R&S® FSV-K93
Firmware Option WiMAX, WiBro Measurements
Operating Manual

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Test & Measurement

Operating Manual

ROHDE&SCHWARZ

This manual describes the following R&S®FSV options:
analyzer-K93 (1310.8955.02)
This manual is applicable for the following analyzer models with firmware version 1.55:

- R&S®FSV 3 (1307.9002K03)
- R&S®FSV 7 (1307.9002K07)
- R&S®FSV 13 (1307.9002K13)
- R&S®FSV 30 (1307.9002K30)
- R&S®FSV 40 (1307.9002K40)
- R&S®FSVR 7 (1311.0006K7)
- R&S®FSVR 13 (1311.0006K13)
- R&S®FSVR 30 (1311.0006K30)

The firmware of the instrument makes use of several valuable open source software packages. The most important of them are listed below together with their corresponding open source license. The verbatim license texts are provided on the user documentation CD-ROM (included in delivery).

Package	**Link**	**License**
OpenSSL	http://www.openssl.org	OpenSSL/SSLeavy
Xitami	http://www.xitami.com	2.5b6
PHP	http://www.php.net	PHP v.3
DOJO-AJAX	http://www.dojotoolkit.org	Academic Free License (BSD)
ResizableLib	http://www.geocities.com/ppescher	Artistic License
BOOST Library	http://www.boost.org	Boost Software v.1
ONC/RPC	http://www.plt.rwth-aachen.de/ index.php?id=258	SUN

The product Open SSL includes cryptographic software written by Eric Young (eay@cryptsoft.com) and software written by Tim Hudson (tjh@cryptsoft.com).
Rohde & Schwarz would like to thank the open source community for their valuable contribution to embedded computing.

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The following abbreviations are used throughout this manual: R&S®FSV is abbreviated as R&S FSV.

Contents

1 Documentation Overview

The user documentation for the analyzer is divided as follows:

- Quick Start Guide
- Operating Manuals for base unit and options
- Service Manual
- Online Help
- Release Notes

Quick Start Guide

This manual is delivered with the instrument in printed form and in PDF format on the CD. It provides the information needed to set up and start working with the instrument. Basic operations and basic measurements are described. Also a brief introduction to remote control is given. The manual includes general information (e.g. Safety Instructions) and the following chapters:

Chapters 1-3	Introduction, General information
Chapter 4	Front and Rear Panel
Chapter 5	Preparing for Use
Chapter 6	Firmware Update and Installation of Firmware Options
Chapter 7	Basic Operations
Chapter 8	Basic Measurement Examples
Chapter 9	Brief Introduction to Remote Control
Appendix 1	Printer Interface
Appendix 2	LAN Interface

Operating Manuals

The Operating Manuals are a supplement to the Quick Start Guide. Operating Manuals are provided for the base unit and each additional (software) option.

The Operating Manual for the base unit provides basic information on operating the analyzer in general, and the "Spectrum" mode in particular. Furthermore, the software options that enhance the basic functionality for various measurement modes are described here. The set of measurement examples in the Quick Start Guide is expanded by more advanced measurement examples. In addition to the brief introduction to remote control in the Quick Start Guide, a description of the basic analyzer commands and programming examples is given. Information on maintenance, instrument interfaces and error messages is also provided.

In the individual option manuals, the specific instrument functions of the option are described in detail. For additional information on default settings and parameters, refer to the data sheets. Basic information on operating the analyzer is not included in the option manuals.

The following Operating Manuals are available for the analyzer:

- R&S FSV base unit; in addition:
  - R&S FSV-K9 Power Sensor Support
  - R&S FSV-K14 Spectrogram Measurement
- R&S FSV-K7 Analog Demodulation and R&S FSV-K7S FM Stereo Measurements
- R&S FSV-K10 GSM/EDGE Measurement
- R&S FSV-K30 Noise Figure Measurement
- R&S FSV-K40 Phase Noise Measurement
- R&S FSV-K70 Vector Signal Analysis
- R&S FSV-K72 3GPP FDD BTS Analysis
- R&S FSV-K73 3GPP FDD UE Analysis
- R&S FSV-K76/77 3GPP TD-SCDMA BTS/UE Measurement
- R&S FSV-K82/83 CDMA2000 BTS/MS Analysis
- R&S FSV-K84/85 1xEV-DO BTS/MS Analysis
- R&S FSV-K91 WLAN IEEE 802.11a/b/g/j/n
- R&S FSV-K93 WiMAX IEEE 802.16 OFDM/OFDMA Analysis
- R&S FSV-K100/K104 EUTRA / LTE Downlink Measurement Application

These manuals are available in PDF format on the CD delivered with the instrument. The printed manual can be ordered from Rohde & Schwarz GmbH & Co. KG.

Service Manual

This manual is available in PDF format on the CD delivered with the instrument. It describes how to check compliance with rated specifications, instrument function, repair, troubleshooting and fault elimination. It contains all information required for repairing the analyzer by replacing modules. The manual includes the following chapters:

Chapter 1	Performance Test
Chapter 2	Adjustment
Chapter 3	Repair
Chapter 4	Software Update / Installing Options
Chapter 5	Documents

Online Help

The online help contains context-specific help on operating the analyzer and all available options. It describes both manual and remote operation. The online help is installed on the analyzer by default, and is also available as an executable .chm file on the CD delivered with the instrument.

Release Notes

The release notes describe the installation of the firmware, new and modified functions, eliminated problems, and last minute changes to the documentation. The corresponding

firmware version is indicated on the title page of the release notes. The current release notes are provided in the Internet.

2 Conventions Used in the Documentation

2.1 Typographical Conventions

The following text markers are used throughout this documentation:

Convention	Description
"Graphical user interface elements"	All names of graphical user interface elements on the screen, such as dialog boxes, menus, options, buttons, and softkeys are enclosed by quotation marks.
KEYS	Key names are written in capital letters.
`File names, commands, program code`	File names, commands, coding samples and screen output are distinguished by their font.
Input	Input to be entered by the user is displayed in italics.
Links	Links that you can click are displayed in blue font.
"References"	References to other parts of the documentation are enclosed by quotation marks.

2.2 Conventions for Procedure Descriptions

When describing how to operate the instrument, several alternative methods may be available to perform the same task. In this case, the procedure using the touch screen is described. Any elements that can be activated by touching can also be clicked using an additionally connected mouse. The alternative procedure using the keys on the device or the on-screen keyboard is only described if it deviates from the standard operating procedures.

The term "select" may refer to any of the described methods, i.e. using a finger on the touchscreen, a mouse pointer in the display, or a key on the device or on a keyboard.

3 How to Use the Help System

Calling context-sensitive and general help

► To display the general help dialog box, press the HELP key on the front panel.

The help dialog box "View" tab is displayed. A topic containing information about the current menu or the currently opened dialog box and its function is displayed.

For standard Windows dialog boxes (e.g. File Properties, Print dialog etc.), no context-sensitive help is available.

► If the help is already displayed, press the softkey for which you want to display help.

A topic containing information about the softkey and its function is displayed.

If a softkey opens a submenu and you press the softkey a second time, the submenu of the softkey is displayed.

Contents of the help dialog box

The help dialog box contains four tabs:

- "Contents" - contains a table of help contents
- "View" - contains a specific help topic
- "Index" - contains index entries to search for help topics
- "Zoom" - contains zoom functions for the help display

To change between these tabs, press the tab on the touchscreen.

Navigating in the table of contents

- To move through the displayed contents entries, use the UP ARROW and DOWN ARROW keys. Entries that contain further entries are marked with a plus sign.
- To display a help topic, press the ENTER key. The "View" tab with the corresponding help topic is displayed.
- To change to the next tab, press the tab on the touchscreen.

Navigating in the help topics

- To scroll through a page, use the rotary knob or the UP ARROW and DOWN ARROW keys.
- To jump to the linked topic, press the link text on the touchscreen.

Searching for a topic

1. Change to the "Index" tab.

2. Enter the first characters of the topic you are interested in. The entries starting with these characters are displayed.
3. Change the focus by pressing the ENTER key.
4. Select the suitable keyword by using the UP ARROW or DOWN ARROW keys or the rotary knob.
5. Press the ENTER key to display the help topic.

   The "View" tab with the corresponding help topic is displayed.

Changing the zoom

1. Change to the "Zoom" tab.
2. Set the zoom using the rotary knob. Four settings are available: 1-4. The smallest size is selected by number 1, the largest size is selected by number 4.

Closing the help window

► Press the ESC key or a function key on the front panel.

4 WiMAX, WiBro Measurements Option R&S FSV-K93

Overview of Firmware Option R&S FSV-K93

This section contains all information required for operation of an analyzer equipped with Application Firmware R&S FSV-K93. It covers operation via menus and the remote control commands for WiMAX, WiBro measurements.

This part of the documentation consists of the following chapters:

- chapter 4.1.1, "Basic Measurement Examples", on page 14
  Describes the measurement setup for WiMAX, WiBro measurements.
- chapter 4.2, "Instrument Functions WiMAX, WiBro Measurements (R&S FSV-K93)", on page 36
  Describes the overall instrument functions and provides further information.
- chapter 4.2.3, "Softkeys of the WiMAX, WiBro Menu (R&S FSV-K93)", on page 45
  Shows all softkeys available in the "WiMAX, WiBro" menu. This chapter also refers to the remote control commands associated with each softkey function.
- chapter 4.3, "Remote Commands of the WiMAX/WiBro Measurements (R&S FSV-K93)", on page 111
  Describes all remote control commands defined for the WiMAX, WiBro measurement.

This part of the documentation includes only functions of the Application Firmware R&S FSV-K93. For all other descriptions, please refer to the description of the base unit at the beginning of the documentation.

4.1 WiMAX, WiBro Measurements (R&S FSV-K93)

The R&S FSV-K93 application extends the functionality of the analyzer Signal and Spectrum analyzer to enable WiMAX and WiBro TX-measurements according to the following standards:

- IEEE 802.16-2004/Cor 1-2005 OFDM physical layer mode.
  The short form 'IEEE 802.16-2004 OFDM' is used in this document, to reference this standard.
- IEEE 802.16-2004/Cor 1-2005, IEEE 802.16e-2005 OFDMA physical layer mode.
  The short form 'IEEE 802.16e-2005 OFDMA' is used in this document, to reference this standard.
- IEEE 802.16-2004/Cor 1-2005, IEEE 802.16e-2005 based WiBro.
  The short form 'WiBro' is used in this document, to reference this standard.

The following measurements are described in this section:

4.1.1 Basic Measurement Examples

This section provides step-by-step instruction for working through an ordinary measurement. The following steps are described:

1. chapter 4.1.1.1, "Setting Up the Measurement", on page 15
2. chapter 4.1.1.2, "Performing the Level Detection", on page 16
3. chapter 4.1.1.3, "Performing the Main Measurement", on page 17

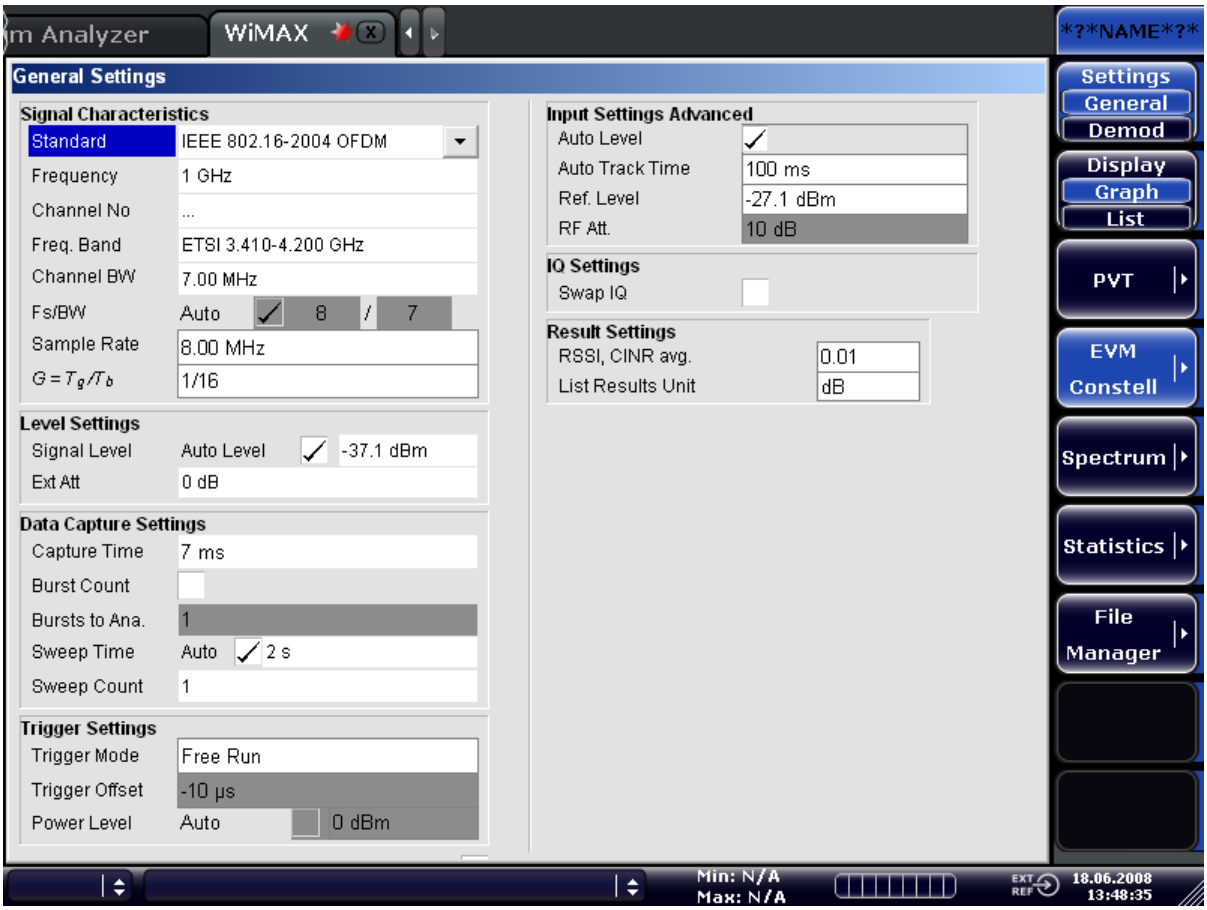
Test setup

In this example, a DUT using IEEE 802.16-2004 is be used.

Connect the DUT to the analyzer using the RF input of the analyzer. The DUT generates a signal modulated using 16QAM 2/3.

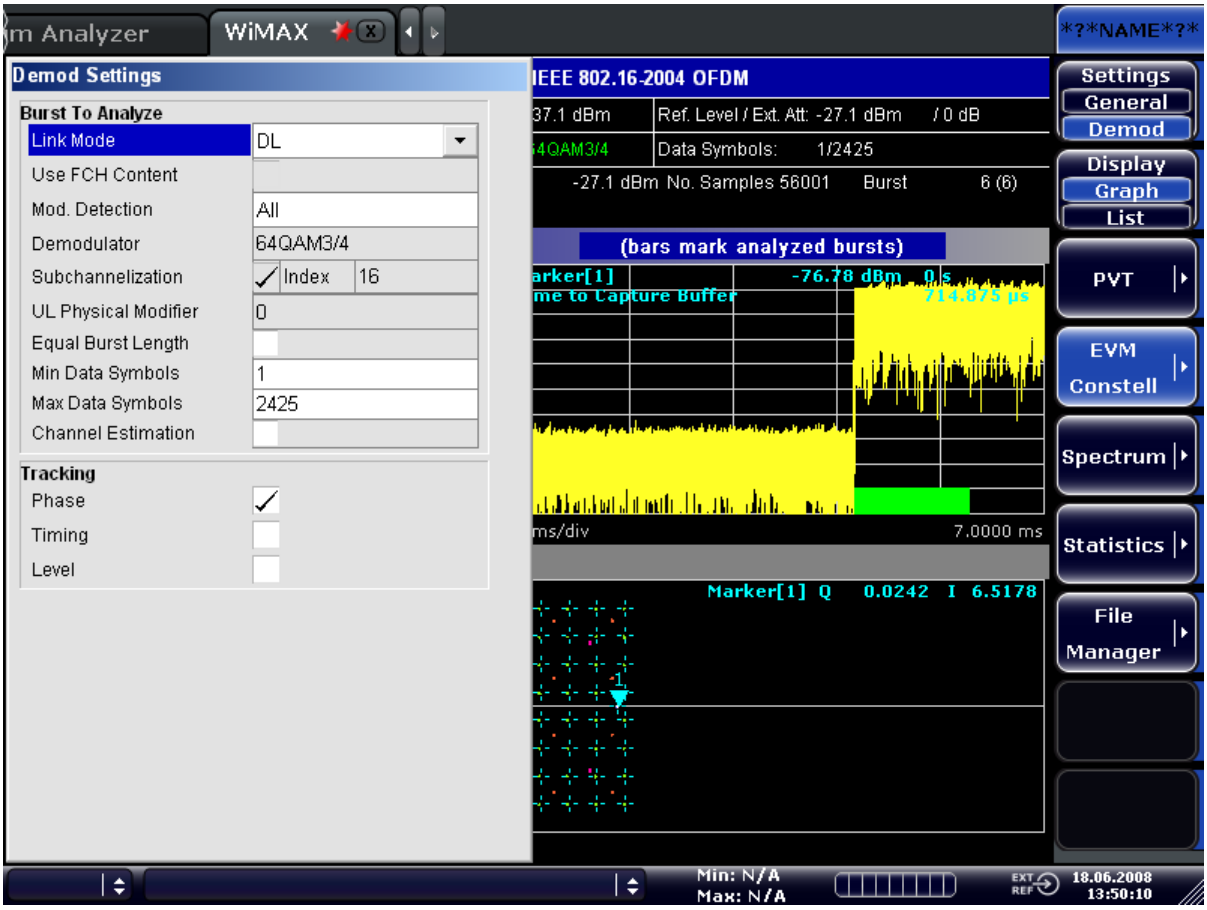
4.1.1.1 Setting Up the Measurement

1. Activate the "WIMAX" mode.
2. Press the Settings General/Demod softkey once to select and open the chapter 4.2.3.2, "General Settings Dialog Box", on page 85 dialog box.



a) In the "Frequency" on page 86 field, enter the desired frequency to measure. If a frequency is entered, which maps to a specific channel, the "Channel No" field updates.
b) In the "Frequency Band" on page 87 field, select the signal to be analyzed. The target band is either one of the bands given as example in the IEEE 802.16-2004 standard or an unspecified band.
c) In the "Channel BW" on page 87 or "Sample Rate" on page 87 field depending on the characteristics of the signal to be analyzed, select a value. The second parameter is derived from the first according to the standard.
d) In the "G = T_g/T_b" on page 87 field, select a useful time ratio according to the characteristics of the signal to be analyzed.
e) Under "Level Settings", deactivate the "Auto Level" on page 87 option. In this example, the level detection measurement is executed manually (for details see Performing the level detection).

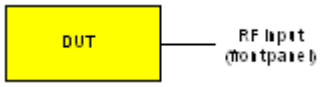
3. Press the "Settings General"/"Demod" softkey twice to select and open the chapter 4.2.3.3, "Demod Settings Dialog Box", on page 92 dialog box.



a) In the "Link Mode (IEEE 802.16-2004 OFDM)" on page 94 field, select the link mode of the bursts to be analyzed.
b) In the "Demodulator" field, select the used modulation scheme.

4.1.1.2 Performing the Level Detection

1. Connect the DUT to the RF input of the analyzer.



2. Start the level detection measurement by pressing the chapter 4.2.4, "Softkeys of the Sweep Menu – SWEEP Key (R&S FSV-K93)", on page 105 and then the "Auto Level" on page 105 softkey.

   During the level detection measurement the text "Running" is displayed in the status bar at the bottom of the screen.

After successful level detection, the status message "Measurement Complete" is displayed, the signal level field for the selected input displays the detected signal level and the Magnitude Capture Buffer (screen A) displays the zero span trace obtained during the measurement sequence.

An automatic level detection can be performed in two ways:

- Once by pressing the "Auto Level" on page 105 softkey in the "Sweep" menu.
- At the start of each measurement sweep by activating the "Auto Level" on page 87 option in the chapter 4.2.3.2, "General Settings Dialog Box", on page 85 dialog box under "Level Settings".

4.1.1.3 Performing the Main Measurement

1. Select single sweep measurements by pressing the SWEEP key and then the Run Single/Cont softkey to select "Single".
2. Start the measurement by pressing the RUN key.

   During the measurement, the status message "Running" is displayed. Measurement results are updated once the measurement has completed. The results are displayed in graphical form. The display can be toggled to a tabular list of measurement points by pressing the Display Graph/List softkey (in the "WiMAX/WiBro" menu or "Trace" menu).

4.1.2 Signal Processing of the IEEE 802.16-2004 OFDM measurement application

This description gives a rough view of the IEEE 802.16-2004 OFDM measurement application signal processing. Details are disregarded in order to get a concept overview.

Abbrevations:

Abbreviation	Description
$\mathbf{N_{FFT}}$ = 256	FFT length
$\mathbf{a_{lk}}$	symbol from the alphabet at symbol-index **l** of sub carrier **k**
$\mathbf{EVM_k}$	error vector magnitude of sub carrier**k**
EVM	error vector magnitude of current packet
g	signal gain
Δ**f**	frequency deviation between Tx and Rx
l	symbol index **l** = [1, **nof _Symbols**]
nof _symbols	number of symbols of payload
$\mathbf{H_k}$	channel transfer function of sub carrier **k**

Abbreviation	Description
k	channel index **k** = [−128,127]
$\mathbf{K}_{mod}$	modulation dependent normalization factor
ξ	relative clock error of reference oscillator
$\mathbf{r}_{lk}$	received symbol at symbol-index **l** of sub carrier **k**
	Pilots = {-88, -63, -38, -13, 13, 38, 63, 88}

4.1.2.1 Understanding Signal Processing of the IEEE 802.16-2004 OFDM Measurement Application

A diagram of the relevant blocks is shown in figure 4-1. First the RF signal is down-converted to the IF frequency $\mathbf{f}_{IF}$ = 20.4 MHz. The resulting IF signal $\mathbf{r}_{IF}(\mathbf{t})$ is shown on the left-hand side of the figure. After bandpass filtering, the signal is sampled by an Analog to Digital Converter (ADC) at a sampling rate of $\mathbf{f}_{s1}$ = 81.6 MHz. This digital sequence is resampled to the new sampling frequency of $\mathbf{f}_{s2}$ = 80 MHz which is a multiple of the Nyquist rate (20 MHz). The subsequent digital down-converter shifts the IF signal to the complex base band. In the next step the base band signal is filtered by a FIR filter. To get an idea, the rough transfer function is plotted in the figure. This filter fulfils two tasks: first it suppresses the IF image frequency, secondly it attenuates the aliasing frequency bands caused by the subsequent down-sampling. After filtering, the sequence is sampled down by the factor of 4. Thus the sampling rate of the down-sampled sequence **r**(**i**) is the Nyquist rate of $\mathbf{f}_{s3}$ = 20 MHz. Up to this point the digital part is implemented in an ASIC.

