flat top- a filter with a flat amplitude response, which provides the best amplitude accuracy.

Gaussian - a filter with Gaussian characteristics, which provides the best pulse response.

Factory Preset and *RST: Flat top

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Spectrum Measurement Resolution BW

[:SENSe]:SPECtrum:BANDwidth|BWIDth[:RESolution] <freq>

[:SENSe]:SPECtrum:BANDwidth|BWIDth[:RESolution]?

Set the resolution bandwidth for the FFT. This is the bandwidth used for resolving the FFT measurement. It is not the pre-FFT bandwidth. This value is ignored if the function is auto-coupled.

Frequency span, resolution bandwidth, and the pre-FFT bandwidth settings are normally coupled. If you are not auto-coupled, there can be combinations of these settings that are not valid.

Factory Preset and *RST: 20 kHz

250 Hz, for iDEN mode

Range: 0.10 Hz to 3 MHz

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Spectrum Measurement Resolution BW Auto

[:SENSe]:SPECtrum:BANDwidth|BWIDth[:RESolution]:AUTO OFF|ON|0|1

[:SENSe]:SPECtrum:BANDwidth|BWIDth[:RESolution]:AUTO?

Select auto or manual control of the resolution BW. The automatic mode couples the resolution bandwidth setting to the frequency span.

Factory Preset and *RST: On

Off, for iDEN mode

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Decimation of Spectrum Display

[:SENSe]:SPECtrum:DECimate[:FACTor] <integer>

[:SENSe]:SPECtrum:DECimate[:FACTor]?

Set the amount of data decimation done by the hardware and/or the software. Decimation by 3 keeps every third sample, throwing away the two in between. Similarly, decimation by 5 keeps every fifth sample, throwing away the four in between.

Using zero (0) decimation selects the automatic mode. The measurement will then automatically choose decimation by “1” or “2” as is appropriate for the bandwidth being used. This is an advanced control that normally does not need to be changed.

Factory Preset and *RST: 0

Range: 0 to 1000, where 0 sets the function to automatic

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

History: Version A.02.00 or later

Spectrum Measurement FFT Length

[:SENSe]:SPECtrum:FFT:LENGth <integer>

[:SENSe]:SPECtrum:FFT:LENGth?

Set the FFT length. This value is only used if length control is set to manual. The value must be greater than or equal to the window length value. Any amount greater than the window length is implemented by zero-padding. This is an advanced control that normally does not need to be changed.

Factory Preset

and *RST: 4096

32768, for iDEN mode

Range: 8 to 1,048,576

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

History: Short form changed from LENgth to LENGth, A.03.00

Spectrum Measurement FFT Length Auto

[:SENSe]:SPECtrum:FFT:LENGth:AUTO OFF|ON|0|1

[:SENSe]:SPECtum:FFT:LENGth:AUTO?

Select auto or manual control of the FFT and window lengths.

This is an advanced control that normally does not need to be changed.

Auto - the window lengths are coupled to resolution bandwidth, window type (FFT), pre-FFT bandwidth (sample rate) and SENSe:SPECtrum:FFT:RBWPoints.

Manual - lets you set `SENSe:SPECtrum:FFT:LENGth` and `SENSe:SPECtrum:FFT:WINDow:LENGth`.

Factory Preset and *RST: Auto

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

History: Short form changed from LENgth to LENGth, A.03.00

Spectrum Measurement FFT Minimum Points in Resolution BW

[:SENSe]:SPECtrum:FFT:RBWPoints <real>

[:SENSe]:SPECtum:FFT:RBWPoints?

Set the minimum number of data points that will be used inside the resolution bandwidth. The value is ignored if length control is set to manual. This is an advanced control that normally does not need to be changed.

Factory Preset and *RST: 1.30

Range: 0.1 to 100

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Spectrum Measurement Window Length

[:SENSe]:SPECtrum:FFT:WINDow:LENGth <integer>

[:SENSe]:SPECtrum:FFT:WINDow:LENGth?

Set the FFT window length. This value is only used if length control is set to manual. This is an advanced control that normally does not need to be changed.

Factory Preset and *RST: 706

5648, for iDEN mode

Range: 8 to 1,048,576

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

History: Short form changed from LENgth to LENGth, A.03.00

Spectrum Measurement FFT Window

[:SENSe]:SPECtrum:FFT:WINDow[:TYPE] BH4Tap|BLACkman|FLATtop|GAUSsian|HAMMing|HANNing|KB70|KB90 |KB110|UNIForm

[:SENSe]:SPECtrum:FFT:WINDow[:TYPE]?

Select the FFT window type.

BH4Tap - Blackman Harris with 4 taps

Blackman - Blackman

Flat Top - flat top, the default (for high amplitude accuracy)

Gaussian - Gaussian with alpha of 3.5

Hamming - Hamming

Hanning - Hanning

KB70, 90, and 110 - Kaiser Bessel with sidelobes at –70, –90, or –110 dBc

Uniform - no window is used. (This is the unity response.)

Factory Preset and *RST: Flat top

Remarks: This selection affects the acquisition point quantity and the FFT size, based on the resolution bandwidth selected.

To use this command, the appropriate mode should be selected with INSTrument:SELect.

Spectrum Measurement Frequency Span

[:SENSe]:SPECtrum:FREQuency:SPAN <freq>

[:SENSe]:SPECtrum:FREQuency:SPAN?

Set the frequency span to be measured.

Factory Preset and *RST: 1 MHz

100 kHz for iDEN mode

Range: 10 Hz to 10 MHz (15 MHz when Service mode is selected)

Default Unit: Hz

Remarks: The actual measured span will generally be slightly wider due to the finite resolution of the FFT.

To use this command, the appropriate mode should be selected with INSTrument:SELect.

Spectrum Measurement Sweep (Acquisition) Time Auto

[:SENSe]:SPECtrum:SWEep:TIME:AUTO OFF|ON|0|1

[:SENSe]:SPECtrum:SWEep:TIME:AUTO

Select auto or manual control of the sweep (acquisition) time. This is an advanced control that normally does not need to be changed.

Auto - couples the Sweep Time to the Frequency Span and Resolution BW

Manual - the Sweep Time is uncoupled from the Frequency Span and Resolution BW.

Factory Preset and *RST: Auto

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Spectrum Measurement Trigger Source

[:SENSe]:SPECtrum:TRIGger:SOURce EXTernal[1]|EXTernal 2|FRAMe|IF|LINE|IMMediate|RFBurst

[:SENSe]:SPECtrum: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 - internal frame timer from front panel input

IF - internal IF envelope (video) trigger

Line - internal line trigger

Immediate - the next data acquisition is immediately taken (also called free run)

RF Burst - internal wideband RF burst envelope trigger that has automatic level control for periodic burst signals

Factory Preset and *RST: Immediate (free run)

RF burst, for GSM, iDEN mode

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Sync Alignment

[:SENSe]:SYNC:ALIGnment GSM|HBIT

[: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 Bit - burst alignment is advanced by1/2 bit, which corresponds to an earlier interpretation of the GSM standard

Factory Preset and *RST: Half bit

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: **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 and *RST: 0 s

Default Unit: seconds

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: **Mode Setup, Trigger, RF Amptd Sync Delay**

Sync Slot Threshold

[:SENSe]:SYNC:STHReshold <rel power>

[:SENSe]:SYNC:STHReshold?

Set the relative power threshold, which is used to determine the timeslots that will be included in the search for GSM bursts. For

measurements that have burst sync set to training sequence, these bursts will be the only ones that will be searched for valid TSC's (training sequence codes). The threshold power is relative to the peak power of the highest power timeslot. This is useful when measuring a BTS with different power levels in different timeslots, and you want to exclude bursts with lower power levels.

Factory Preset and *RST:	–10 dB
Range:	–200 dB to –0.01 dB
Default Unit:	dB
Remarks:	You must be in the GSM mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**Mode Setup, Trigger, Slot 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 24. 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 Measurement 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 mode (terminal control) setting determines the averaging action.

Factory Preset and *RST: 30

Range: 1 to 10,000

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

History: Version A.03.00 or later

Transmit Band Spurs Measurement Averaging State

[:SENSe]:TSPur:AVERage[:STATe] OFF|ON|0|1

[:SENSe]:TSPur:AVERage[:STATe]?

Turn averaging on or off.

Factory Preset and *RST: On

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

History: Version A.03.00 or later

Transmit Band Spurs Measurement Averaging Termination Control

[:SENSe]:TSPur:AVERage:TCONtrol EXPonential|REPeat

[:SENSe]:TSPur:AVERage:TCONtrol?

Select the type of terminal control used for averaging. This determines the averaging action after the specified number of data acquisitions (average count) is reached.