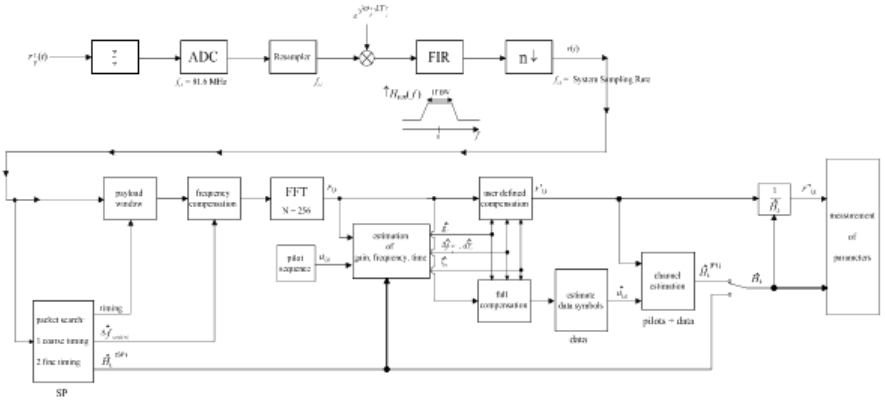


Fig. 4-1: Signal processing of the IEEE 802.16 OFDM measurement application

In the lower part of the figure the subsequent digital signal processing is shown. In the first block the packet search is performed. This block detects the Short Preamble (SP) and recovers the timing. The coarse timing is detected first. This search is implemented in the time domain. The algorithm is based on cyclic repetition within the SP after **N = N_{FFT} / 2** = 128 samples. Note this cyclic repetition occurs also in the Long Preamble (LP). Numerous treatises exist on this subject, e.g. [1]-[3].

Furthermore, a coarse estimate $\Delta\hat{f}_{coarse}$ of the Rx-Tx frequency offset **Δf** is derived from the metric in [6].

In this documentation, the ^ generally describes an estimate. Example: $\hat{H}$ is the estimate of H.

This can easily be understood because the phase of **r(i) r^* (i + N)** is determined by the mod 2π frequency offset. As the frequency deviation **Δf** can exceed several bins (distance between neighbor sub-carriers) the SP is further used to solve this n2π [offset over several bins] ambiguities.

After the coarse timing calculation the time estimate is improved by the fine timing calculation. This is achieved by first estimating the coarse frequency response $\hat{H}_k^{(SP)}$, with **k** = [−100, 100] denoting the channel index of the occupied sub-carriers. First the FFT of the SP is calculated. After the FFT calculation the known symbol information of the SP sub-carriers is removed by dividing by the symbols. The result is a coarse estimate $\hat{H}_k$ of the channel transfer function. In the next step the complex channel impulse response is computed by an IFFT. Next the energy of the windowed impulse response (the window size is equal to the guard period) is calculated for every trial time. Afterwards the trail time of the maximum energy is detected. This trial time is used to adjust the timing.

Now the position of the SP is known and the starting point of the useful part of the first payload symbol can be derived. In the next block this calculated time instant is used to position the payload window. Only the payload part is windowed. This is sufficient because the payload is the only subject of the subsequent measurements.

In the next block the windowed sequence is compensated by the coarse frequency estimate $\Delta\hat{f}_{coarse}$. This is necessary because otherwise inter channel interference (ICI) would occur in the frequency domain.

The transition to the frequency domain is achieved by an FFT of length 256. The FFT is performed symbol-wise for every of the **nof _symbols** symbols of the payload. The calculated FFTs are described by $\mathbf{r_{l,k}}$ with

- the symbol index **l** = [1 , nof _symbols] and
- the channel index **k** = [−128 , 127].

In case of an additive white Gaussian noise (AWGN) channel the FFT is described by [4], [5]

$$r_{l,k} = K_{\mathrm{mod}} \cdot a_{l,k} \cdot g_l \cdot H_k \cdot e^{j\left(phase_l^{(common)} + phase_{l,k}^{(timing)}\right)} + n_{l,k}$$

Fig. 4-2: Equation (30)

with

- the modulation-dependent normalization factor **K**mod
- the alphabet symbol $\mathbf{a_{l,k}}$at symbol-index **l** of sub-carrier **k**
- the gain $\mathbf{g_l}$ at the symbol **l** in relation to the reference gain **g** = 1 at the Short Preamble (SP)
- the channel frequency response $\mathbf{H_k}$ at the Short Preamble (SP)
- the common phase drift $phase_l^{(common)}$ of all sub-carriers at symbol **l** (see below)
- the $phase_{l,k}^{(timing)}$ of sub-carrier **k** at symbol **l** caused by the timing drift (see below)
- the independent Gaussian distributed noise samples $\mathbf{n_{l,k}}$

The common phase drift in equation (29) is given by

$$phase_l^{(common)} = 2\pi \cdot N_s / N \cdot \Delta f_{rest} T \cdot l + d\gamma_l$$

Equation (31) (4 - 1)

with

- $\mathbf{N_s = N_g + N_b}$ being the number of Nyquist samples of the symbol period
- $\mathbf{N = N_b}$ = 256 being the number of Nyquist samples of the useful part of the symbol
- $\Delta\mathbf{f_{rest}}$ being the (not yet compensated) frequency deviation
- $\mathbf{d\Upsilon_l}$ being the phase jitter at the symbol **l**

In general, the coarse frequency estimate $\Delta\hat{f}_{coarse}$ (see figure 4-1) is not error-free. Therefore the remaining frequency error $\Delta\mathbf{f_{rest}}$ represents the not yet compensated frequency deviation in $\mathbf{r_{l,k}}$. Consequently the overall frequency deviation of the device under test (DUT) is calculated by:

$$\Delta f = \Delta\hat{f}_{coarse} + \Delta f_{rest}$$

The only motivation for dividing the common phase drift in equation (11) into two parts is to be able to calculate the overall frequency deviation of the DUT.

The reason for the phase jitter $\mathbf{d\Upsilon_l}$ in equation (11) may be different. The nonlinear part of the phase jitter may be caused by the phase noise of the DUT oscillator. Another reason for nonlinear phase jitter may be the increase of the DUT amplifier temperature at the beginning of the burst. Please note that besides the nonlinear part the phase jitter $\mathbf{d\Upsilon_l}$ also contains a constant part. This constant part is caused by the not yet compensated frequency deviation $\Delta\mathbf{f_{rest}}$. To understand this, please keep in mind that the measurement of the phase starts at the first symbol **l** = 1 of the payload. In contrast the channel frequency response $\mathbf{H_k}$ in equation (29) represents the channel at the Short Preamble of the preamble.

Consequently the not yet compensated frequency deviation $\Delta\mathbf{f_{rest}}$ produces a phase drift between the Short Preamble and the first symbol of the payload. Therefore this phase drift appears as a constant value ("DC value") in $\mathbf{d\Upsilon_l}$.

Referring to the IEEE 802.16-2004 measurement standard `Chapter 8.3.10.1.2 "Transmitter constellation error and test method''` [6], the common phase drift $phase_l^{(common)}$ must be estimated and compensated from the pilots. Therefore the "symbol wise phase tracking" (Tracking Phase) is activated as the default setting of the R&S FSV-K93.

Furthermore the timing drift in equation (29) is given by:

$$phase_{l,k}^{(timing)} = 2\pi \cdot N_s / N \cdot \xi \cdot k \cdot l$$

Equation (32) (4 - 2)

with ξ being the relative clock deviation of the reference oscillator. Normally a symbol-wise timing jitter is negligible and thus not modeled in equation (32). There may be situations where the timing drift has to be taken into account. This is illustrated by an example: In accordance to [6] the allowed clock deviation of the DUT is up to ξ_{max} = ±8 ppm. Furthermore the maximal length of a frame **nof _symbols** = 2420 symbols is assumed.

Assuming the maximum system sampling rate F_s = 32MHz.

From equations (29) and (32), it results that the phase drift of the highest sub-carrier **k** = 100 in the last symbol **l = nof _symbols** is to-do degrees. Even in the noise-free case, this would lead to symbol errors. The example shows that it is actually necessary to estimate and compensate the clock deviation, which is accomplished in the next block.

Referring to the IEEE 802.16-2004 measurement standard [6], the timing drift $phase_{l,k}^{(timing)}$ is not part of the requirements. Therefore the "time tracking" (Tracking Time) is not activated as the default setting of the R&S FSV-K93.

The time tracking option should rather be seen as a powerful analyzing option.

In addition the tracking of the gain $\mathbf{g_l}$ in equation (29) is supported for each symbol in relation to the reference gain **g** = 1 at the time instant of the Short Preamble (SP). At this time the coarse channel transfer function $\hat{H}_k^{(SP)}$ is calculated. This makes sense since the sequence $\mathbf{r'_{l,k}}$ is compensated by the coarse channel transfer function $\hat{H}_k^{(SP)}$ before estimating the symbols. Consequently a potential change of the gain at the symbol **l** (caused, for example, by the increase of the DUT amplifier temperature) may lead to symbol errors especially for a large symbol alphabet **M** of the MQAM transmission. In this case the estimation and the subsequent compensation of the gain are useful.

Referring to the IEEE 802.16-2004 measurement standard [6], the compensation of the gain $\mathbf{g_l}$ is not part of the requirements. Therefore the "gain tracking" (Tracking Gain) is not activated as the default setting of the R&S FSV-K93.

The unknown deviations of gain, frequency and time are calculated by an optimum maximum likelihood procedure, which works well even at low signal to noise ratios with the Cramer Rao Bound being reached. After estimation of these parameters, the received signal is fully compensated for the decision of the ideal reference signal $\mathbf{\hat{a}_{l,k}}$ and compensated according to the user settings to get the measurement signal $\mathbf{r'_{l,k}}$. Then the measurement signal is equalized by the inverse channel transfer function. According to the chosen setting, either the preamble estimation of the channel transfer function or a data aided estimation using the ideal reference signal is used. According to the IEEE 802.16-2004 measurement standard [6], the coarse channel estimation $\hat{H}_k^{(SP)}$ (from the short preamble) has to be used for equalization. Therefore the default setting of the R&S FSV-K93 is equalization from the coarse channel estimate derived from the short preamble.

In the last block the measurement variables are calculated. The most important variable is the error vector magnitude

$$EVM_k = \sqrt{\frac{1}{nof\_Symbols} \cdot \sum_{l=1}^{nof\_Symbols} \left| r''_{l,k} - K_{\mathrm{mod}} \cdot a_{l,k} \right|^2}$$

Equation (33) (4 - 3)

of the sub-carrier **k** of the current packet. Furthermore the packet error vector magnitude

$$EVM = \sqrt{\frac{1}{200} \cdot \sum_{\substack{k=-100 \\ (k \neq 0)}}^{100} EVM_k^2}$$

Equation (34) (4 - 4)

is derived by averaging the squared $\mathbf{EVM_k}$ versus **k**. Finally the average error vector magnitude

$$\overline{EVM} = \sqrt{\frac{1}{nof\_packets} \sum_{counter=1}^{nof\_packets} EVM^2(counter)}$$

Equation (35) (4 - 5)

is calculated by averaging the packet **EVM** of all **nof _ packets** detected packets. This parameter is equivalent to the so-called "RMS average of all errors **Error$_{RMS}$**' of the IEEE 802.16-2004 measurement commandment (see [6], Chapter 8.3.10.1.2).

4.1.2.2 Analysis Steps

Preamble related result	Remark
Rough frequency estimation	In case of subchannelization, a rough frequency estimation is obtained by exploiting the cyclic prefix of the OFDM symbols.
Preamble power	
Preamble EVM	Uses payload channel estimation for equalization.
Frequency error vs. preamble	
Phase error vs. preamble	
Channel estimation	Used for equalizing

Payload related result	Remark
Fine frequency estimtion	Estimation on pilots used for phase correction if 'Phase Tracking' is selected. Phase tracking needs at least one pilot. In case of subchannelization, the value shown in the result summary table is estimated on pilots and data.
Clock offset estimation	Estimation on pilots used for timing correction if 'Timing Tracking' is selected. Timing tracking needs at least two pilots. In case of subchannelization, the value shown in the result summary table is estimated on pilots and data.
IQ Offset	Power at spectral line 0 normalized to the total transmitted power.
Gain Imbalance	Estimation not available in case of subchannelization.
Quadrature Error	Estimation not available in case of subchannelization.
Payload channel estimation	Combined with the preamble channel estimation.

Burst related result	Remark
EVM All carriers EVM Data carriers EVM Pilot carriers	According to standard normalized to the average power of all 200 used carriers.
Burst Power	
Crest Factor	

4.1.2.3 Subchannelization

Subchannelization can be used in uplink bursts to allocate only a subset of the available OFDM sub carriers. The measurement software can distinguish between downlink bursts, uplink bursts without subchannelization and uplink bursts with a selectable sub-channel index. Thus it is possible to analyze the complete WirelessMAN traffic with one capture buffer shot.

4.1.2.4 Synchronization

The synchronization of uplink bursts using subchannelization is performed after the synchronization on standard downlink and uplink preambles:

1. Synchronization of downlink and uplink bursts without subchannelization.
2. Pre-analysis of the bursts without subchannelization to determine their length.
3. Extraction of TX power areas without already detected bursts.
4. Synchronization of uplink bursts with the selected subchannel index.

In the following sections, the influence of subchannelization on results is discussed.

4.1.2.5 Channel Results

The standard requires an interpolation of order 0 for the channel estimation on unallocated sub carriers, i.e. the estimated channel coefficient of the nearest allocated sub carrier shall be used for those sub carriers not part of the allocated subchannels.

For the derived channel results like group delay or flatness difference, the unallocated carriers are not taken into account.

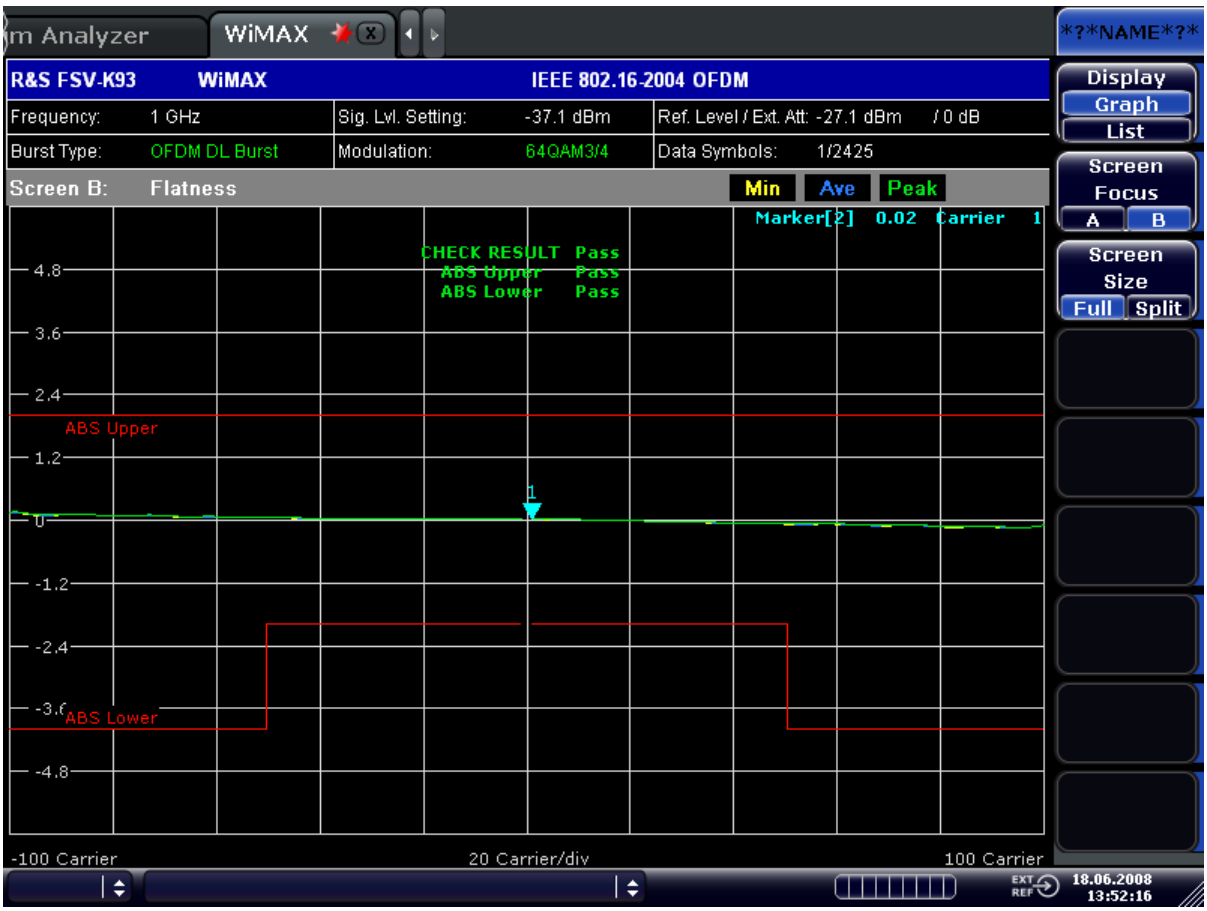


Fig. 4-3: Spectrum Flatness

4.1.2.6 Frequency and Clock Offset

The measurement software allows selectable compensation of phase, timing and gain errors based on pilot estimations. However, in case of subchannelization the number of pilots is decreased. Bursts with odd subchannel indices do not provide pilots at all.

The following table lists the restrictions on the tracking ability for subchannelization:

Tracking	Subchannel Index		
	16 (8 Pilots) 8, 24 (4 Pilots) 4, 12, 20, 28 (2 Pilots)	2, 6, 10, 14, 18, 22, 26, 30 (1 Pilot)	1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31 (No Pilot)
Phase	Available	Available	Available, but uses rough frequency offset estimation from the synchronization step only
Timing	Available	Not available	Not available
Gain	Available	Available	Not available

While the tracking functionality has to use pilot based estimates, the actual results for frequency and clock offset in the result summary can be data aided. In case of subchannelization the final estimation of frequency and clock offset is done using the already decided data sequence, which gives stable results even without pilots.

4.1.2.7 EVM

The error vector magnitude of a single constellation point is defined by

$$\mathrm{EVM(l,k)} = \sqrt{\frac{\left|r(l,k)-a(l,k)\right|^2}{\frac{1}{N_{\mathrm{used}}}\sum_{\substack{k=-N_{\mathrm{used}}/2 \\ k\neq 0}}^{k=N_{\mathrm{used}}/2}\left|a(l,k)\right|^2}}$$

where **r(l,k)** is the received constellation point and **a(l,k)** is the transmitted constellation point at the l^{th} symbol and carrier number **k**.

In case of subchannelization, it is required by the standard to include the unallocated carriers $\mathbf{k_{unalloc}}$ by assuming $\mathbf{a(l, k_{unalloc})} = 0$ in the denominator of the EVM calculation.

Thus the EVM All Carriers result for one burst in the result summary equals

$$\mathrm{EVM\_All\_Carr} = \sqrt{\frac{\frac{1}{L}\sum_{l=1}^{L}\frac{1}{N_{\mathrm{used}}}\sum_{\substack{k=-N_{\mathrm{used}}/2 \\ k\neq 0}}^{k=N_{\mathrm{used}}/2}\left|r(l,k)-a(l,k)\right|^2}{\frac{1}{L}\sum_{l=1}^{L}\frac{1}{N_{\mathrm{used}}}\sum_{\substack{k=-N_{\mathrm{used}}/2 \\ k\neq 0}}^{k=N_{\mathrm{used}}/2}\left|a(l,k)\right|^2}}$$

where **L** is the number of symbols in the burst.

This definition is according to the relative constellation error defined in the IEEE 802.16-2004 standard.

Using the equations above, the error power is normalized by the average transmitted power in all 200 carriers. Please notify that by this definition the same absolute error power leads to different EVM results depending on the number of allocated carriers in case of subchannelization.

4.1.2.8 IQ Impairments

IQ imbalance in an OFDM transmitter or receiver leads to an interference of the symbols $\mathbf{a_{l-k}}$ with the symbols $\mathbf{a_{l,k}}$. In case of subchannelization, the used sub carriers are always situated in such a way, that $\mathbf{a_{l,-k}} = 0$, if $\mathbf{a_{l,k}} \neq 0$. There is no impact of IQ imbalance on the actually allocated carriers of a subchannelization transmission. The effect can only be

seen on the unallocated carriers and yields a pattern around the origin of the constellation diagram.

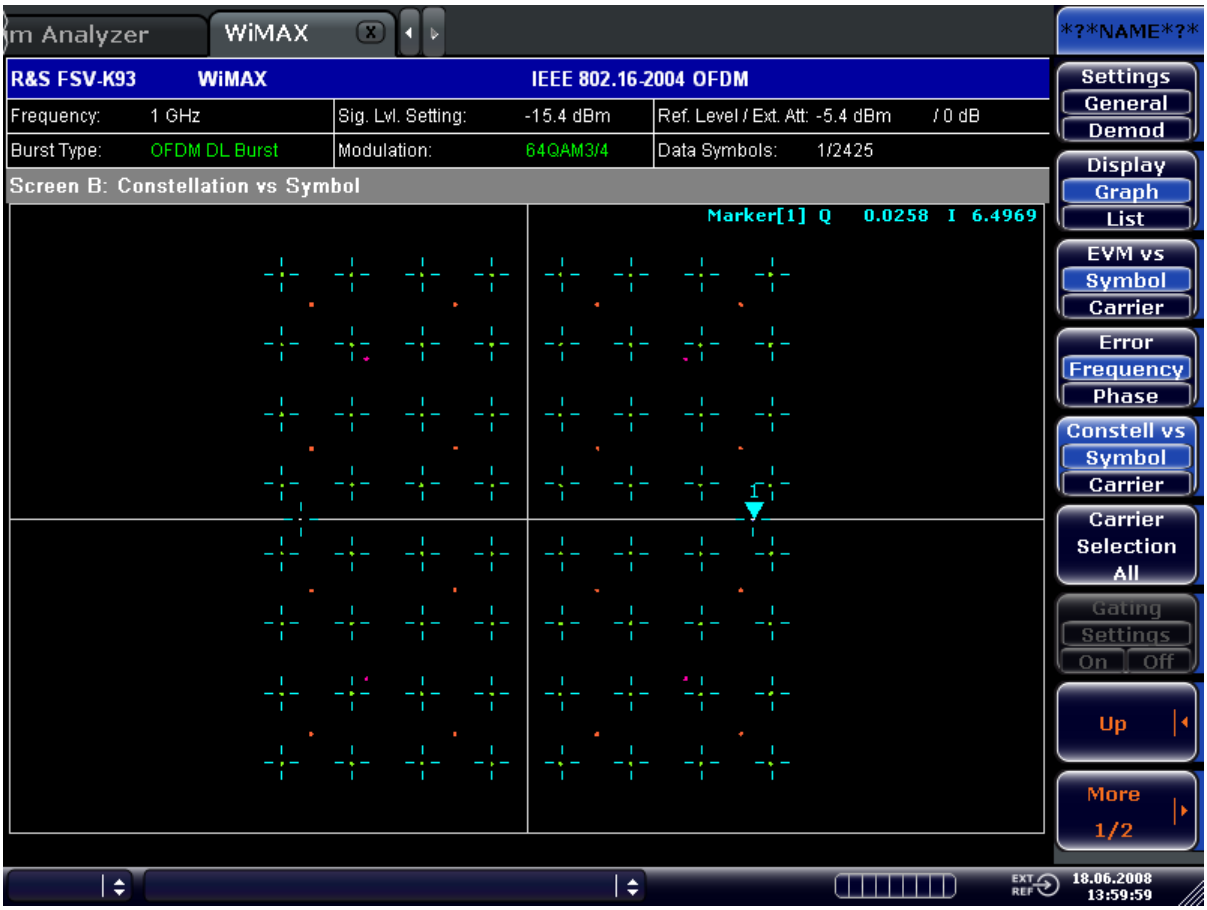


Fig. 4-4: Constellation vs Symbol

The unsymmetrical allocation of the sub carriers prevents a measurement of gain imbalance and quadrature error in case of subchannelization. The influence of the occupied carriers $\mathbf{a}_{l,k}$ on the unoccupied carriers $\mathbf{a}_{l,-k}$ could be measured, but there is no possibility to distinguish them from an unknown channel coefficient.

4.1.2.9 RSSI

See IEEE Std 802.16-2004 [6] section "8.3.9.2 RSSI mean and standard deviation". The Received Signal Strength Indication [RSSI] is basically the preamble power. The result summary provides the RSSI statistics according to the standard. A possible method to compute RSSI[k] at the antenna connector is given in [6] equation (87). RSSI[k] is the RSSI measurement based on the k-th signal/preamble.

The RSSI statistics of the "result summary" is calculated as follows:

1. RSSI row:
2. Statistic {min, mean, max} of the R[k]=RSSI[k].

3. The mean value is $\hat{\mu}_{RSSIdBm}$[k] according to [6] formula (89).
4. RSSI Standard Deviation row:
5. $\hat{\sigma}_{RSSIdB}$ according to [6] formula (91).

4.1.2.10 CINR

See IEEE Std 802.16-2004 [6] section "8.3.9.3 CINR mean and standard deviation". The result summary provides the Carrier Interference Noise Ratio [CINR] statistics according to the standard. One possible method to estimate the CINR of a single message is to compute the ratio of the sum of signal power and the sum of residual error for each data sample, using equation (92).

$$CINR[k] = \frac{\sum_{n=0}^{N-1} |s[k,n]|^2}{\sum_{n=0}^{N-1} |r[k,n] - s[k,n]|^2}$$

with

r[k,n]	received/measured sample n within message k
s[k,n]	corresponding detected/reference sample (with channel state weighting)
	corresponding to received symbol n

The CINR statistics of the "result summary" is calculated as follows:

1. CINR row:
2. Statistic {min, mean, max} of the CINR[k].
3. The mean value is $\hat{\mu}_{CINRdB}$[k] according to [6] formula (94).
4. CINR Standard Deviation row
5. $\hat{\sigma}_{CINRdB}$ according to [6] formula (96).

4.1.2.11 OFDM Literature

[1]	Speth, Classen, Meyr: "Frame synchronization of OFDM systems in frequency selective fading channels", VTC '97, pp. 1807-1811
[2]	Schmidl, Cox: "Robust Frequency and Timing Synchronization of OFDM", IEEE Trans. on Comm., Dec. 1997, pp. 1613-621
[3]	Minn, Zeng, Bhargava: "On Timing Offset Estimation for OFDM", IEEE Communication Letters, July 2000, pp. 242-244

[4]	Speth, Fechtel, Fock, Meyr: "Optimum Receiver Design for Wireless Broad-Band Systems Using OFDM – Part I", IEEE Trans. On Comm. VOL. 47, NO 11, Nov. 1999
[5]	Speth, Fechtel, Fock, Meyr: "Optimum Receiver Design for Wireless Broad-Band Systems Using OFDM – Part II", IEEE Trans. On Comm. VOL. 49, NO 4, April. 2001
[6]	IEEE 802.16-2004, Part 16: Air Interface for Fixed Broadband Wireless Access Systems; 1 October 2004; Medium Access Control (MAC) and Physical Layer (PHY) specifications

4.1.3 Signal Processing of the IEEE802.16-2005 OFDMA/WiBro Measurement Application

The following description provides a brief overview of the digital signal processing used in the IEEE 802.16 OFDMA measurement application.

From the received IF signal as the point of origin to the actual analysis results like EVM or CINR, the digital signal processing can be divided into four major groups:

• Data capturing	
• chapter 4.1.3.2, "Synchronisation", on page 31 • chapter 4.1.3.3, "Channel Estimation/Equalization", on page 32 • chapter 4.1.3.4, "Analysis", on page 33	(OFDMA measurement application) (OFDMA measurement application) (OFDMA measurement application)

The description of the IEEE802.16-2005 OFDMA/WiBro measurement signal processing is structured accordingly:

- chapter 4.1.3.1, "Signal Processing Block Diagram", on page 31
- chapter 4.1.3.2, "Synchronisation", on page 31
- chapter 4.1.3.3, "Channel Estimation/Equalization", on page 32
- chapter 4.1.3.4, "Analysis", on page 33
- chapter 4.1.3.5, "OFDMA/WiBro Literature", on page 35

Abbrevations and Symbols:

Symbol	Description
$\mathbf{a}_{l,k}$, $\hat{\mathbf{a}}_{l,k}$	data symbol (actual, decided)
$\Delta\mathbf{f}_{res}$	residual carrier frequency offset
Δf, $\Delta\hat{f}_{coarse}$	carrier frequency offset between transmitter and receiver (actual, coarse estimate)
ξ	relative sampling frequency offset
$\mathbf{g}_l$	gain
$\mathbf{HI}_{,k}$, $\hat{\mathbf{H}}_{l,k}$	channel transfer function (actual, estimate)
i	time index

Symbol	Description
$\hat{\mathbf{i}}_{coarse}$, $\hat{\mathbf{i}}_{fine}$	timing estimate (coarse, fine)
k, $\mathbf{k}_p$, $\mathbf{k}_d$, $\mathbf{k}_{ch\ n}$	subcarrier index (general, pilot, data, subchannel **n**)
l	OFDM symbol index
N_{FFT}	length of FFT
N_g	number of samples in cyclic prefix (guard interval)
N_s	number of Nyquist samples
N_{sc}	number of subcarriers
n	subchannel index, subframe index
$\mathbf{n}_{l,k}$	noise sample
Φ_l	common phase error
$\Delta Q, \Delta \hat{Q}$	I/Q imbalance (actual, estimate)
r(i)	received sample in the time domain
$r_{l,k}, r'_{l,k}, r''_{l,k}, r'''_{l,k}$	received sample (uncompensated, fully compensated, partially compensated, equalized) in the frequency domain
T	useful symbol time
$\mathbf{T}_g$	guard time
$\mathbf{T}_s$	symbol time

Abbreviation	Description
AWGN	additive white Gaussian noise
BER	bit error rate
CFO	carrier frequency offset
CINR	carrier to interference and noise ratio
CIR	channel impulse response
CP	cyclic prefix (guard interval)
CPE	common phase error
CTF	channel transfer function
DL	downlink
EVM	error vector magnitude
FFT	fast Fourier transformation
IF	intermediate frequency
ISI	intersymbol interference
OFDM	orthogonal frequency division multiplexing

OFDMA	orthogonal frequency division multiple access
PAPR	peak to average power ratio
RSSI	received signal strength indicator
SFO	sampling frequency offset
UL	uplink

4.1.3.1 Signal Processing Block Diagram

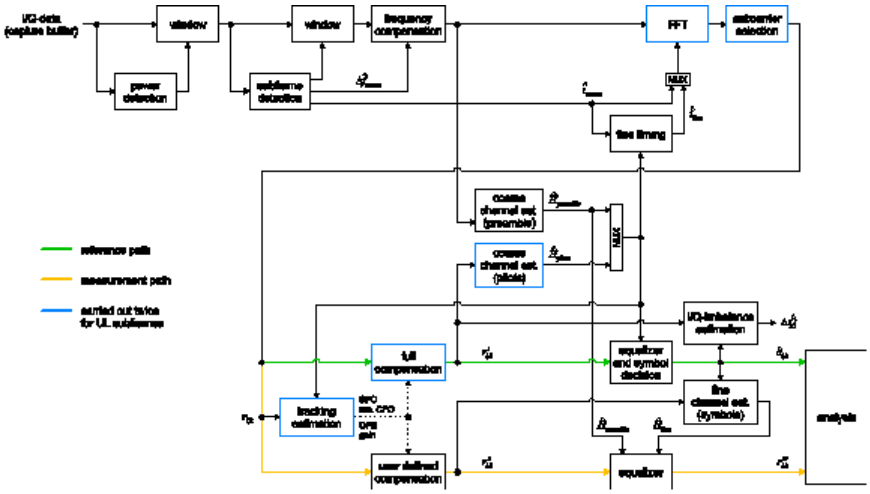


Fig. 4-5: Signal processing of the IEEE 802.16 OFDMA measurement application

The block diagram in the figure above in figure 4-5 shows the OFDMA measurement application from the capture buffer containing the I/Q data to the actual analysis block. Outcome of the fully compensated reference path (green) are the estimates $\hat{\mathbf{a}}_{l,k}$ of the transmitted data symbols $\mathbf{a}_{l,k}$. Depending on the user defined compensation, the received samples $r'''_{l,k}$ of the measurement path (orange) still contain the transmitted signal impairments of interest. The analysis block reveals these impairments by comparing the reference and the measurement path. Prior to the analysis, diverse synchronization and channel estimation tasks have to be accomplished.

4.1.3.2 Synchronisation

The first of the synchronization tasks is to detect areas of sufficient power within the captured I/Q data stream. The subframe detection block determines the beginning and end of each subframe and coarsely estimates both timing and carrier frequency offset. The fine timing block prior to the FFT allows a timing improvement using a level-based search for the beginning and end of the coarsely estimated channel impulse response. In the DL the coarse estimate of the CIR can be directly obtained from the preamble. Other than that the UL consists only of payload information with scattered pilots in the subcarrier-symbol plane, thus several OFDM symbols have to be observed to get a reliable estimate of the CIR. Since the OFDM symbols need to be phase synchronized prior to the channel estimation, the blue blocks in the figure above figure 4-5 have to be carried

out twice. In the first iteration the timing estimate $\hat{\mathbf{i}}_{coarse}$ is used to position the window of the FFT. Having found the pilot-based estimate of the CIR, the fine timing estimate $\mathbf{i}_{fine}$ is used in the second iteration.

After the time to frequency transformation by an FFT of length $\mathbf{N}_{FFT}$, the tracking estimation block is used to estimate the following:

relative sampling frequency offset ξ

residual carrier frequency offset $\Delta\mathbf{f}_{res}$

common phase error Φ_l

gain $\mathbf{g}_l$

Corresponding to [3] and [4], the uncompensated samples $\mathbf{r}_{l,k}$ can be expressed as

$$r_{l,k} = g_l \cdot a_{l,k} \cdot H_{l,k} \cdot \underbrace{e^{j\Phi_l}}_{\text{CPE}} \cdot \underbrace{e^{j2\pi \cdot N_s / N_{FFT} \cdot \xi \cdot k \cdot l}}_{\text{SFO}} \cdot \underbrace{e^{j2\pi \cdot N_s / N_{FFT} \cdot \Delta f_{res} \cdot T \cdot l}}_{\text{res.CFO}} + n_{l,k}$$

Equation (36) (4 - 6)

with

data symbol $\mathbf{a}_{l,k}$ on subcarrier **k** at OFDM symbol **l**

channel transfer function $\mathbf{H}_{l,k}$

number of Nyquist samples $\mathbf{N}_s$ within the symbol time $\mathbf{T}_s$

useful symbol time $\mathbf{T} = \mathbf{T}_s - \mathbf{T}_g$

independent and Gaussian distributed noise sample $\mathbf{n}_{l,k}$

Within one OFDM symbol both the CPE and the residual CFO respectively cause the same phase rotation for each subcarrier, while the rotation due to the SFO linearly depends on the subcarrier index. A linear phase increase in symbol direction can be observed for the residual CFO as well as the SFO.

The results of the tracking estimation block are used to compensate the samples $\mathbf{r}_{l,k}$. While a full compensation is performed in the reference path, the signal impairments that are of interest to the user are left uncompensated in the measurement path.

4.1.3.3 Channel Estimation/Equalization

According to figure 4-5, there are two coarse and one fine channel estimation blocks. Which of the two coarse estimation blocks is used depends on the link direction. For DL subframes the coarse channel estimation is based on the preamble and directly follows the coarse frequency compensation block. The pilot-based estimation for UL subframes is tapped behind the full compensation block of the reference path. Both of the coarse estimation blocks use available training symbols to determine initial estimates $\hat{H}_{l,k}$ of the channel transfer function at fixed positions in the subcarrier-symbol plane. Based on these nodes, the missing CTF values are obtained by interpolation in both time and frequency direction. The coarse estimation results are used for the above mentioned fine

timing and to equalize the samples $r'_{l,k}$ of the reference path prior to symbol decision. Based on the decided data symbols, a fine channel estimation is performed and then used to equalize the partially compensated samples of the measurement path.

4.1.3.4 Analysis

The analysis block of the OFDMA measurement application allows to calculate a variety of measurement variables.

- EVM
- CINR
- RSSI
- I/Q Imbalance
- Other Measurement Variables

EVM

The most important variable is the error vector magnitude (EVM).

$$EVM_{l,k} = \left| \frac{r'''_{l,k} - \hat{a}_{l,k}}{\hat{a}_{l,k}} \right|$$

Equation (37) (4 - 7)

on subcarrier **k** at OFDM symbol **l**. The subsequent average values can be derived from (37).

EVM of subchannel **n** at OFDM symbol **l**:

$$EVM_{l,\text{subchannel}\,n} = \sqrt{\frac{1}{N_{\text{sc}}} \sum_{k_{\text{ch}\,n}} EVM^2_{l,k_{\text{ch}\,n}}}$$

Equation (38) (4 - 8)

EVM of all pilot subcarriers:

$$EVM_{\text{pilots}} = \sqrt{\frac{1}{N_{\text{sc}}} \sum_{l} \sum_{k_{\text{p}}} EVM^2_{l,k_{\text{p}}}}$$

Equation (39) (4 - 9)

EVM of all data subcarriers:

$$EVM_{\text{data}} = \sqrt{\frac{1}{N_{\text{sc}}} \sum_{l} \sum_{k_{\text{d}}} EVM^2_{l,k_{\text{d}}}}$$

Equation (40) (4 - 10)

EVM of all used subcarriers:

$$EVM_{\text{all}} = \sqrt{\frac{1}{N_{\text{sc}}} \sum_{l} \left[\sum_{k_p} EVM_{l,k_p}^2 + \sum_{k_a} EVM_{l,k_a}^2 \right]}$$

Equation (41) (4 - 11)

The number of subcarriers respectively taken into account is denoted by $\mathbf{N}_{sc}$.

CINR

The carrier to interference and noise ratio is determined for each subframe **n**. The computation is based on the partially compensated samples $r''_{l,k}$, the decided symbols $\hat{\mathbf{a}}_{l,k}$, and the channel estimates $\hat{\mathbf{H}}_k$ (DL: preamble and fine; UL: fine).

$$CINR(n) = \frac{\sum_{l}\sum_{k} | \hat{a}_{l,k} \cdot \hat{H}_k |^2}{\sum_{l}\sum_{k} | r''_{l,k} - \hat{a}_{l,k} \cdot \hat{H}_k |^2}$$

Equation (42) (4 - 12)

Further CINR statistics are defined in the standards [5], [6].

$$\hat{\mu}_{\text{CINR}}(n) = \begin{cases} CINR(0) & n = 0 \\ (1-\alpha_{\text{avg}}) \cdot \hat{\mu}_{\text{CINR}}(n-1) + \alpha_{\text{avg}} \cdot CINR(n) & n > 0 \end{cases}$$

$$\hat{\mu}_{\text{CINR}}^{(\text{dB})}(n) = 10 \cdot \log \hat{\mu}_{\text{CINR}}(n)\ \text{dB}$$

$$\hat{x}_{\text{CINR}}^2(n) = \begin{cases} CINR^2(0) & n = 0 \\ (1-\alpha_{\text{avg}}) \cdot \hat{x}_{\text{CINR}}^2(n-1) + \alpha_{\text{avg}} \cdot CINR^2(n) & n > 0 \end{cases}$$

$$\hat{\sigma}_{\text{CINR}}^{(\text{dB})}(n) = 5 \cdot \log \left(\hat{x}_{\text{CINR}}^2(n) - \hat{\mu}_{\text{CINR}}^2(n) \right)\ \text{dB}$$

Equation (43) (4 - 13)

RSSI

The received signal strength indicator is determined for each subframe **n**. The computation is based on the time domain samples **r(i)** extracted by the subframe detection block.

$$RSSI(n) \sim \overline{| r(i) |^2}$$

Equation (44) (4 - 14)

Further RSSI statistics are defined in the standard [5], [6].

$$\hat{\mu}_{\mathrm{RSSI}}(n) = \begin{cases} RSSI(0) & n = 0 \\ (1-\alpha_{\mathrm{avg}}) \cdot \hat{\mu}_{\mathrm{RSSI}}(n-1) + \alpha_{\mathrm{avg}} \cdot RSSI(n) & n > 0 \end{cases}$$

$$\hat{\mu}_{\mathrm{RSSI}}^{(\mathrm{dB})}(n) = 10 \cdot \log \hat{\mu}_{\mathrm{RSSI}}(n)\ \mathrm{dB}$$

$$\hat{x}_{\mathrm{RSSI}}^{2}(n) = \begin{cases} RSSI^{2}(0) & n = 0 \\ (1-\alpha_{\mathrm{avg}}) \cdot \hat{x}_{\mathrm{RSSI}}^{2}(n-1) + \alpha_{\mathrm{avg}} \cdot RSSI^{2}(n) & n > 0 \end{cases}$$

$$\hat{\sigma}_{\mathrm{RSSI}}^{(\mathrm{dB})}(n) = 5 \cdot \log(\hat{x}_{\mathrm{RSSI}}^{2}(n) - \hat{\mu}_{\mathrm{RSSI}}^{2}(n))\ \mathrm{dB}$$

Equation (45) (4 - 15)

I/Q Imbalance

The I/Q imbalance estimation block allows to evaluate the

modulator gain balance = |1+ ΔQ| (46)

and the

quadrature mismatch = arg{1+ Q} (47)

respectively based on the block's estimate $\hat{\Delta Q}$.

Other Measurement Variables

Without going into detail, the OFDMA measurement application additionally provides the following results:

- Burst power
- Constellation diagram
- Group delay
- I/Q offset
- PAPR
- Pilot BER
- Spectral flatness

4.1.3.5 OFDMA/WiBro Literature

[1]	Speth, M., Classen, F., and Meyr, H.: Frame Synchronization of OFDM Systems in Frequency Selective Fading Channels. IEEE VTC'97, May 1997, pp. 1807-1811.
[2]	Schmidl, T. M. and Cox, D. C.: Robust Frequency and Timing Synchronization of OFDM. IEEE Trans. on Commun. Vol. 45 (1997) No. 12, pp. 1613-1621.
[3]	Speth, M., Fechtel, S., Fock, G., and Meyr, H.: Optimum Receiver Design for Wireless Broad-Band Systems Using OFDM – Part I. IEEE Trans. on Commun. Vol. 47 (1999) No. 11, pp. 1668-1677.