Exponential - Each successive data acquisition after the average

count is reached, 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 and *RST: Repeat

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

History: Version A.03.00 or later

Transmit Band Spurs Measurement Averaging Type

[:SENSe]:TSPur:AVERage:TYPE LOG|MAXimum|RMS

[:SENSe]:TSPur:AVERage:TYPE?

Select the type of averaging.

Log - The log of the power is averaged. (This is also known as video averaging.)

Maximum - The maximum values are retained.

RMS - The power is averaged, providing the rms of the voltage.

Factory Preset and *RST: Maximum

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

History: Version A.03.00 or later

Transmit Band Spurs Measurement 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 and *RST: Full

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

History: Version A.03.00 or later

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 24. 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 Measurement 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 (terminal control) setting determines the averaging action.

Factory Preset and *RST: 50 10

Range: 1 to 10,000

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

Transmit Power Measurement Averaging State

[:SENSe]:TXPower:AVERage[:STATe] OFF|ON|0|1

[:SENSe]:TXPower:AVERage[:STATe]?

Turn averaging on or off.

Factory Preset and *RST: On

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

Transmit Power Measurement Averaging Mode

[:SENSe]:TXPower:AVERage:TCONtrol EXPonential|REPeat

[:SENSe]:TXPower:AVERage:TCONtrol?

Select the type of terminal control used for averaging. This determines the averaging action after the specified number of frames (average count) is reached.

Exponential - Each successive data acquisition after the average count is reached, 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 and *RST: Exponential

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

Transmit Power Measurement 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 and *RST: 500 kHz

Range: 1 kHz to 5 MHz

Default Unit: Hz

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

Transmit Power Measurement Resolution BW Filter Type

[:SENSe]:TXPower:BANDwidth|BWIDth[:RESolution]:TYPE FLAT|GAUSsian

[:SENSe]:TXPower:BANDwidth|BWIDth[:RESolution]:TYPE?

Select the type of resolution BW filter. 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.

Flat top - a filter with a flat amplitude response, which provides the best amplitude accuracy.

Gaussian - a filter with Gaussian characteristics, which provides the best pulse response.

Factory Preset and *RST: Gaussian

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

Transmit Power Measurement Sweep Time

[:SENSe]:TXPower:SWEep:TIME <integer>

[:SENSe]:TXPower:SWEep:TIME?

Set the number of slots which are used in each data acquisition. Each slot is approximately equal to 600 ms.

Factory Preset and *RST: 1

Range: 1 to 50 time slots (for resolution BW = 500 kHz)

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

Transmit Power Measurement 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 and *RST: –6.0 dB

Range: –100 dB to 0 dB, for relative mode

–100 dB to +30 dB, for absolute mode

Default Unit: dB

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

Transmit Power Measurement 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 and *RST: Relative

Remarks: You must be in the GSM mode to use this command.

Use INSTrument:SELect to set the mode.

Transmit Power Measurement Trigger Source

[:SENSe]:TXPower:TRIGger:SOURce EXTernal[1]|EXTernal 2|IF|IMMediate|RFBurst

[:SENSe]:TXPower: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

IF - internal IF envelope (video) trigger

Immediate - the next data acquisition is immediately taken (also called free run)

RF burst - internal wideband RF burst envelope trigger that has automatic level control for periodic burst signals

Factory Preset and *RST: RF burst

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

Waveform (Time-Domain) Measurement

Commands for querying the waveform measurement results and for setting to the default values are found in the "MEASure Group of Commands" on page 24. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **Waveform (Time Domain)** measurement has been selected from the **MEASURE** key menu.

Waveform Measurement pre-ADC Bandpass Filter

[:SENSe]:WAVeform:ADC:FILTer:[:STATe] OFF|ON|0|1

[:SENSe]:WAVeform:ADC:FILTer:[:STATe]?

Turn the pre-ADC bandpass filter on or off. This is an Advanced control that normally does not need to be changed.

Preset: Off

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Waveform Measurement ADC Range

[:SENSe]:WAVeform:ADC:RANGe AUTO|APEak|APLock|GROund|M6|P0|P6|P12|P18|P24|

[:SENSe]:WAVeform:ADC:RANGe?

Select the range for the gain-ranging that is done in front of the ADC. This is an Advanced control that normally does not need to be changed.

Auto - automatic range

Auto Peak - automatically peak the range

Auto Peak Lock - automatically peak lock the range

Ground - ground

M6 - subtracts 6 dB of fixed gain across the range

P0 to 24 - adds 0 to 24 dB of fixed gain across the range

Factory Preset and *RST: Auto

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Waveform Measurement Number of Averages

[:SENSe]:WAVeform:AVERage:COUNt <integer>

[:SENSe]:WAVeform:AVERage:COUNt?