[4]	Speth, M., Fechtel, S., Fock, G., and Meyr, H.: Optimum Receiver Design for OFDM-Based Broadband Transmission – Part II: A Case Study. IEEE Trans. on Commun. Vol. 49 (2001) No. 4, pp. 571-578.
[5]	IEEE 802.16-2004™: Air Interface for Fixed Broadband Wireless Access Systems (2004).
[6]	IEEE Std 802.16e™-2005 and IEEE Std 802.16™-2004/Cor1-2005: Air Interface for Fixed and Mobile Broadband Wireless Access Systems (2006)

4.2 Instrument Functions WiMAX, WiBro Measurements (R&S FSV-K93)

The WiMAX IEEE 802.16 OFDM, OFDMA Measurements option (R&S FSV-K93) extends the functionality of the analyzer to enable WiMAX IEEE 802.16e, WiBro Measurements according to the IEEE standards listed below. It includes the functionality of the WiMAX 802.16 OFDM Measurements option (R&S FSV-K93). Accordingly both options are described together in this section, differentiated by the corresponding standards:

- WiMAX 802.16 OFDM Measurements (R&S FSV-K93)
  - IEEE 802.16-2004/Cor 1-2005 OFDM physical layer mode
    The short form IEEE 802.16-2004 OFDM is used in this section to reference this standard. The corresponding remote control mode is OFDM.
- WiMAX IEEE 802.16 OFDM, OFDMA Measurements option (R&S FSV-K93)
  - IEEE 802.16-2004/Cor 1-2005, IEEE 802.16e-2005 OFDMA physical layer mode
    The short form IEEE 802.16e-2005 OFDMA is used in this section to reference this standard. The corresponding remote control mode is OFDMA.
  - IEEE 802.16-2004/Cor 1-2005, IEEE 802.16e-2005 based WiBro
    The short form IEEE 802.16e-2005 WiBro is used in this section to reference this standard. The corresponding remote control mode is WiBro.

TX measurements of a WiMAX Device Under Test (DUT) according to the standards specified for the device are performed:

- Modulation formats
  - IEEE 802.16-2004: BPSK (IEEE 802.16-2004 OFDM), QPSK, 16QAM, 64QAM
- Modulation measurements
  - Constellation diagram
  - Constellation diagram per OFDM carrier
  - I/Q offset and I/Q imbalance
  - Carrier and symbol frequency errors
  - Modulation error (EVM) per OFDM carrier or symbol
  - Amplitude response and group-delay distortion (spectral flatness)
- Amplitude statistics (CCDF) and crest factor
- Frequency and Phase error vs Symbol
- Transmit spectrum mask
- Adjacent Channel Power (absolute and relative)

- FFT, also over a selected part of the signal, e.g. preamble
- Payload bit information
- Capture time selectable up to 50 ms, multiple sweeps possible for large number of bursts

To open the measurement menu

- If the "WiMAX" mode is not the active measurement mode, press the MODE key and activate the "WiMAX" option.
- If the "WiMAX" mode is already active, press the HOME or MEAS key.
  The measurement menu is displayed.
  To exit the "WiMAX" measurement mode, select another option.

4.2.1 Menu and Softkey Description

For WiMAX measurements, the following menus and softkeys are available.

- chapter 4.2.3, "Softkeys of the WiMAX, WiBro Menu (R&S FSV-K93)", on page 45
- chapter 4.2.4, "Softkeys of the Sweep Menu – SWEEP Key (R&S FSV-K93)", on page 105
- chapter 4.2.5, "Softkeys of the Marker Menu – MKR Key (R&S FSV-K93)", on page 106
- chapter 4.2.6, "Softkeys of the Marker to Menu – MKR-> Key (R&S FSV-K93)", on page 108
- chapter 4.2.7, "Softkeys of the Lines Menu – LINES Key (R&S FSV-K93)", on page 108
- chapter 4.2.8, "Softkeys of the Trace Menu – TRAC Key (R&S FSV-K93)", on page 109
- chapter 4.2.9, "Softkeys of the Input/Output Menu for WiMAX Measurements", on page 109

The "File", "Setup", and "Print" menus are provided as described for the base unit. For details refer to the corresponding menu descriptions. The "Span" and "Bandwidth" menus are not available in the "WiMAX" mode.

The FREQ, AMPT and TRIG keys open the "General Settings" or the "Demod Settings" dialog box. For details refer to "Settings General/Demod" on page 47.

4.2.2 Further Information

This chapter provides further information about the measurements and result displays for R&S FSV-K93 application.

- chapter 4.2.2.1, "Measurement and Result Displays", on page 38
- chapter 4.2.2.2, "Measurement Settings", on page 39
- chapter 4.2.2.3, "Result Summary List", on page 40

- chapter 4.2.2.4, "Result Display Graph", on page 43
- chapter 4.2.2.5, "Transfering the Current R&S SMU WiMAX Settings via LAN", on page 45
- chapter 4.2.2.6, "Title Bar Information", on page 45
- chapter 4.2.2.7, "Status Bar Information", on page 45

4.2.2.1 Measurement and Result Displays

The WiMAX IEEE 802.16 OFDM, OFDMA Measurements option provides two main measurement types:

- IQ measurements (based on captured IQ data)
  - Power vs Time (see "PVT" on page 47 softkey)
  - EVM vs Symbol, EVM vs Carrier (see "EVM vs Symbol/Carrier" on page 53 softkey)
  - Phase vs Preamble, Frequency vs Preamble (see "Error Frequency/Phase (IEEE 802.16-2004 OFDM)" on page 56 softkey)
  - Spectrum Flatness (see "Spectrum Flat./Diff./Group Delay (IEEE 802.16-2004 OFDM, WiBro)" on page 62 softkey)
  - Spectrum Flatness Adjacent Carrier Power Difference (see "Spectrum Flat./Diff./Group Delay (IEEE 802.16-2004 OFDM, WiBro)" on page 62 softkey)
  - Spectrum Group Delay (see "Spectrum Flat./Diff./Group Delay (IEEE 802.16-2004 OFDM, WiBro)" on page 62 softkey)
  - Preamble Channel Frequency Response: Phase (see "Channel Phase/Group Delay (IEEE 802.16e-2005 OFDMA)" on page 67 softkey)
  - Spectrum FFT (see "Spectrum FFT" on page 73 softkey)
  - Constellation vs Symbol (see "Constell vs Symbol/Carrier" on page 58 softkey)
  - Constellation vs Carrier (IEEE 802.16-2004 OFDM only, see "Constell vs Symbol/Carrier" on page 58 softkey)
  - Conditional Cumulative Distribution Function (see "CCDF" on page 78 softkey)
  - Bit Stream (see "Bitstream" on page 80 softkey)
- frequency sweep measurements
  - Spectrum Mask (see "SEM Settings" on page 76 softkey)
  - Spectrum ACP/ACPR (see "ACPR Abs/Rel" on page 74 softkey)

For current restrictions refer to "Current restrictions to the IEEE 802.16e-2005 OFDMA/ WiBro signal to be analyzed.

The measurement result display is divided into two parts:

- chapter 4.2.2.2, "Measurement Settings", on page 39
- Result display

The results can be displayed in form of a list or a graph (see also Display Graph/List softkey).

- chapter 4.2.2.3, "Result Summary List", on page 40
- chapter 4.2.2.4, "Result Display Graph", on page 43

When a graph is displayed, the result area can be split into 2 screens (see Screen Size Full/Split softkey):

- Screen A: capture buffer display
- Screen B: measurement result display

4.2.2.2 Measurement Settings

The overall measurement settings used to obtain the current measurement results are displayed below the title bar (see figure 4-6). The following settings are listed:

Setting	Description	Restrictions
Frequency	The frequency of the measured input signal.	
Burst Type	The type of burst being analyzed.	IEEE 802.16-2004 OFDM only
Zone/Seg	The zone and segment being analyzed	IEEE 802.16e-2005 OFDMA/ WiBro only
Signal Level	The expected mean signal level for the input signal.	
Modulation	Shows the active setting selected in the "Demod Settings" dialog box, "Demodulator" list. If the "Mod". "Detection" field is set to "ALL", "ALL" is displayed.	IEEE 802.16-2004 OFDM only
	Shows the active setting selected in the "Demod Settings" dialog box, "Demodulator" list. If the "Modulation Analysis Scope" field is set to "ALL", "ALL" is displayed.	IEEE 802.16e-2005 OFDMA/ WiBro only
External Att	The attenuation (positive values) or gain (negative values) applied to the signal externally (i.e. before the RF or IQ connector of the spectrum analyzer), e.g.: External Att = 10 dB means that before the RF connector of the analyzer a 10 dB attenuator is used External Att = -20 dB means that before the RF connector of the analyzer a amplifier with 20 dB gain is used.	
Data Symbols	Shows the minimum and maximum number of data symbols that a burst may have to be considered in results analysis.	IEEE 802.16-2004 OFDM only
Zone Offset/Length	A combined display of the offset and length of the analyzed zone	IEEE 802.16e-2005 OFDMA/ WiBro only

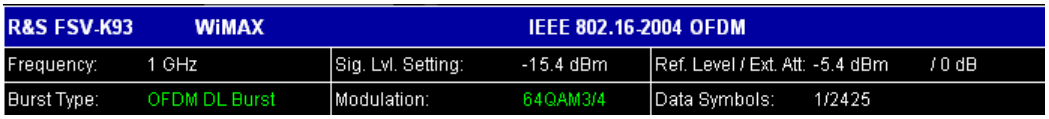


Fig. 4-6: Measurement settings for IEEE 802.16-2004 OFDM (example)

R&S FSV-K93	WiMAX	IEEE 802.16e-2005 OFDMA			
Frequency:	1 GHz	Sig. Lvl Set:	-14.8 dBm	Ref. Level / Ext. Att:	-4.81 dBm / 0 dB
Zone / Seg:	DL-PUSC, ID=A, Seg=0	Modulation:	ALL	Zone Offset / Len:	1 / 26 Symbols

Fig. 4-7: Measurement settings for IEEE 802.16e-2005 OFDMA/WiBro (example)

4.2.2.3 Result Summary List

If the results are displayed in tabular form (Display Graph/List softkey), the result summary list is displayed. It shows the overall measurement results and provides limit checking for result values in accordance with the selected standard. Result values which are within the limit as specified by the standard are displayed in green. Result values which are outside of the limits specified by the standard are displayed in red with a '*' to the left. Results which have no limits specified by the standard are displayed in white. Limit values are displayed in white (not bold) and can be modified, when focused, via the keypad. Limits are modified for the currently selected modulation scheme. Each modulation scheme may have its own set of user defined limits. To reset the limit values to the values specified in the standard, use the "Lines" menu (LINES key).

- IEEE 802.16-2004 OFDM
  The results displayed in this list are for the entire measurement. If a specific number of bursts have been requested which requires more than one sweep, the result summary list is updated at the end of each sweep. The number of bursts measured and the number of bursts requested are displayed to show the progress through the measurement. The Min/Mean/Max columns show the minimum, mean or maximum values of the burst results.

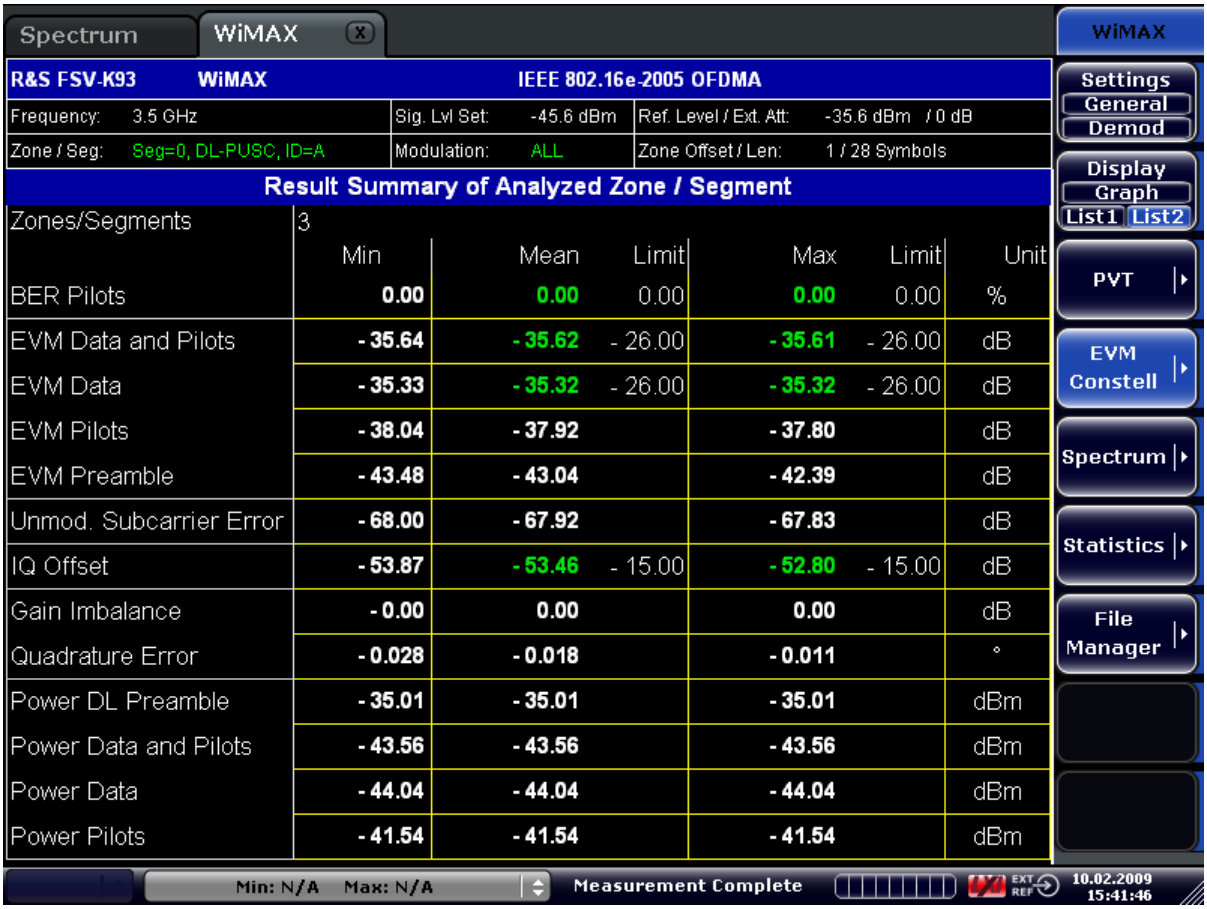


Fig. 4-8: Result summary list for IEEE 802.16-2004 OFDM (example)

- IEEE 802.16e-2005 OFDMA, WiBro

For these measurement results, the minimum, mean, and maximum is taken over the analyzed zones of the current capture buffer content.

Two lists are available:

- Result Summary of Analyzed Subframes (list 1)
- Result Summary of Analyzed Zone/Segment (list 2)

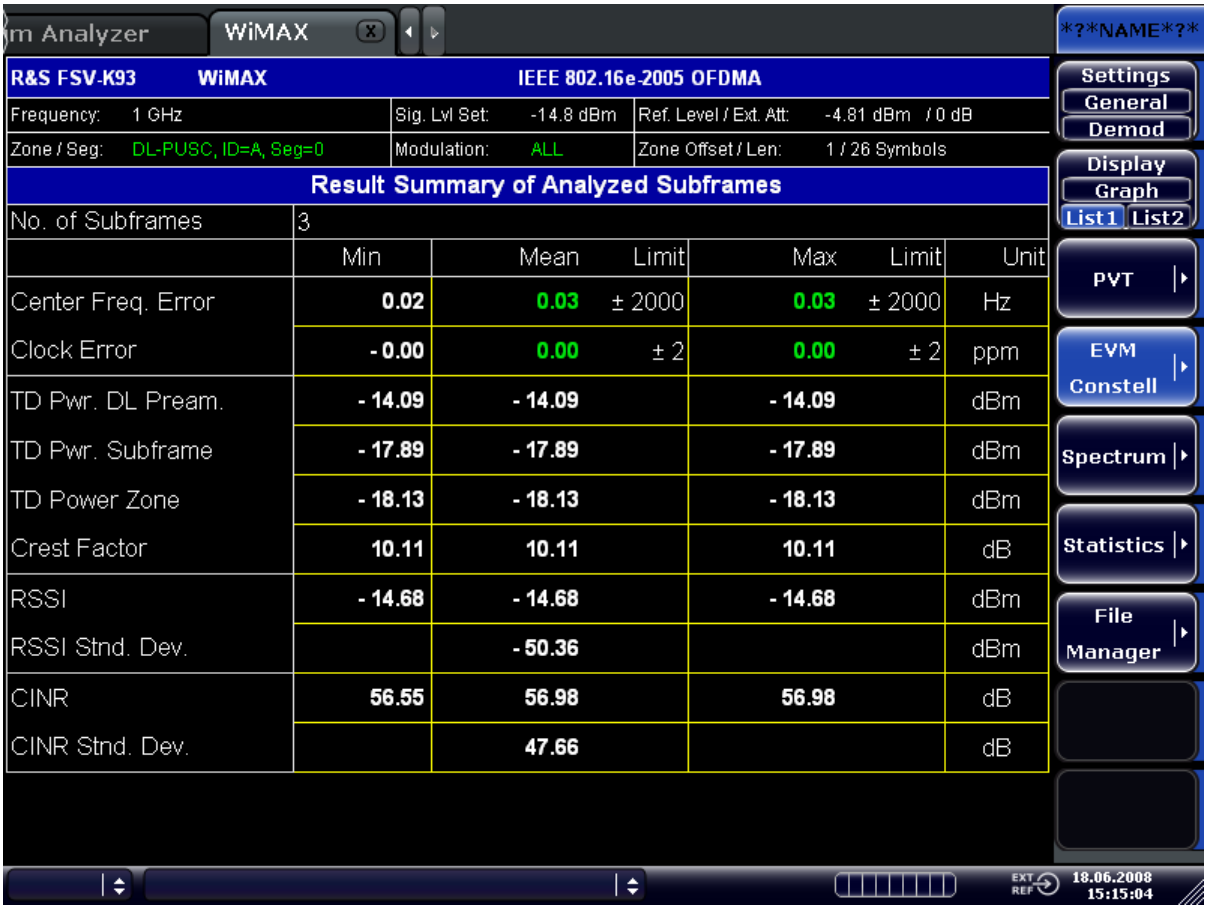


Fig. 4-9: Result summary list for IEEE 802.16e-2005 OFDMA/WiBro (example)

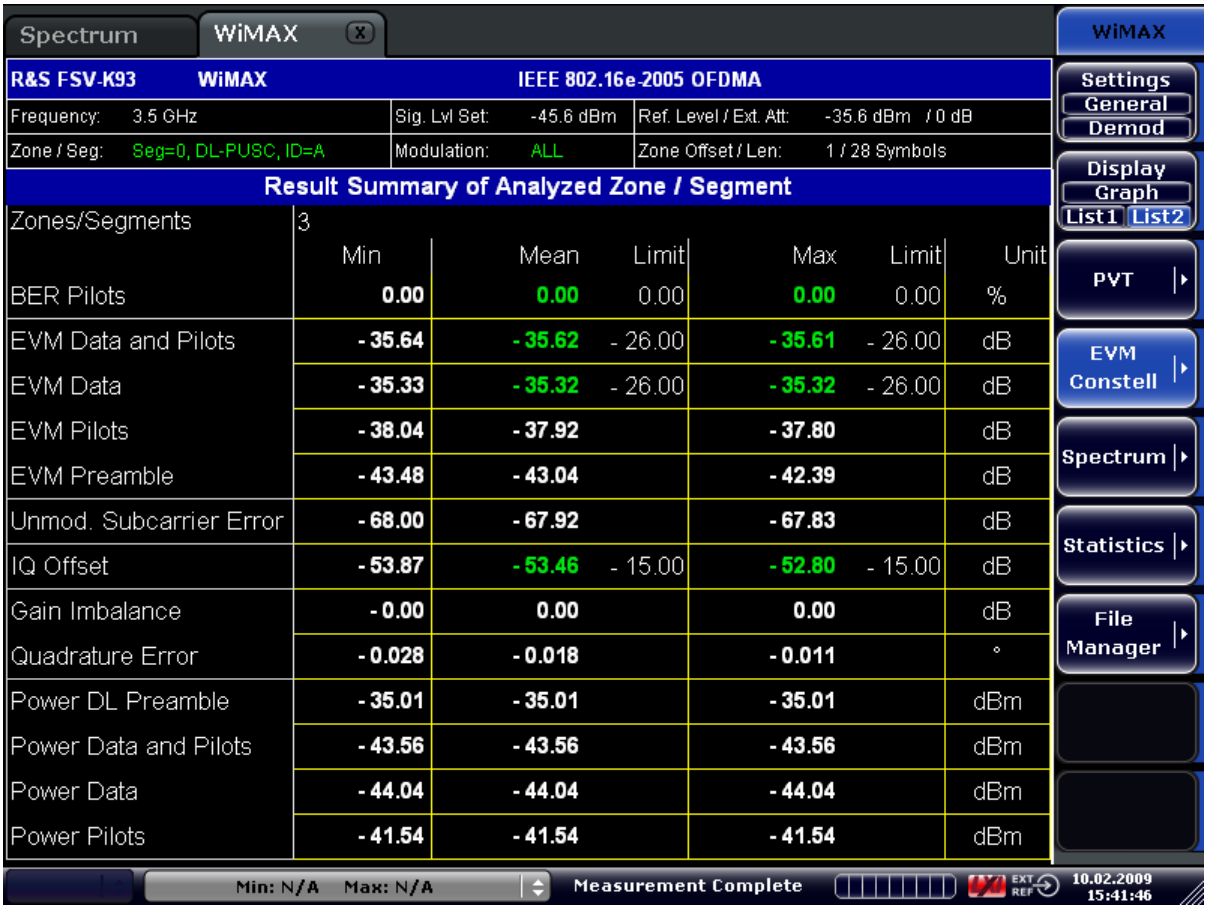


Fig. 4-10: Result summary list 2 for IEEE 802.16e-2005 OFDMA/WiBro (example)

4.2.2.4 Result Display Graph

- IQ measurements
  If the results are displayed in graphical form (Display Graph/List softkey), additionally to the selected graphical result display, the Magnitude Capture Buffer (power profile) display is provided for all IQ measurements. The different result displays are described with the corresponding softkey.
  The Magnitude Capture Buffer display shows the complete range of captured data for the last sweep. All analyzed bursts are identified with a green bar at the bottom of the Magnitude Capture Buffer display. Only those bursts match the required criteria. The gate delay line ("GD") and gate length line ("GL") are displayed in red color.

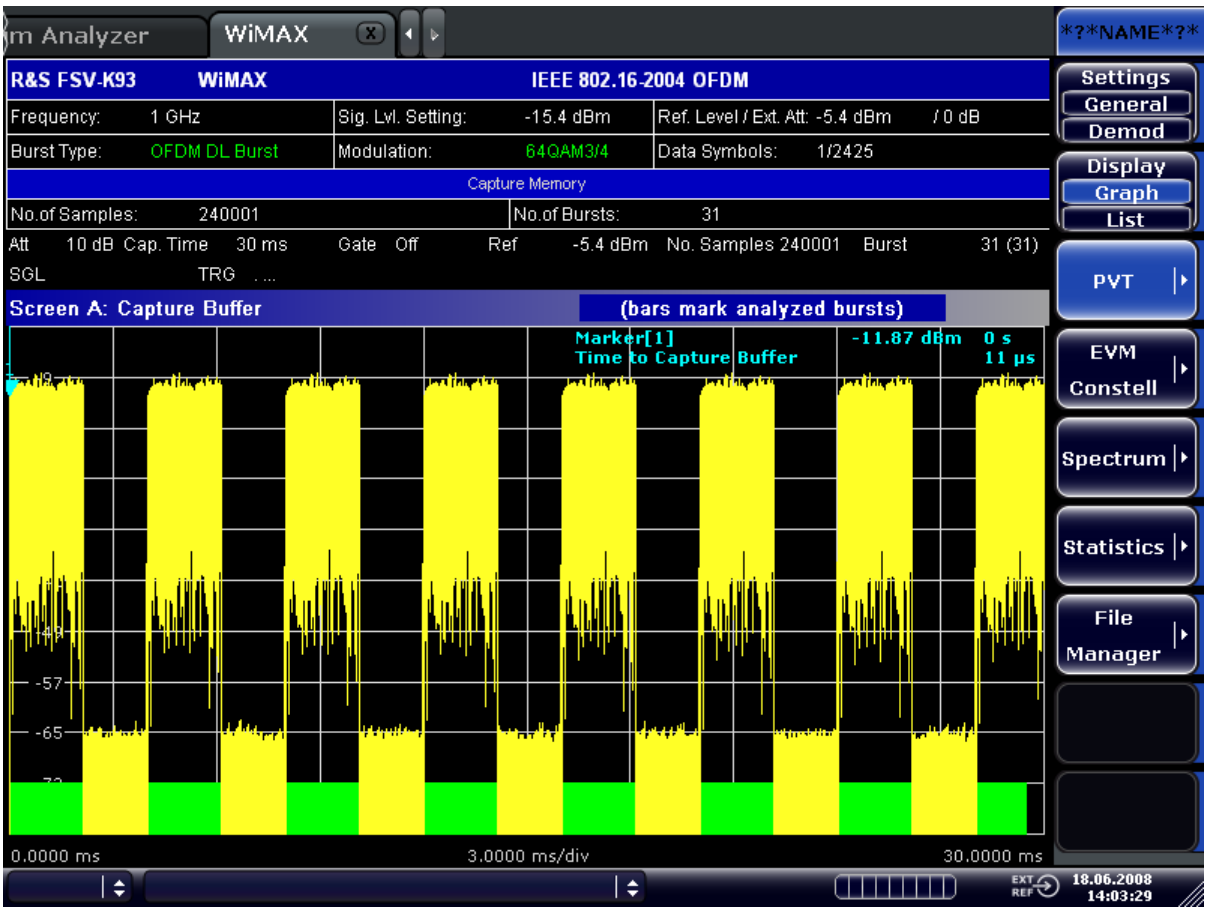


Fig. 4-11: Magnitude capture buffer results (example)

All IQ measurements process the same signal data and as such all IQ measurement results are available after a single IQ measurement execution.

IQ measurements can be run in split screen mode (allowing both the Magnitude Capture Buffer display and the selected IQ measurement results to be displayed simultaneously) or in full screen mode (with either the Magnitude Capture Buffer display or the selected IQ measurement results displayed).

If measuring OFDMA or WiBro measurements, the time from the start of the capture buffer to the start of the first frame is also displayed in the Magnitude Capture buffer. This time is marked with a vertical blue line, with the result displayed at the top of the graph.

- Frequency sweep measurements
  The frequency sweep measurements use different signal data to IQ measurements and as such it is not possible to run an IQ measurement and then view the results in the frequency sweep measurements and vice-versa. Also because each of the frequency sweep measurements uses different settings to obtain signal data it is not possible to run a frequency sweep measurement and view the results of another frequency sweep measurement.
  All frequency sweep measurements are run in full screen mode.

4.2.2.5 Transfering the Current R&S SMU WiMAX Settings via LAN

Prerequisite: The Windows Firewall of the R&S SMU is switched off.

1. Press the Settings General/Demod softkey to open the "General Settings" dialog box.
2. Under "Signal Characteristics" in the Standard list, select the "IEEE 802"."16e"-"2005 OFDMA" or "IEEE 802"."16e"-"2005 WiBro" standard.
3. Open the "Advanced Settings" dialog box
4. Under SETUP in the SMU Address field specify the TCP/IP address of the R&S SMU.
5. Press the "More >" softkey to change into the side menu.
6. Press the File Manager softkey to open the File Manager.
7. Under "Folders", select the "SMU" entry.
8. Under "Files", select the "Current SMU WiMAX Settings" entry using the "RIGHT-ARRROW" key.
9. Press the "Recall" softkey.
10. The selected WiMAX setting file is transferred from the R&S SMU to the analyzer.

4.2.2.6 Title Bar Information

The title bar displays the following information:

- standard applicable to the current measurement

4.2.2.7 Status Bar Information

The status bar displays the following information:

- parameter values
  If a parameter in a settings dialog box is selected, the minimum and maximum values for the selected parameter are displayed.
  If a Boolean parameter in a dialog box is selected, the minimum and maximum values are displayed as N/A for not applicable.
- measurement status
  During the measurement, the current measurement status along with detailed information about the progress is displayed.
- error messages (with red background)
- warning messages (with yellow background)

4.2.3 Softkeys of the WiMAX, WiBro Menu (R&S FSV-K93)

The following table shows all softkeys available in the "WiMAX" menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available

with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

4.2.3.1 Description of the softkeys of the WiMAX, WiBro Menu

Settings General/Demod
Opens the chapter 4.2.3.2, "General Settings Dialog Box", on page 85 or the chapter 4.2.3.3, "Demod Settings Dialog Box", on page 92 dialog box. Screenshots of the dialog boxes are provided in chapter 4.1.1, "Basic Measurement Examples", on page 14.

Alternatively, the "General Settings" dialog box is opened as follows:

- FREQ key, with focus on the "Frequency" field
- AMPT key, with focus on the "Signal Level" ("RF") field
- TRIG key, with focus on the "Trigger Mode" field

Display Graph/List
Configures the result display. The measurement results are displayed either in form of a list of measurement points or as a graphical trace.

For details on the result displays refer to chapter 4.2.2.3, "Result Summary List", on page 40 and chapter 4.2.2.4, "Result Display Graph", on page 43.

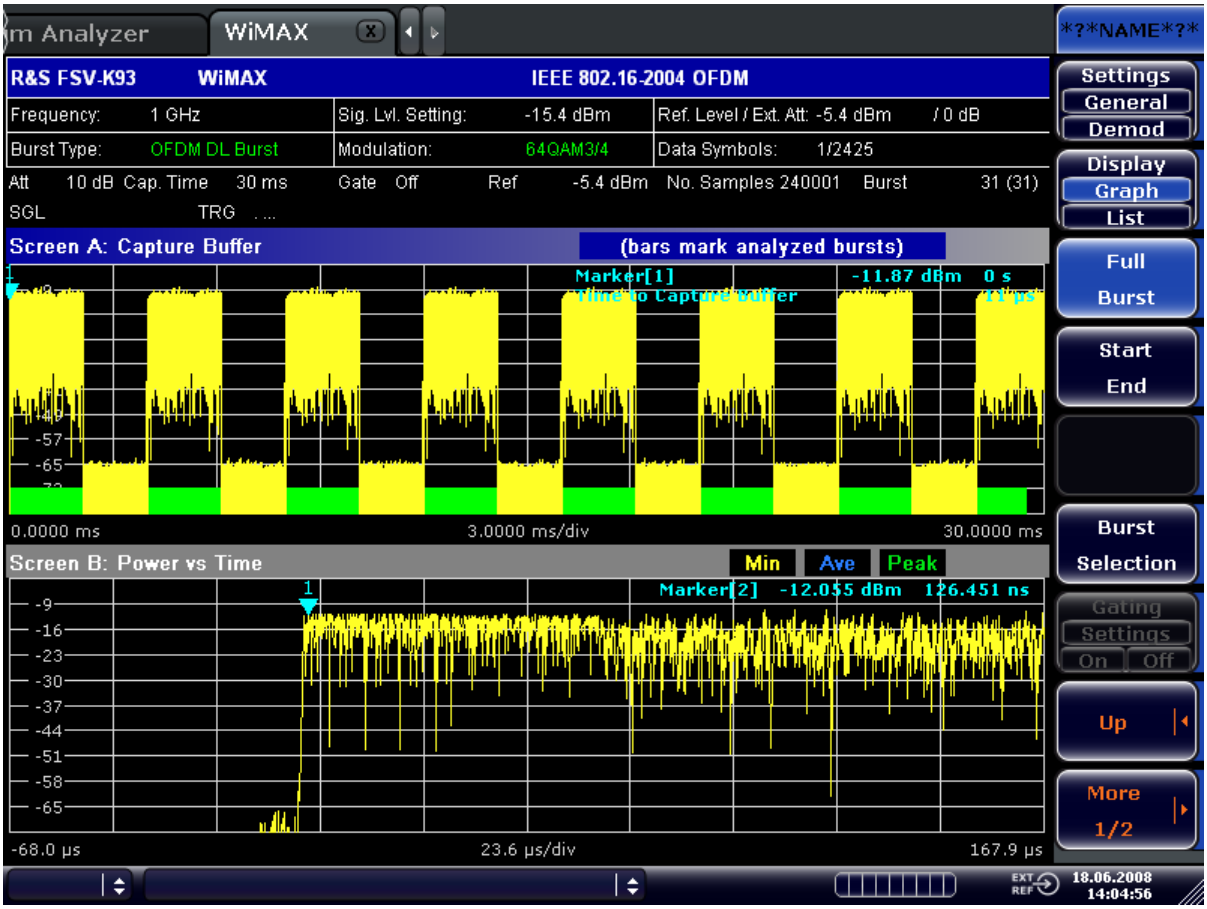
SCPI command:
`DISPlay[:WINDow<n>]:TABLe` on page 181

PVT
Opens the PVT submenu to select the "Power vs Time" measurement results.

The PVT result displays show the measured input data over the full range or over complete bursts, displayed within the gating lines if gating is switched on. The results are displayed as a single burst. If the gate start or gate length are altered then the results can be updated to reflect these changes by pressing the Refresh softkey in the "Sweep" menu.

SCPI command:
`CONFigure:BURSt:PVT[:IMMediate]` on page 156

Full Burst (IEEE 802.16-2004 OFDM) ← PVT
Displays the PVT results in a single graph with all burst data being displayed ("Display Graph" selected), or in a list ("Display List" selected).



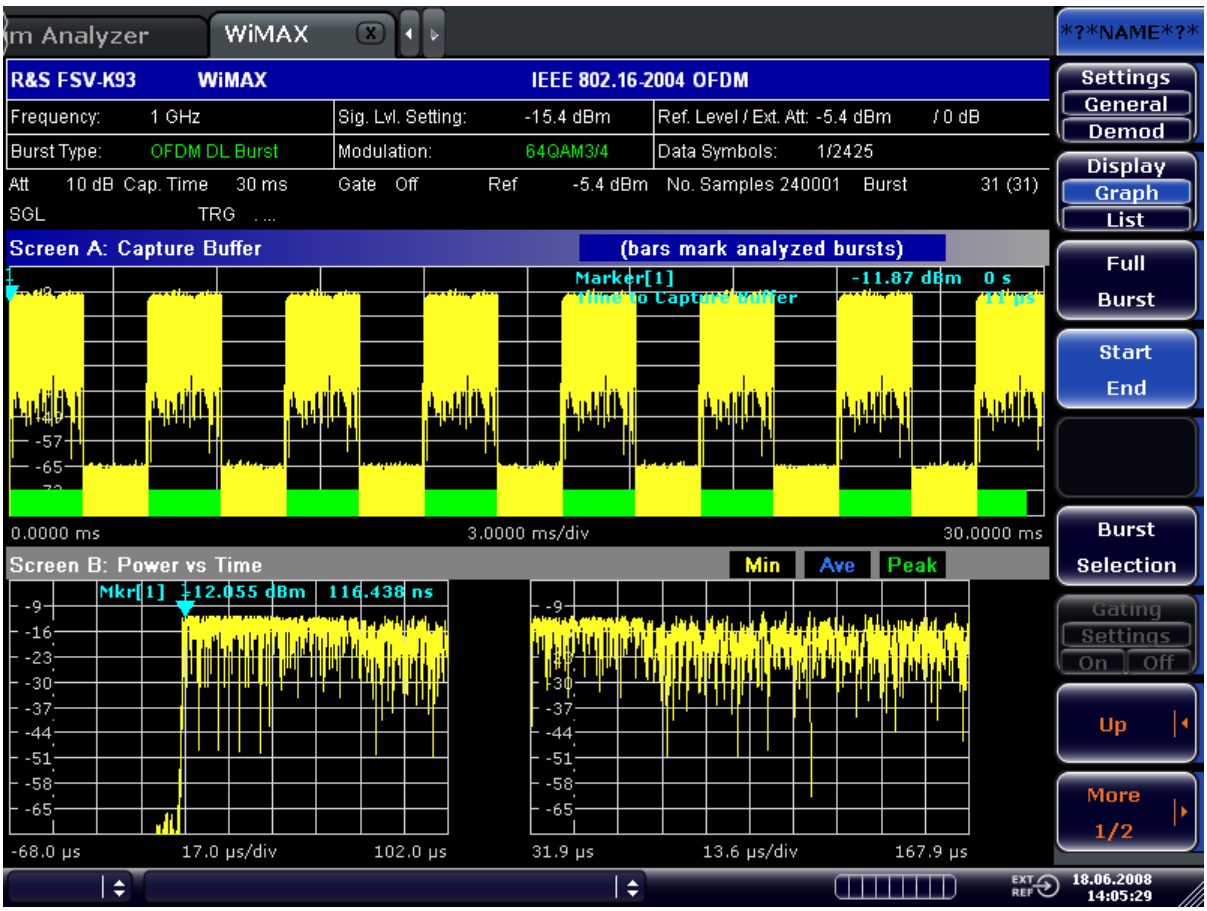
For further details refer to the Display Graph/List softkey.

SCPI command:

`CONFigure:BURSt:PVT:SELect` on page 157

Start End (IEEE 802.16-2004 OFDM) ← PVT

Displays the results in two separate graphs, the left hand side showing the start and the right hand side showing the end of a burst ("Display Graph" selected), or in a list ("Display List" selected).



SCPI command:

CONF:BURS:PVT:SEL EDGE, see CONFigure:BURSt:PVT:SELect on page 157

Burst Selection (IEEE 802.16-2004 OFDM) ← PVT

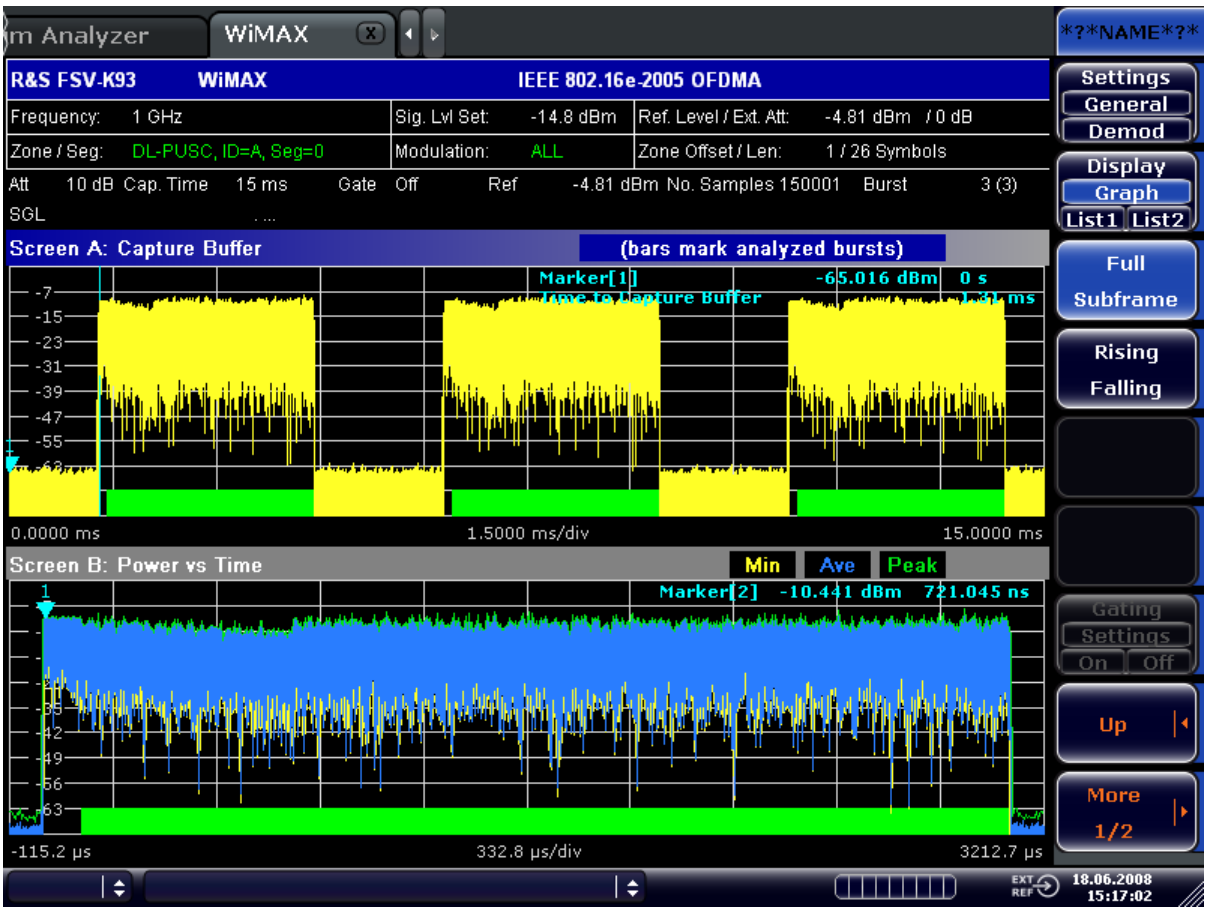
Opens an edit dialog box to select a burst by entering its number.

SCPI command:

CONFigure:BURSt:PVT:BURSt on page 157

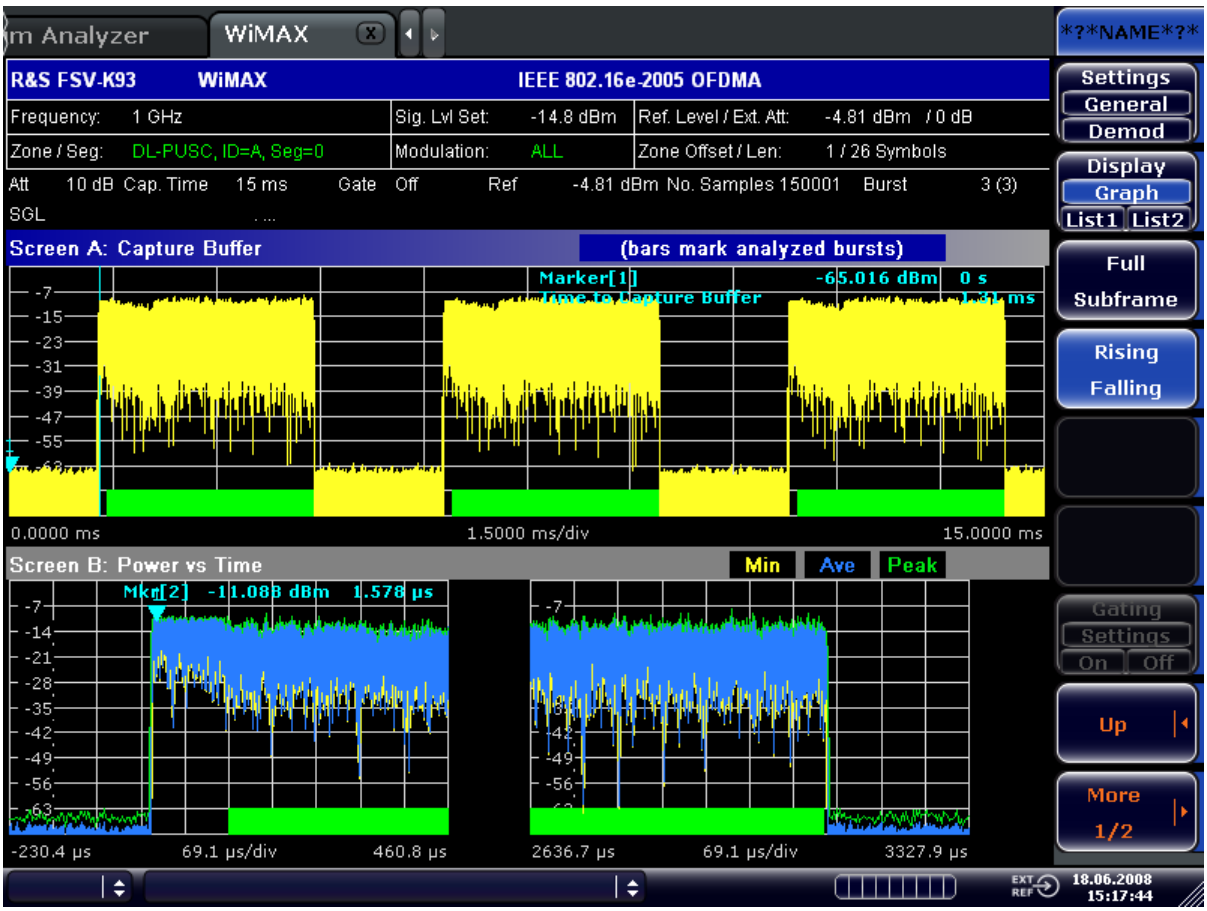
Full Subframe (IEEE 802.16e-2005 OFDMA/WiBro) ← PVT

Displays the results in a single graph with the minimum, mean, and maximum power profile of the subframe that contains the zone selected to be analyzed ("Display Graph" selected), or in two lists ("Display List 1/2" selected).