Set the number of sweeps that will be averaged. After the specified

number of sweeps (average counts), the averaging mode (terminal control) setting determines the averaging action.

Factory Preset and *RST: 10

Range: 1 to 10,000

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Waveform Measurement Averaging State

[:SENSe]:WAVeform:AVERage[:STATe] OFF|ON|0|1

[:SENSe]:WAVeform:AVERage[:STATe]?

Turn averaging on or off.

Factory Preset and *RST: Off

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Waveform Measurement Averaging Mode

[:SENSe]:WAVeform:AVERage:TCONtrol EXPonential|REPeat

[:SENSe]:WAVeform:AVERage:TCONtrol?

Select the type of terminal control used for averaging. This determines the averaging action after the specified number of 'sweeps' (average count) is reached.

Exponential - Each successive data acquisition after the average count is reached, is exponentially weighted and combined with the existing average.

RepPeat - After reaching the average count, the averaging is reset and a new average is started.

Factory Preset and *RST: Exponential

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Waveform Measurement Averaging Type

[:SENSe]:WAVeform:AVERage:TYPE LOG|MAXimum|MINimum|RMS|SCALar

[:SENSe]:WAVeform:AVERage:TYPE?

Select the type of averaging.

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.

RMS - The power is averaged, providing the rms of the voltage.

Factory Preset and *RST: RMS

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Waveform Measurement Resolution BW

[:SENSe]:WAVeform:BANDwidth|BWIDth[:RESolution] <freq>

[:SENSe]:WAVeform:BANDwidth|BWIDth[:RESolution]?

Set the resolution bandwidth. This value is ignored if the function is auto-coupled.

Factory Preset and *RST: 100 kHz, for NADC, PDC, cdma2000, W-CDMA, basic, service mode
500 kHz, for GSM mode
2 MHz. for cdmaOne

Range: 1 kHz to 5 MHz

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Waveform Measurement Resolution BW Filter Type

[:SENSe]:WAVeform:BANDwidth|BWIDth[:RESolution]:TYPE FLATtop|GAUSsian

[:SENSe]:WAVeform:BANDwidth|BWIDth[:RESolution]:TYPE?

Select the type of Resolution BW filter that is used. This is an Advanced control that normally does not need to be changed.

Flat top - a filter with a flat amplitude response, which provides the best amplitude accuracy.

Gaussian - a filter with Gaussian characteristics, which provides the best pulse response.

Factory Preset and *RST: Gaussian

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Decimation of Waveform Display

[:SENSe]:WAVeform:DECimate[:FACTor] <integer>

[:SENSe]:WAVeform:DECimate[:FACTor]?

Set the amount of data decimation done by the hardware and/or the firmware. For example, if 4 is selected, three out of every four data points will be thrown away. So every 4th data point will be kept.

Factory Preset and *RST: 1

Range: 1 to 4

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Control Decimation of Waveform Display

[:SENSe]:WAVeform:DECimate:STATe OFF|ON|0|1

[:SENSe]:WAVeform:DECimate:STATe?

Set the amount of data decimation done by the hardware in order to decrease the number of acquired points in a long capture time. This is the amount of data that the measurement ignores.

Factory Preset and *RST: Off

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Waveform Measurement Sweep (Acquisition) Time

[:SENSe]:WAVeform:SWEep:TIME <time>

[:SENSe]:WAVeform:SWEep:TIME?

Set the measurement acquisition time. It is used to specify the length of the time capture record.

Factory Preset and *RST: 2.0 ms

10.0 ms, for NADC, PDC

15.0 ms, for iDEN mode

Range: 1 µs to 100 s

Default Unit: seconds

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Waveform Measurement Trigger Source

[:SENSe]:WAVeform:TRIGger:SOURce EXTernal[1]|EXTernal 2|FRAMe|IF|IMMediate|LINE|RFBurst

[:SENSe]:WAVeform: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 - internal frame timer from front panel input

IF - internal IF envelope (video) trigger

Immediate - the next data acquisition is immediately taken (also called free run)

Line - internal line trigger

RF Burst - internal wideband RF burst envelope trigger that has automatic level control for periodic burst signals

Factory Preset and *RST: Immediate (free run), for Basic, cdmaOne, NADC, PDC mode

RF burst, for GSM, iDEN mode

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.