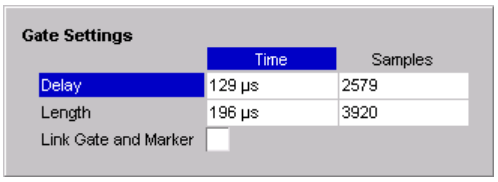
SCPI command:
`CONF:BURS:PVT:SEL FULL`, see `CONFigure:BURSt:PVT:SELect` on page 157

Rising/Falling (IEEE 802.16e-2005 OFDMA/WiBro) ← PVT
Displays the results in two separate graphs: the minimum, mean, and maximum power profile of rising (on the left hand) or falling (on the right hand) edge of the subframe that contains the zone selected to be analyzed ("Display Graph" selected), or in two lists ("Display List 1/2" selected).



SCPI command:
`CONF:BURS:PVT:SEL EDGE`, see `CONFigure:BURSt:PVT:SELect` on page 157

Gating Settings On/Off ← PVT
Activates or deactivates gating, or opens the "Gate Settings" dialog box to specify range of captured data used in results calculation (available for Spectrum Mask, Spectrum FFT, Spectrum ACPR, CCDF).



On	Uses only the specified range of captured data in results calculation. In the Magnitude Capture Buffer trace, two vertical lines mark the specified range.
Off	Uses all the captured data in results calculation.

In the "Gate Settings" dialog box, the following parameters are set:

Delay	Start point of captured data to be used in results calculation, i.e. the delay from the start of the captured data in time or samples. If the delay is specified in time, the number of samples is updated accordingly, and vice versa.
Length	Amount of captured data to be used in results calculation. If the length is specified in time, the number of samples is updated accordingly, and vice versa.
Link Gate and Marker	If activated, the position of the marker and the gate lines are linked. The marker is positioned half way between gate start and end. The marker position alters if the gate is modified, and the gate lines move with the marker if the marker position is altered.

The gate settings are defined for following measurements: Spectrum FFT, CCDF, Spectrum Mask, Spectrum ACPR.

If a frequency sweep measurement is active (Spectrum Mask and Spectrum ACP), the result display is switched to the Magnitude Capture Buffer display in order to help defining the gate settings correctly.

SCPI command:

`[SENSe:]SWEep:EGATe` on page 215

`[SENSe:]SWEep:EGATe:HOLDoff:SAMPle` on page 216

`[SENSe:]SWEep:EGATe:LENGth:SAMPle` on page 216

`[SENSe:]SWEep:EGATe:LINK` on page 217

Import ← PVT

Opens the "Choose the file to import" dialog box.

Select the IQ data file you want to import and press ENTER. The extension of data files is *.iqw.

SCPI command:

`MMEMory:LOAD:IQ:STATe 1,` on page 201

Export ← PVT

Opens the "Choose the file to export" dialog box.

Enter the path and the name of the IQ data file you want to export and press ENTER. The extension of data files is *.iqw. If the file cannot be created or there is no valid IQ data to export an error message is displayed.

SCPI command:

`MMEMory:STORe:IQ:STATe 1,` on page 201

R&S Support ← PVT

Stores useful information for troubleshooting in case of errors.

This data is stored in the `C:\R_S\Instr\user\Support` directory on the instrument.

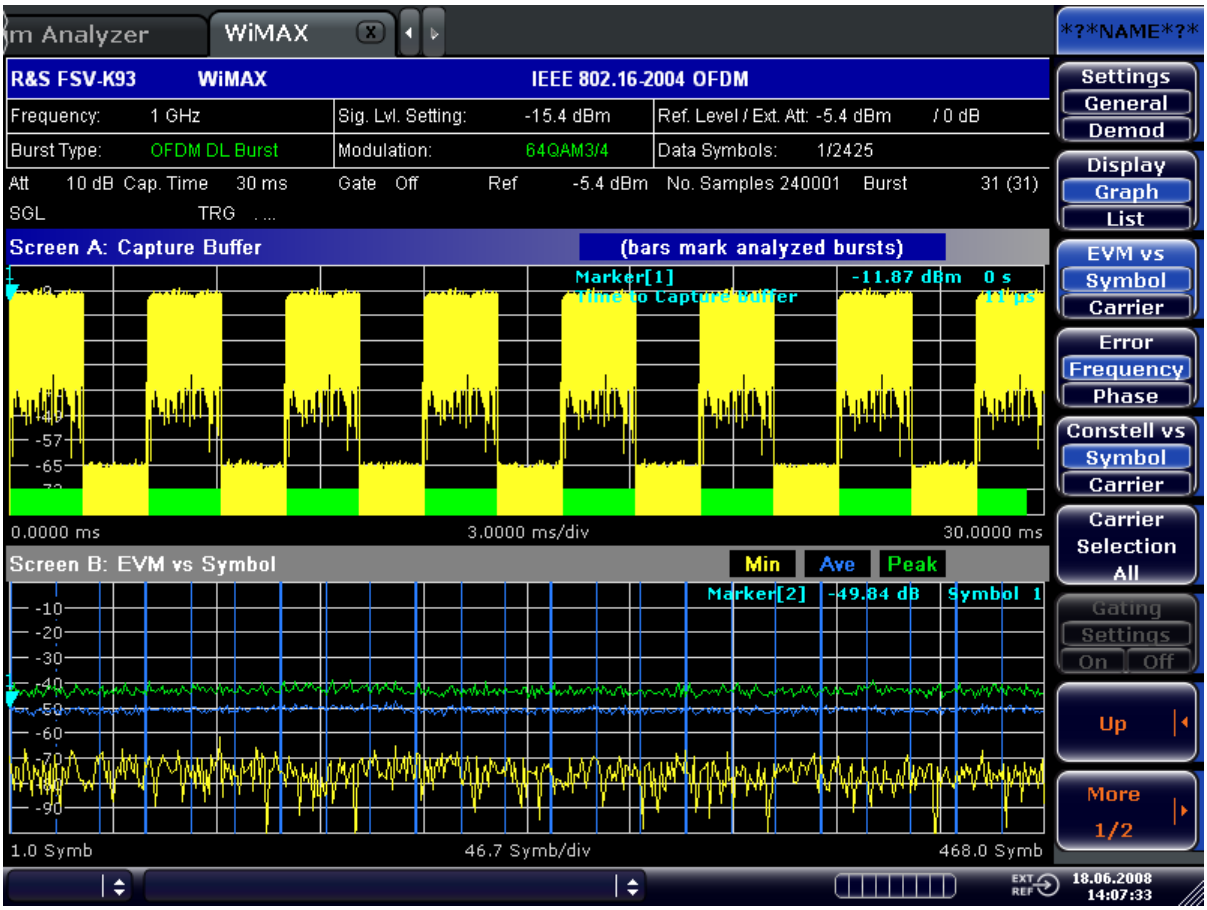
If you contact the Rohde&Schwarz support to get help for a certain problem, send these files to the support in order to identify and solve the problem faster.

EVM Constell

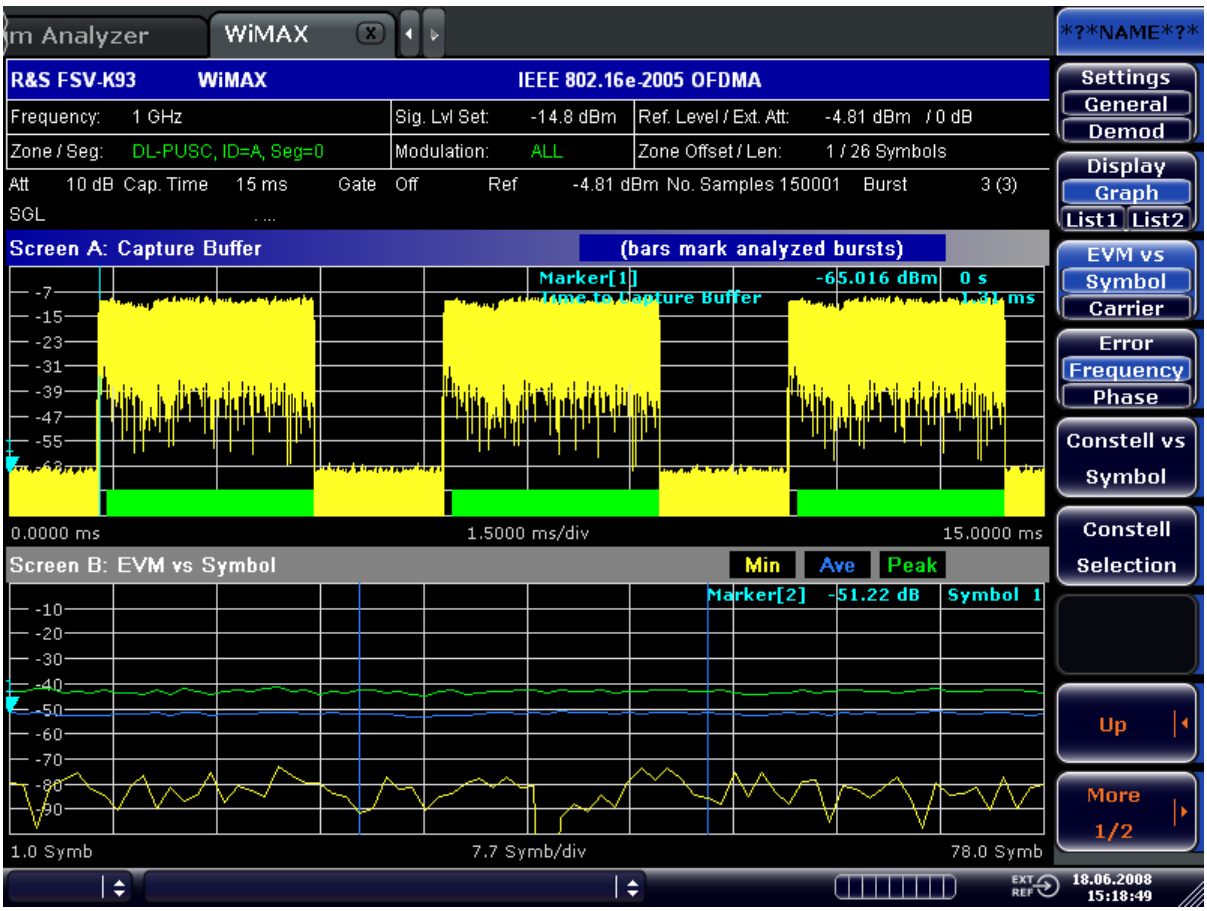
Opens a submenu to select the error vector magnitude (EVM) or the constellation result displays.

EVM vs Symbol/Carrier ← EVM Constell
Selects the EVM vs Symbol or EVM vs Carrier result displays.

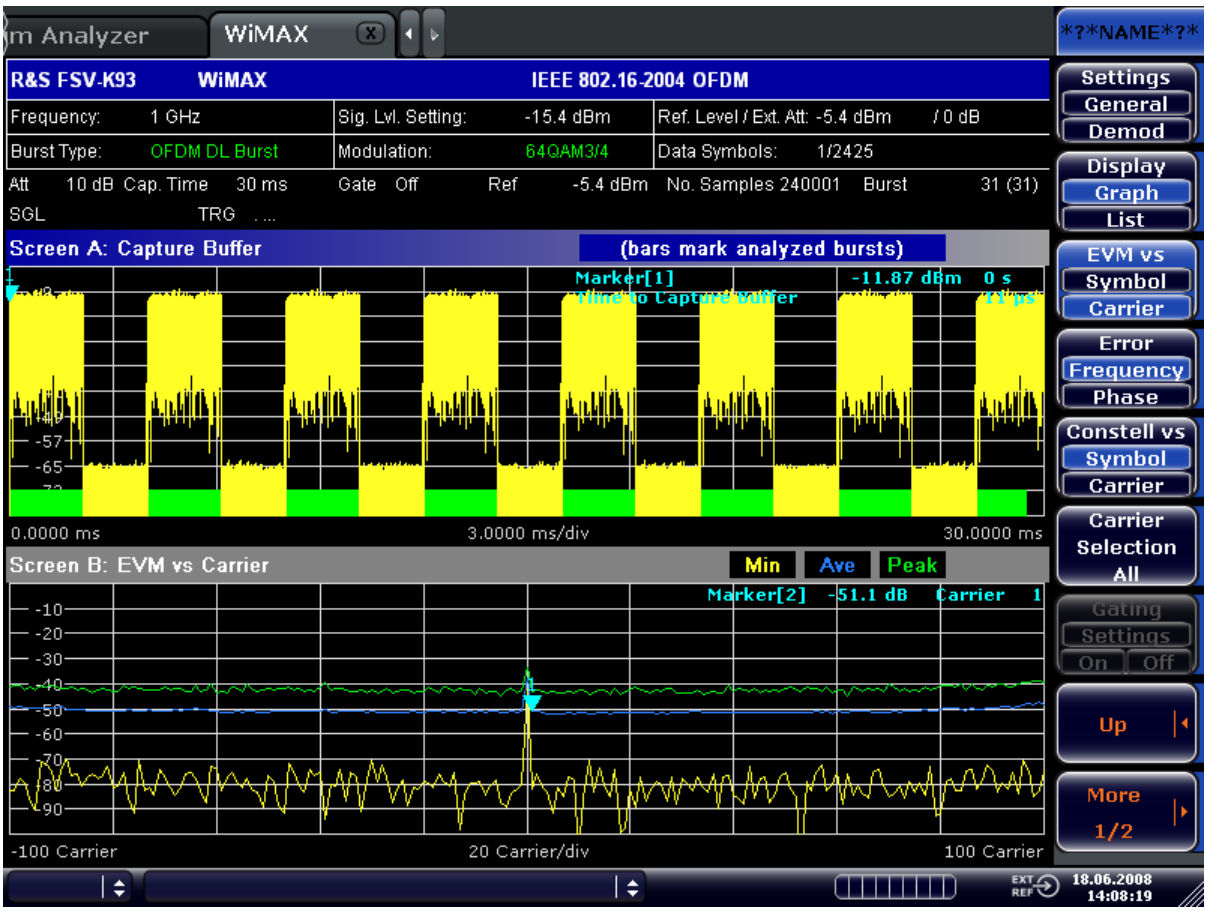
- EVM vs Symbol (IEEE 802.16-2004 OFDM)
  This result display shows the EVM measured over the full range of the measured input data. The results are displayed on a per-symbol basis, with blue vertical lines marking the boundaries of each burst. Note that burst boundary lines are only displayed if the number of analyzed bursts is less than 250. The minimum, average, and maximum traces are displayed.
  For the trace labeled with EVM a commonly used EVM definition is applied, which is the square root of the momentary error power normalized by the averaged reference power. For details of this measurement refer to chapter 4.1.2.1, "Understanding Signal Processing of the IEEE 802.16-2004 OFDM Measurement Application", on page 18.



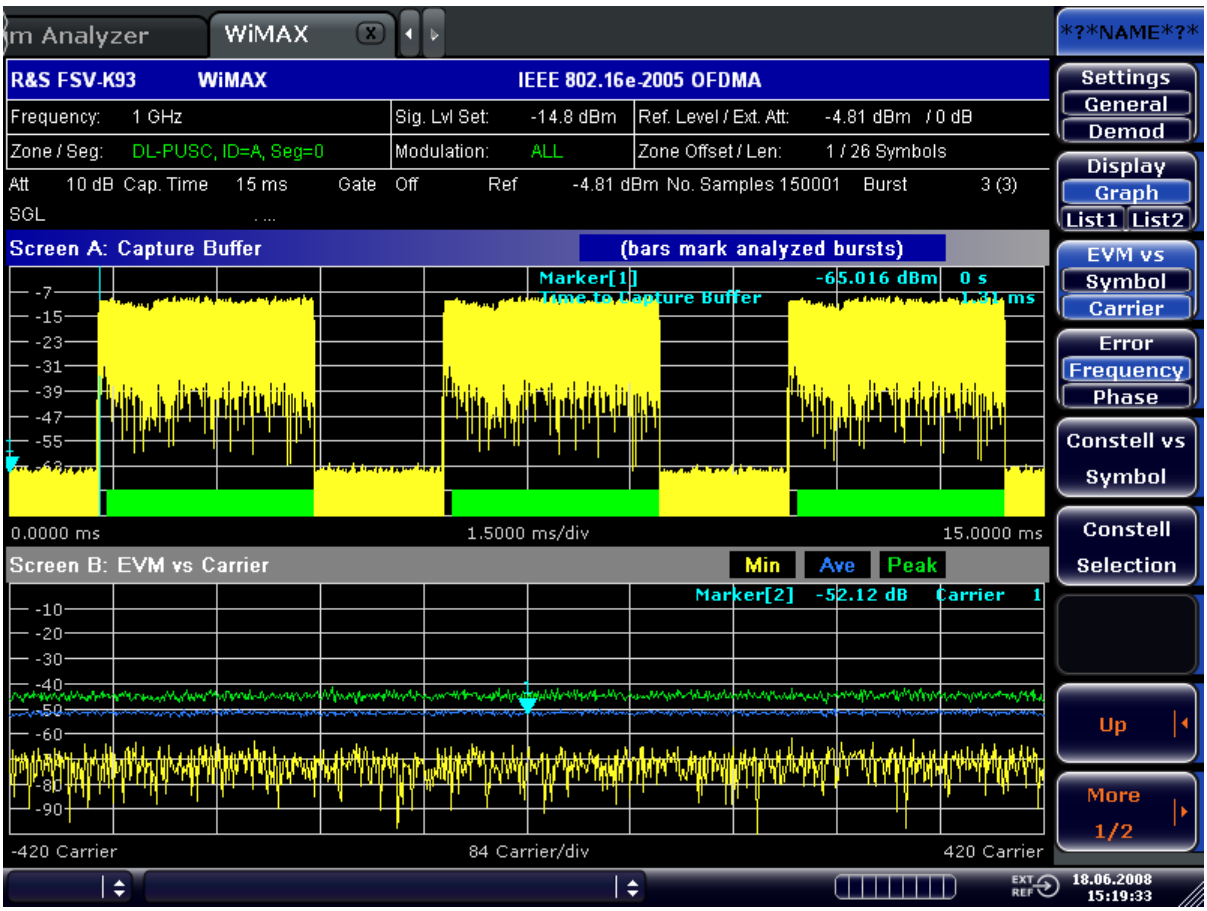
- EVM vs Symbol (IEEE 802.16e-2005 OFDMA/WiBro)
  This result display shows all EVM values versus the symbols of the analyzed zone. If the capture buffer contains more than one analyzed zones, the corresponding result graphs will be appended. The minimum, mean, and maximum statistics is performed over carriers.



- EVM vs Carrier (IEEE 802.16-2004 OFDM)
  This result display shows all EVM values recorded on a per-carrier basis over the full set of measured data. The minimum, average and maximum traces are displayed.



- EVM vs Carrier (IEEE 802.16e-2005 OFDMA/WiBro)
  This result display shows all EVM values versus the physical carriers. The minimum, mean, and maximum statistics is performed over the symbols of all analyzed zones in the capture buffer.



SCPI command:

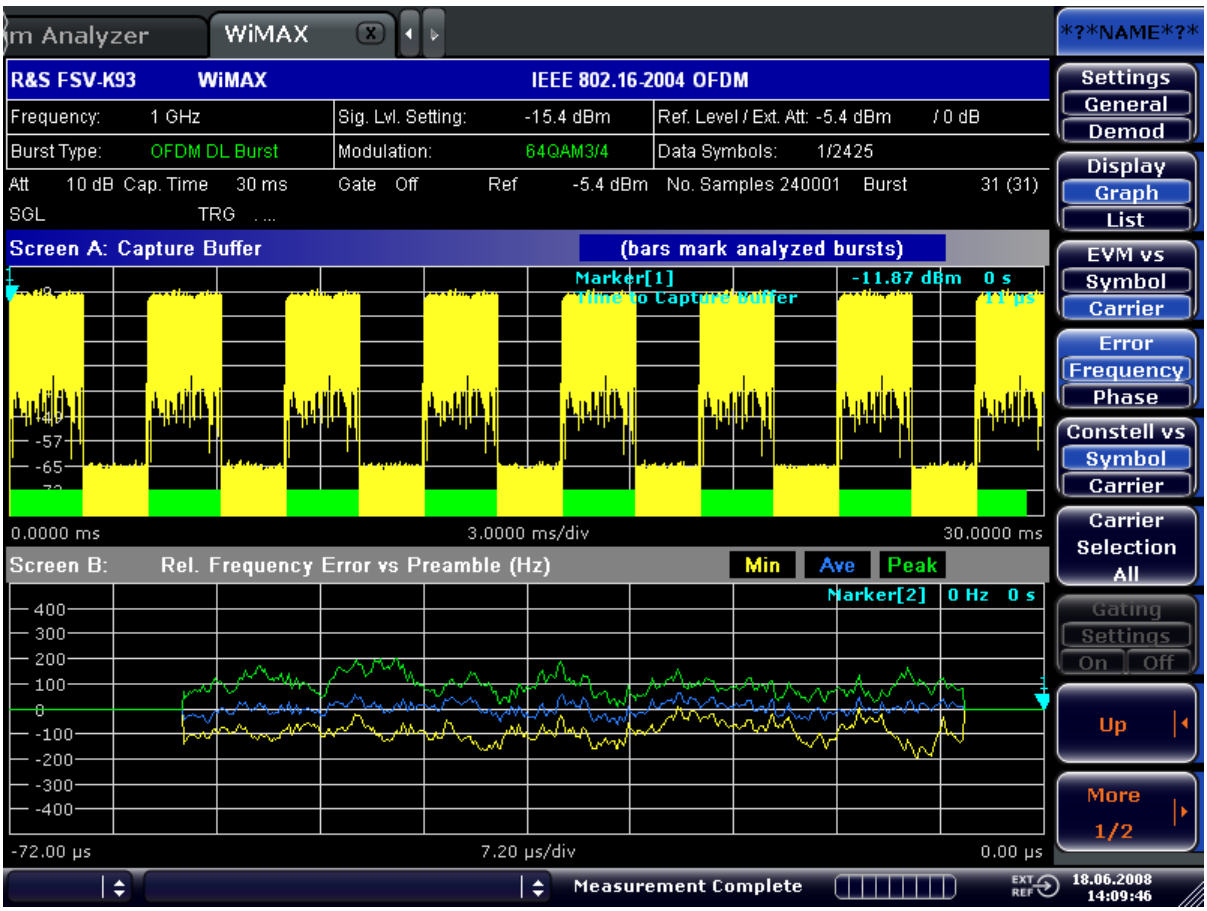
EVM vs Symbol: `CONF:BURS:EVM:ESYM`, see `CONFigure:BURSt:EVM:ESYMbol[:IMMediate]` on page 155

EVM vs Carrier: `CONF:BURS:EVM:ECAR`, see `CONFigure:BURSt:EVM:ECARrier[:IMMediate]` on page 155

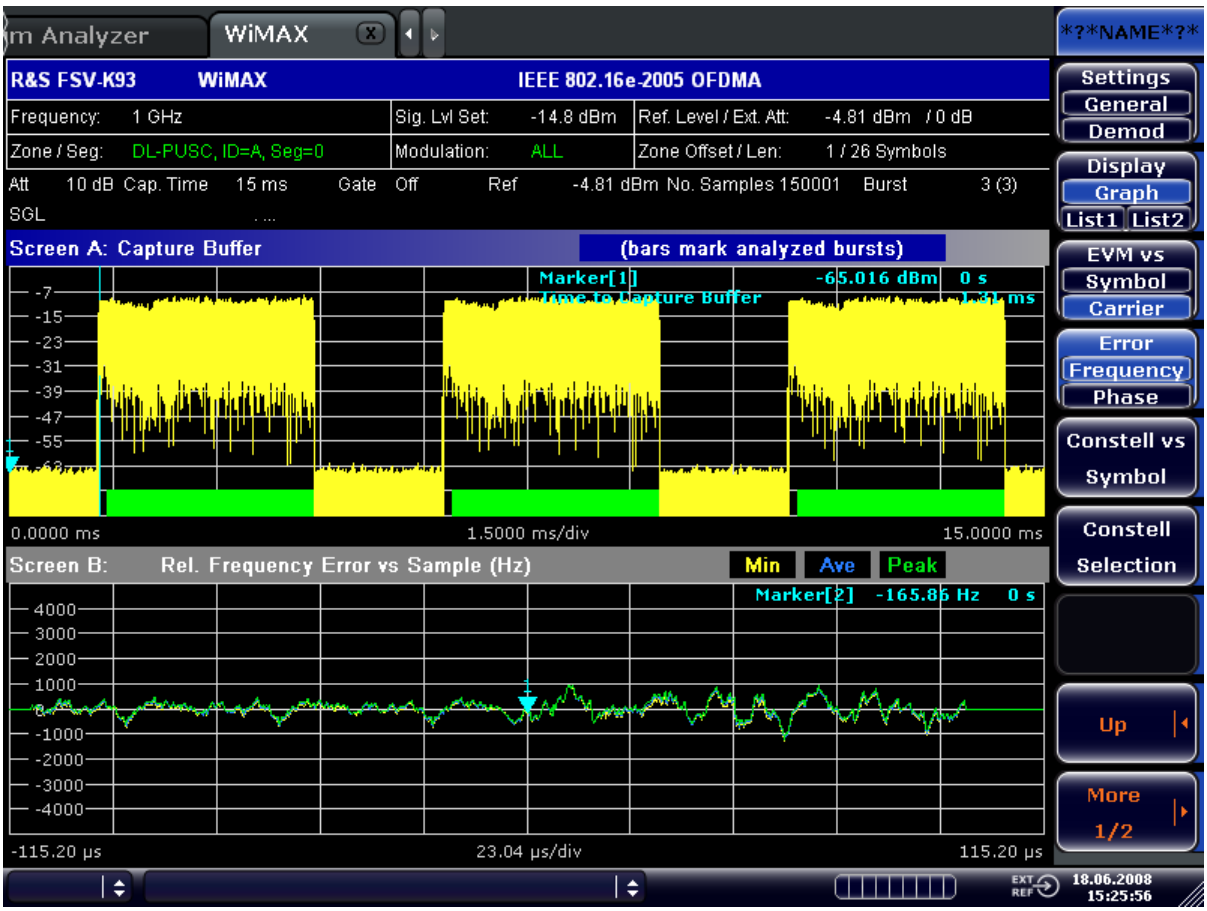
Error Frequency/Phase (IEEE 802.16-2004 OFDM) ← EVM Constell

Selects the Frequency Error vs Preamble or the Phase Error vs Preamble result displays.

- Error Frequency/Phase (IEEE 802.16-2004 OFDM)
  These result displays show the error values recorded over the preamble part of the burst. A minimum, average and maximum trace are displayed. The results display either relative frequency error or phase error.
  Using the Y-Axis/Div softkey, the scaling of the y-axis can be modified to allow the results to be scaled to an optimum level.



- Error Frequency/Phase (IEEE 802.16e-2005 OFDMA/WiBro)
  These result displays show the error values recorded over the first two symbols of the subframe. In OFDMA/WiBro this measurement result is available under the following condition: All subchannels are used by data bursts. A minimum, average and maximum trace are displayed. The results display either relative frequency error or phase error.
  Using the Y-Axis/Div softkey, the scaling of the y-axis can be modified to allow the results to be scaled to an optimum level.



SCPI command:

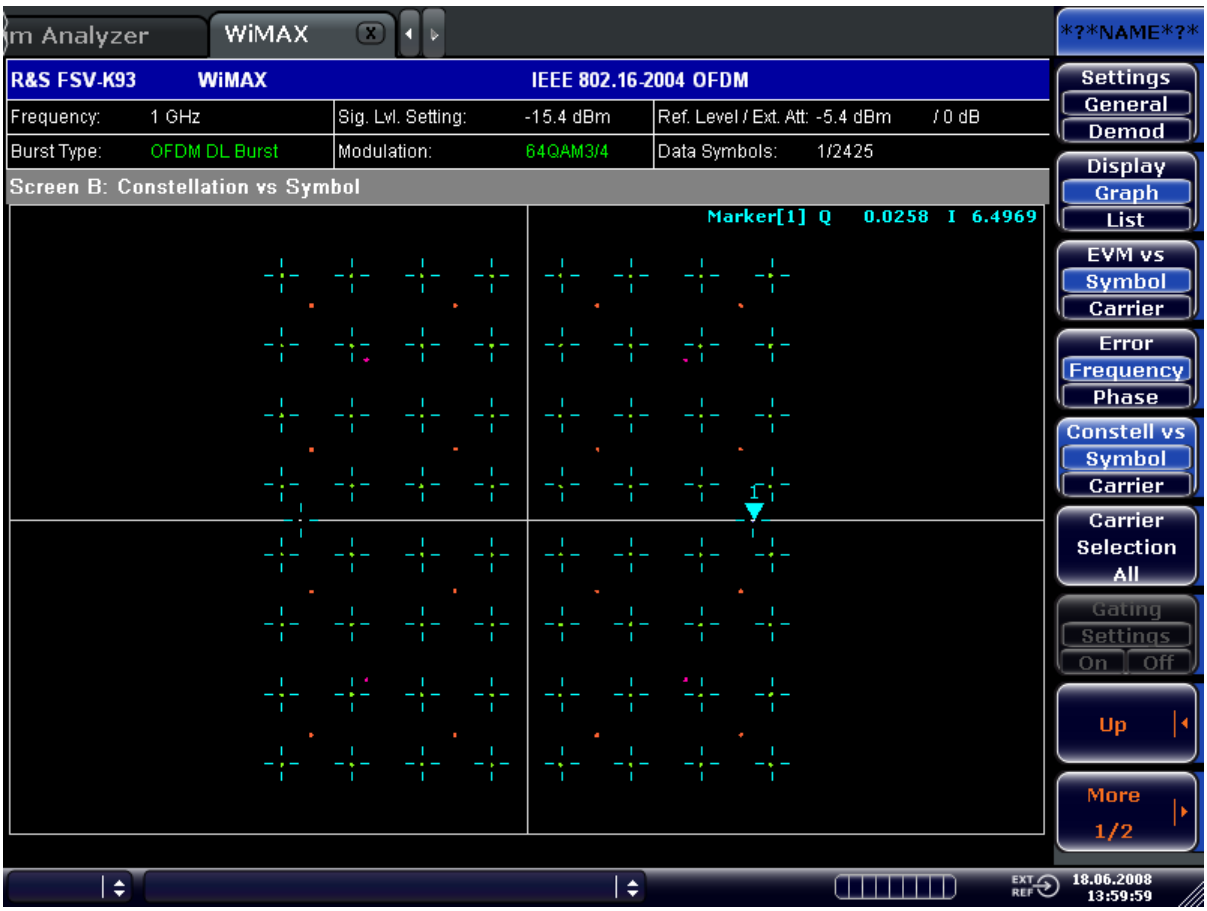
CONFigure:BURSt:PREamble[:IMMediate] on page 156

CONFigure:BURSt:PREamble:SELect on page 156

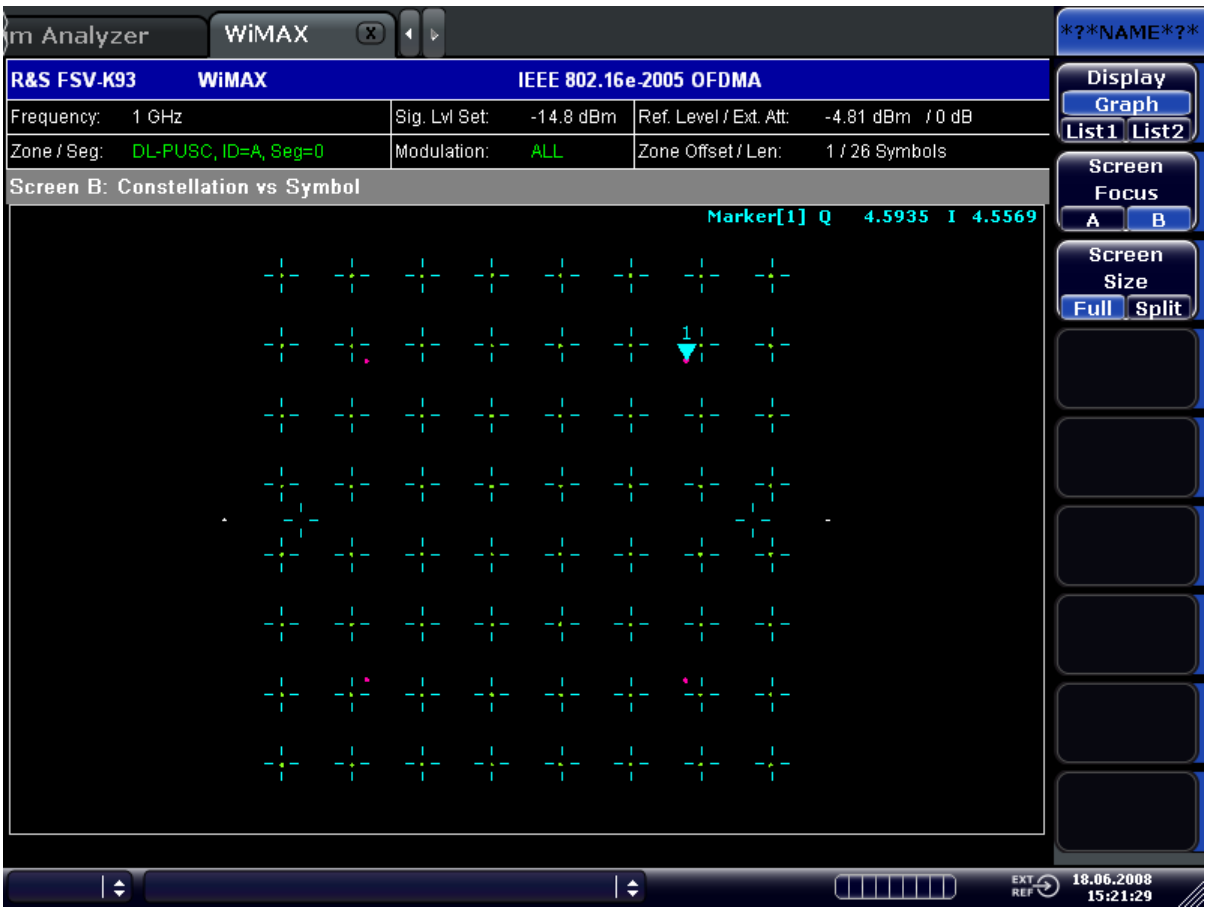
Constell vs Symbol/Carrier ← EVM Constell

Selects the Constellation vs Symbol or the Constellation vs Carrier result displays.

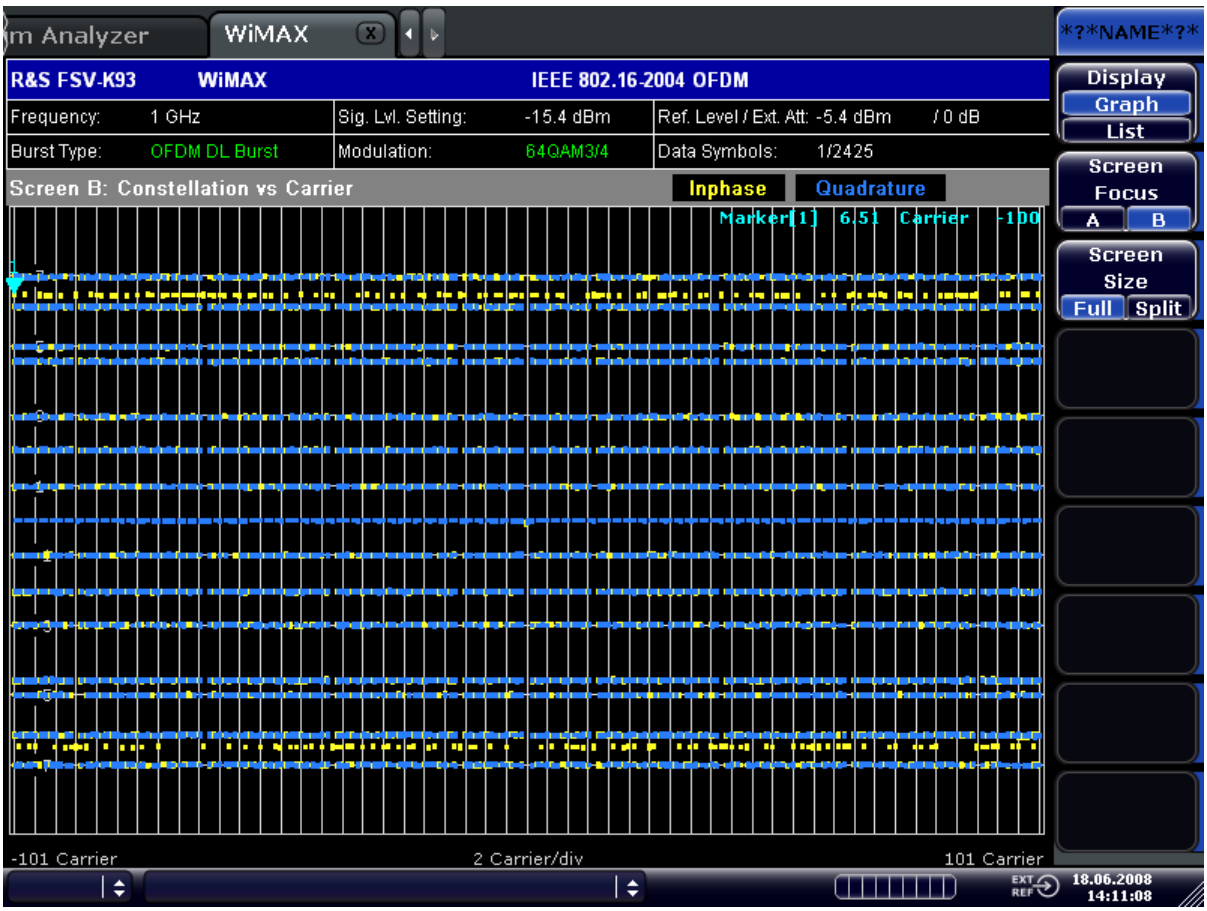
- Constellation vs Symbol (IEEE 802.16-2004 OFDM)
  This result display shows the in-phase and quadrature phase results over the full range of the measured input data. The ideal points for the selected modulations scheme are displayed for reference purposes.
  The amount of data displayed in the Constellation result display can be reduced by selecting the carrier or carriers for which data is to be displayed (Carrier Selection All (IEEE 802.16-2004 OFDM) softkey).



- Constellation vs Symbol (IEEE 802.16e-2005 OFDMA/WiBro)
  This result display shows the complex constellation diagram of the modulation symbols. The modulation symbols belong to the bursts of the analyzed zone. The different modulation formats are displayed in unique colors. The same color assignment is used in the Bitstream result display.
  The amount of data displayed in the Constellation result display can be reduced via the Constell Selection (IEEE 802.16e-2005 OFDMA/WiBro) softkey.



- Constellation vs Carrier (IEEE 802.16-2004 OFDM)
  This result display shows the in-phase and quadrature phase results over the full range of the measured input data plotted on a per-carrier basis. The magnitude of the in-phase and quadrature part is shown on the y-axis, both are displayed as separate traces (I-> trace 1, Q-> trace 2).



SCPI command:

CONFigure:BURSt:CONSt:CSYMbol[:IMMediate] on page 154

CONFigure:BURSt:CONSt:CCARrier[:IMMediate] on page 154

Carrier Selection All (IEEE 802.16-2004 OFDM) ← EVM Constell

Opens a dialog box to select the carrier for data display. Either a specific carrier number, pilots only or all carriers can be selected.

SCPI command:

CONFigure:BURSt:CONSt:CARRier:SELect on page 153

Constell Selection (IEEE 802.16e-2005 OFDMA/WiBro) ← EVM Constell

Opens a dialog box for filtering the displayed results. The results may be filtered by any combination of modulation, burst, symbol, or carrier. If the constellation selection parameters are changed, the result display is updated accordingly.

SCPI command:

CONFigure:BURSt:CONSt:SYMBol:SELect on page 155

CONFigure:BURSt:CONSt:FORMat:SELect on page 154

CONFigure:BURSt:CONSt:BURSt:SELect on page 153

Y-Axis/Div ← EVM Constell

Opens a dialog box to modify the y-axis settings (EVM vs Symbol/Carrier, Error Frequency/Phase measurements, if trace data is displayed):

"Auto Scaling" The scaling of the y-axis is calculated automatically

"Per Division" Specifies the scaling to be used if Auto Scaling is deactivated

"Unit" Specifies the y-axis unit

SCPI command:

`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:AUTO` on page 182

`DISPlay[:WINDow<n>]:TRACe1:Y[:SCALe]:PDIVision` on page 183

`UNIT:EVM` on page 232

`UNIT:PREamble` on page 233

Spectrum

Opens a submenu for frequency measurements.

Spectrum Flat./Diff./Group Delay (IEEE 802.16-2004 OFDM, WiBro) ← Spectrum

Toggles between the Spectrum Flatness, Flatness Difference, or Group Delay result display. The result can be displayed.

- **Spectrum Flatness**
  The result display shows the average energy of the constellation points for the physical carriers being used for the channel estimation. You can define which parts of the subframe are to be used for the channel estimation. The limit lines are displayed according to the requirements of the standard. The minimum, mean, and maximum statistics are performed over the parts of the subframe contributing to the channel estimation.
  `CONFigure:BURSt:SPECtrum:FLATness[:IMMediate]` on page 158
  Starts the Spectrum Flatness measurement.
  `CONFigure:BURSt:SPECtrum:FLATness:SELect` on page 158
  Selects the display mode for the results to be spectrum flatness.

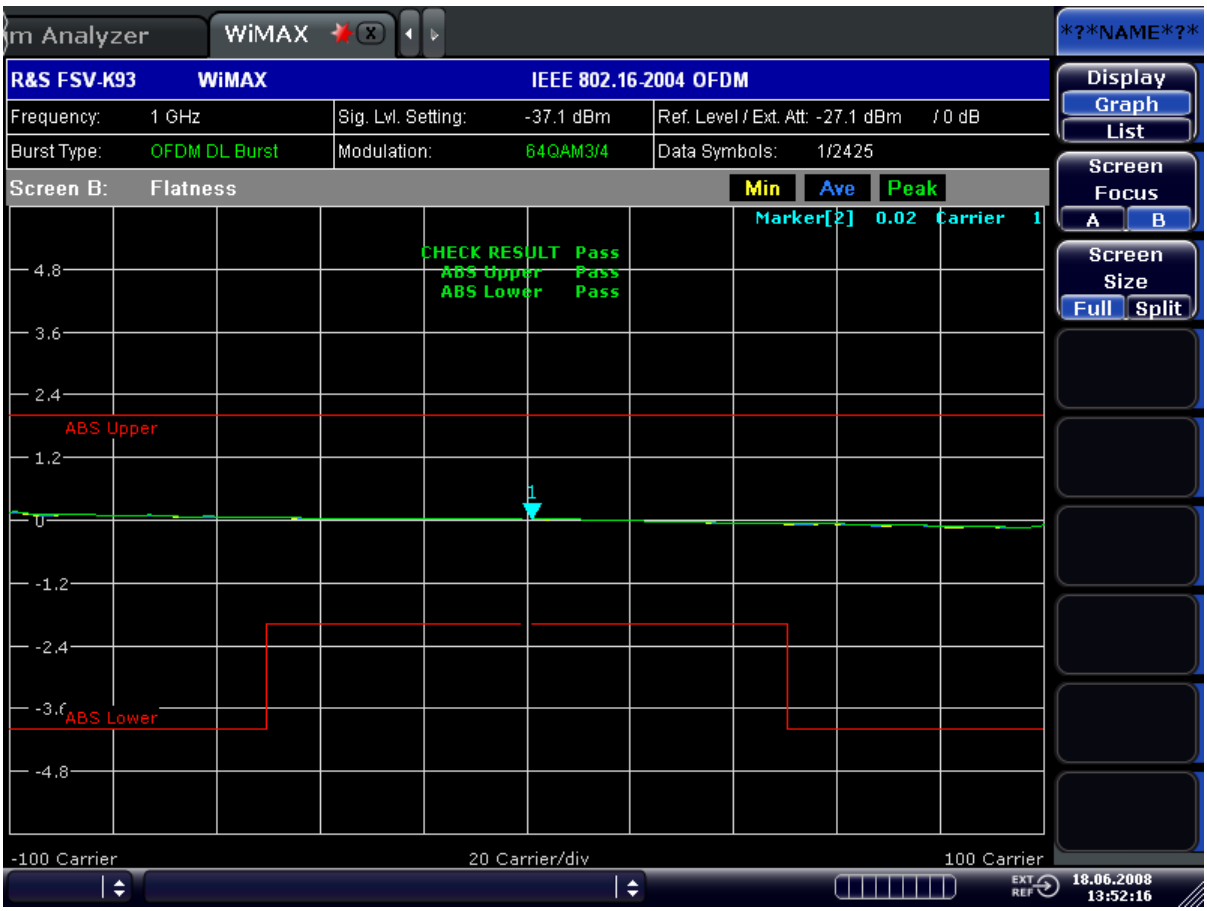


Fig. 4-12: Spectrum Flatness for IEEE 802.16-2004 OFDM and WiBro

- **Spectrum Flatness Difference**
  The result display shows the absolute difference of adjacent carriers being used for the channel estimation. You can define which parts of the subframe are to be used for the channel estimation. The limit lines are displayed according to the requirements of the standard. The minimum, mean, and maximum statistics are performed over the parts of the subframe contributing to the channel estimation.
  `CONFigure:BURSt:SPECtrum:FLATness[:IMMediate]` on page 158
  Selects the Spectrum Flatness measurement.
  `CONFigure:BURSt:SPECtrum:FLATness:SELect` on page 158
  Selects the display mode for the results to be spectrum flatness difference.

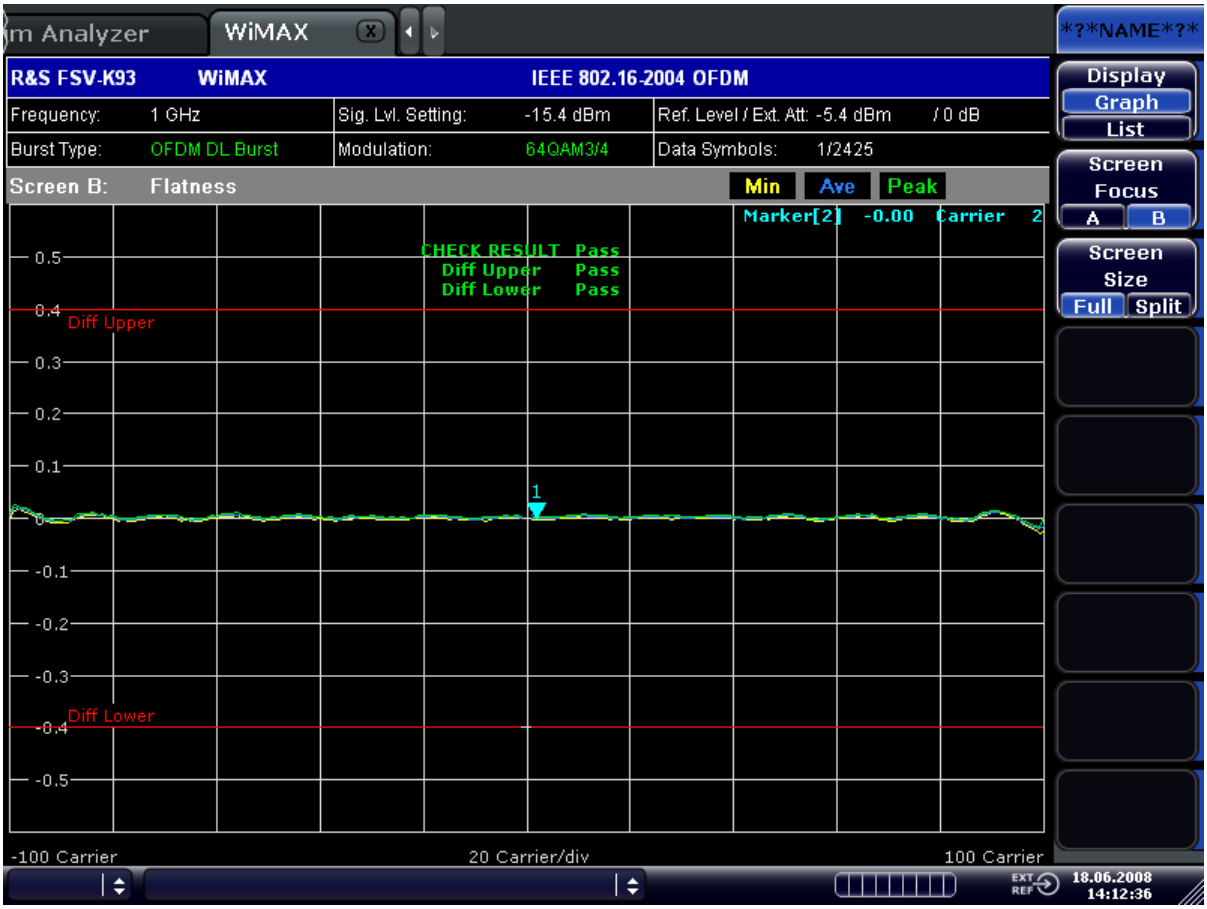


Fig. 4-13: Spectrum Flatness Difference for IEEE 802.16-2004 OFDM

- **Group Delay**

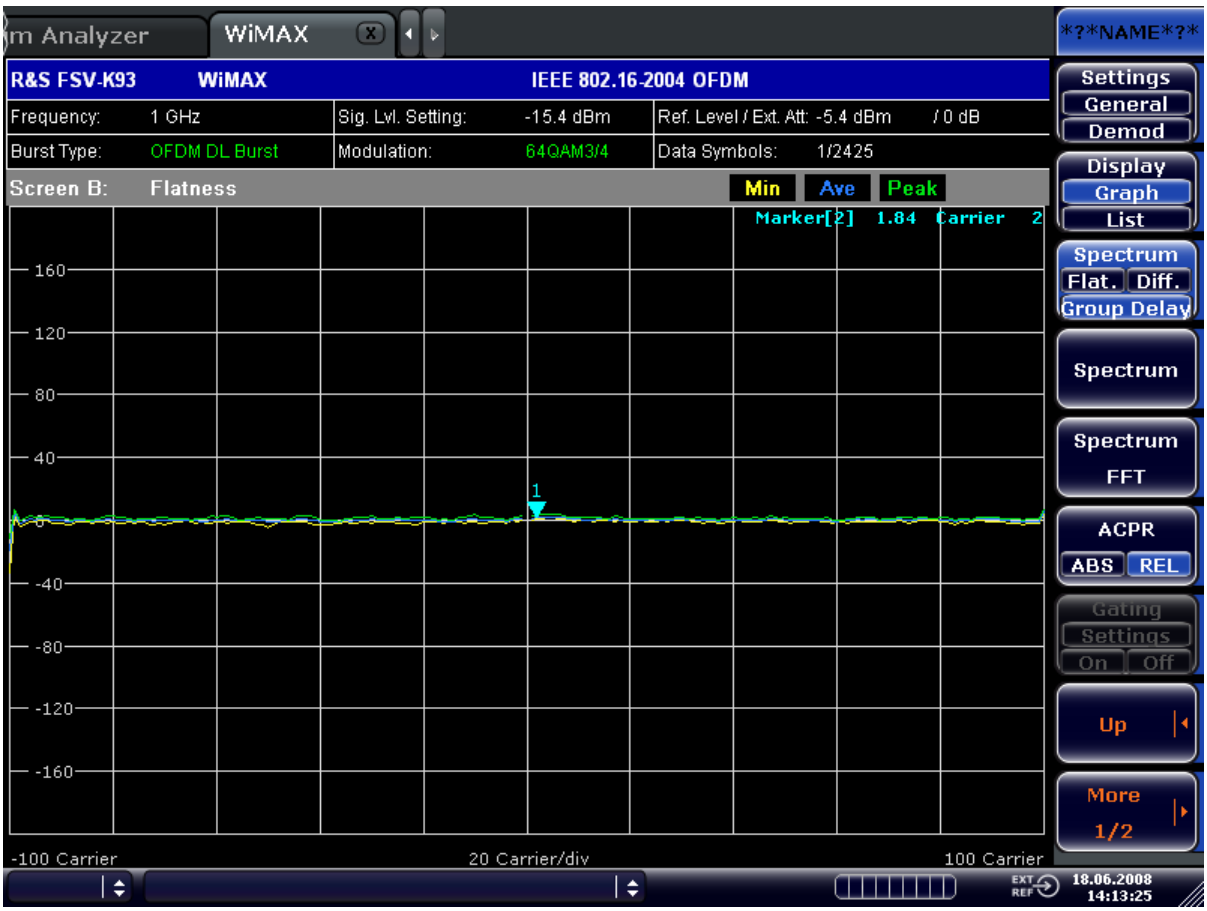


Fig. 4-14: Group Delay for IEEE 802.16-2004 OFDM

CONFigure:BURSt:SPECtrum:FLATness[:IMMediate] on page 158
Selects the Spectrum Flatness measurement.
CONFigure:BURSt:SPECtrum:FLATness:SELect on page 158
Selects the display mode for the results to be group delay.

Spectrum Flatness/Difference (IEEE 802.16e-2005 OFDMA) ← Spectrum
Toggles between the Spectrum Flatness and Flatness Difference result display. The result can be displayed.

- **Spectrum Flatness**
  The result display shows the average energy of the constellation points for the physical carriers being used for the channel estimation. You can define which parts of the subframe are to be used for the channel estimation. The limit lines are displayed according to the requirements of the standard. The minimum, mean, and maximum statistics are performed over the parts of the subframe contributing to the channel estimation.
  CONFigure:BURSt:SPECtrum:FLATness[:IMMediate] on page 158
  Selects the Spectrum Flatness measurement.
  CONFigure:BURSt:SPECtrum:FLATness:SELect on page 158
  Selects the display mode for the results to be spectrum flatness.

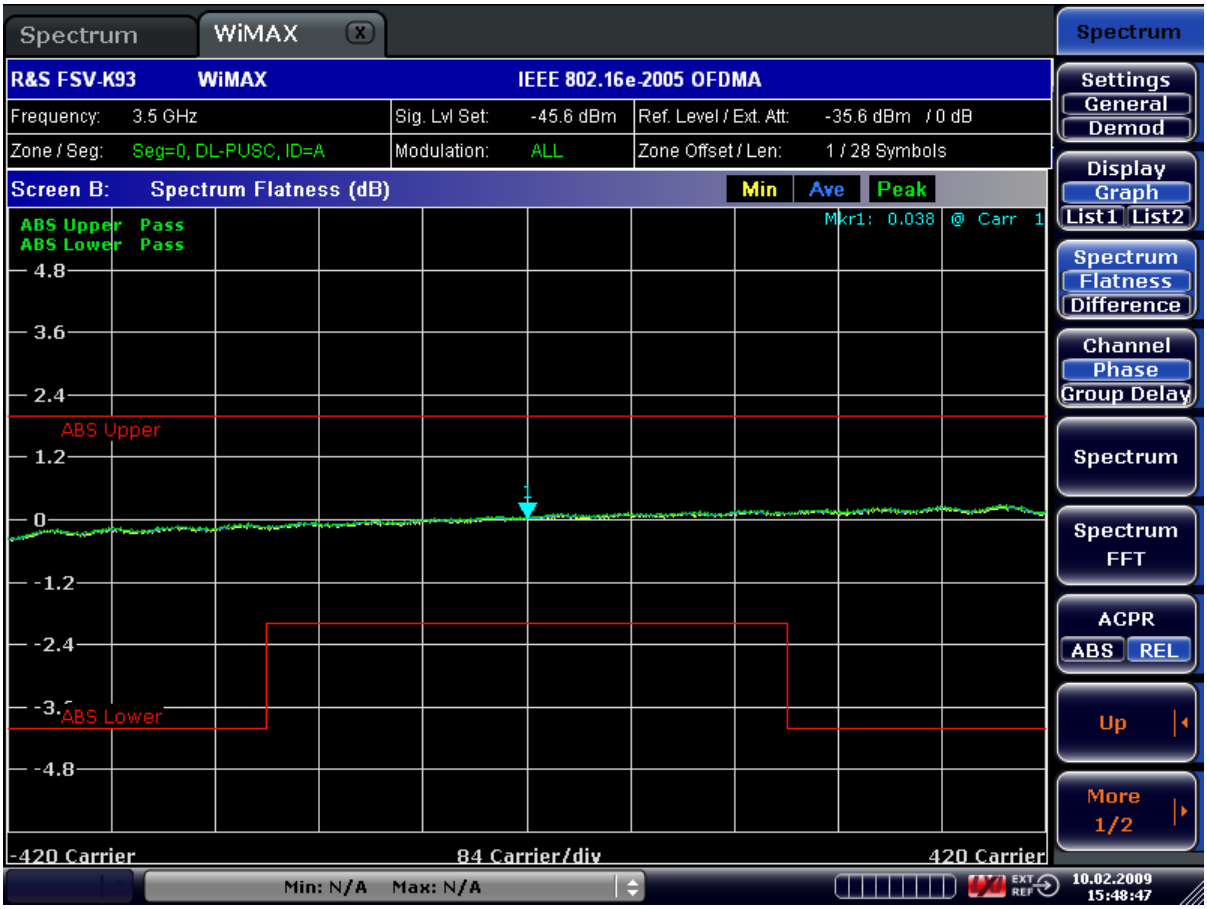


Fig. 4-15: Spectrum Flatness for IEEE 802.16e-2005 OFDMA

- **Spectrum Flatness Difference**
  The result display shows the absolute difference of adjacent carriers being used for the channel estimation. You can define which parts of the subframe are to be used for the channel estimation. The limit lines are displayed according to the requirements of the standard. The minimum, mean, and maximum statistics are performed over the parts of the subframe contributing to the channel estimation.
  `CONFigure:BURSt:SPECtrum:FLATness[:IMMediate]` on page 158
  Selects the Spectrum Flatness measurement.
  `CONFigure:BURSt:SPECtrum:FLATness:SELect` on page 158
  Selects the display mode for the results to be spectrum flatness difference.

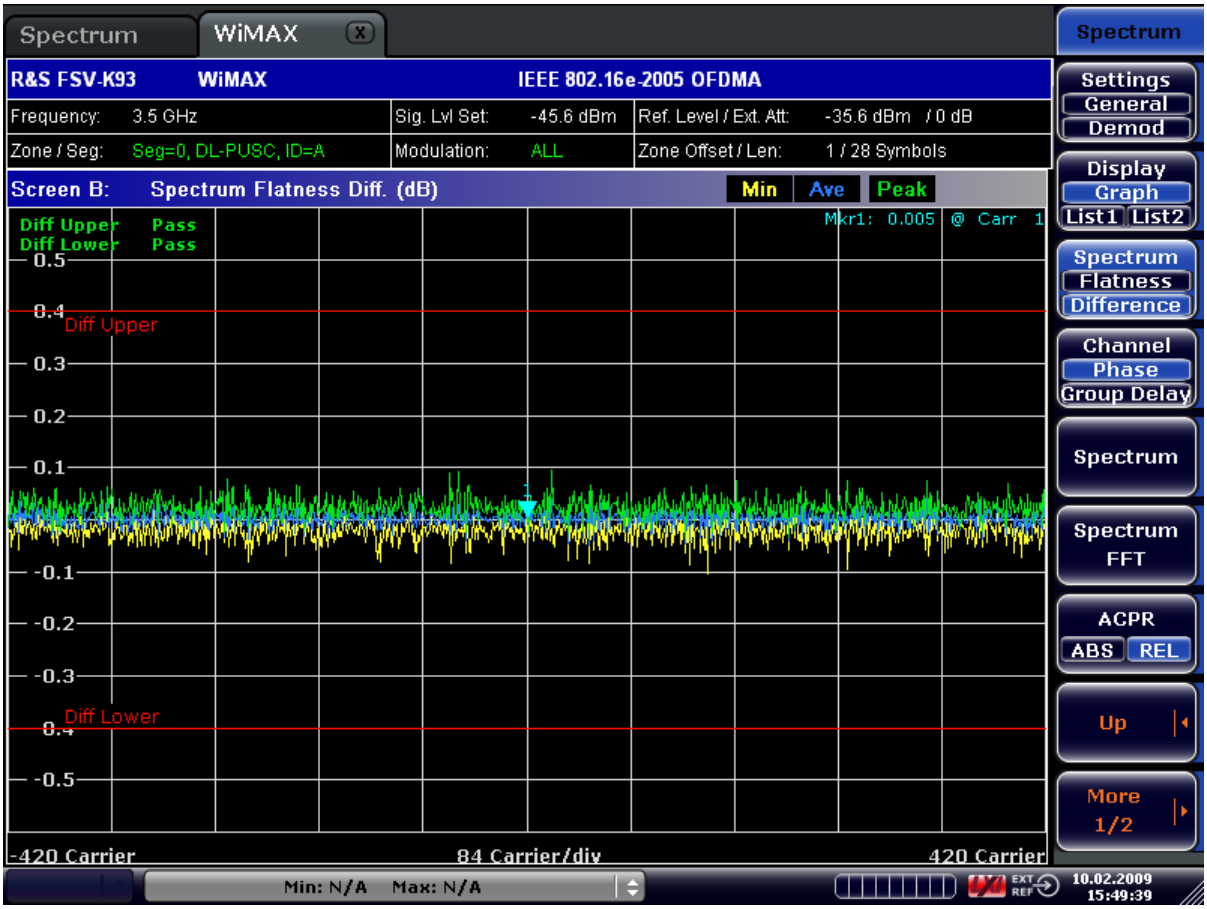


Fig. 4-16: Spectrum Flatness Difference for IEEE 802.16e-2005 OFDMA

Channel Phase/Group Delay (IEEE 802.16e-2005 OFDMA) ← Spectrum
Toggles between the Preamble Channel Frequency Response Phase and the Group Delay result display. The result can be displayed.

- **Channel Phase**
  The result display shows the phase of the preamble channel frequency response. The limit lines are displayed according to the requirements of the standard. The Triangle marker indicated with a U indicates the minimal distance to the Upper Limit Line. The Triangle marker indicated with an L indicates the minimal distance to the Lower Limit Line.The minimum, mean, and maximum statistics are performed over the preambles of the analyzed subframes.

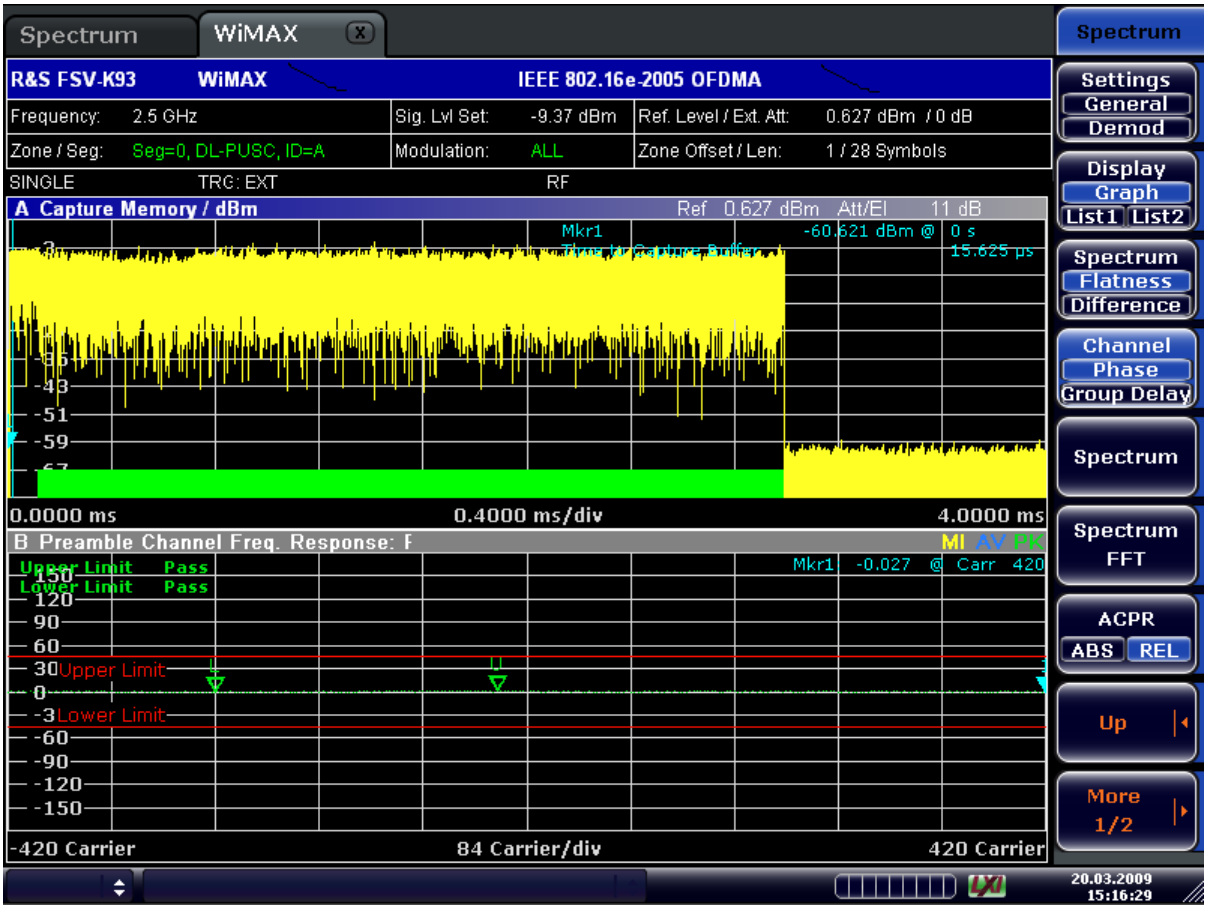


Fig. 4-17: Preamble Channel Frequency Response Phase for IEEE 802.16e-2005 OFDMA

CONFigure:BURSt:SPECtrum:PHASe:PREamble[:IMMediate] on page 160
Selects the Preamble Channel Frequency Response: Phase measurement.

- **Group Delay**

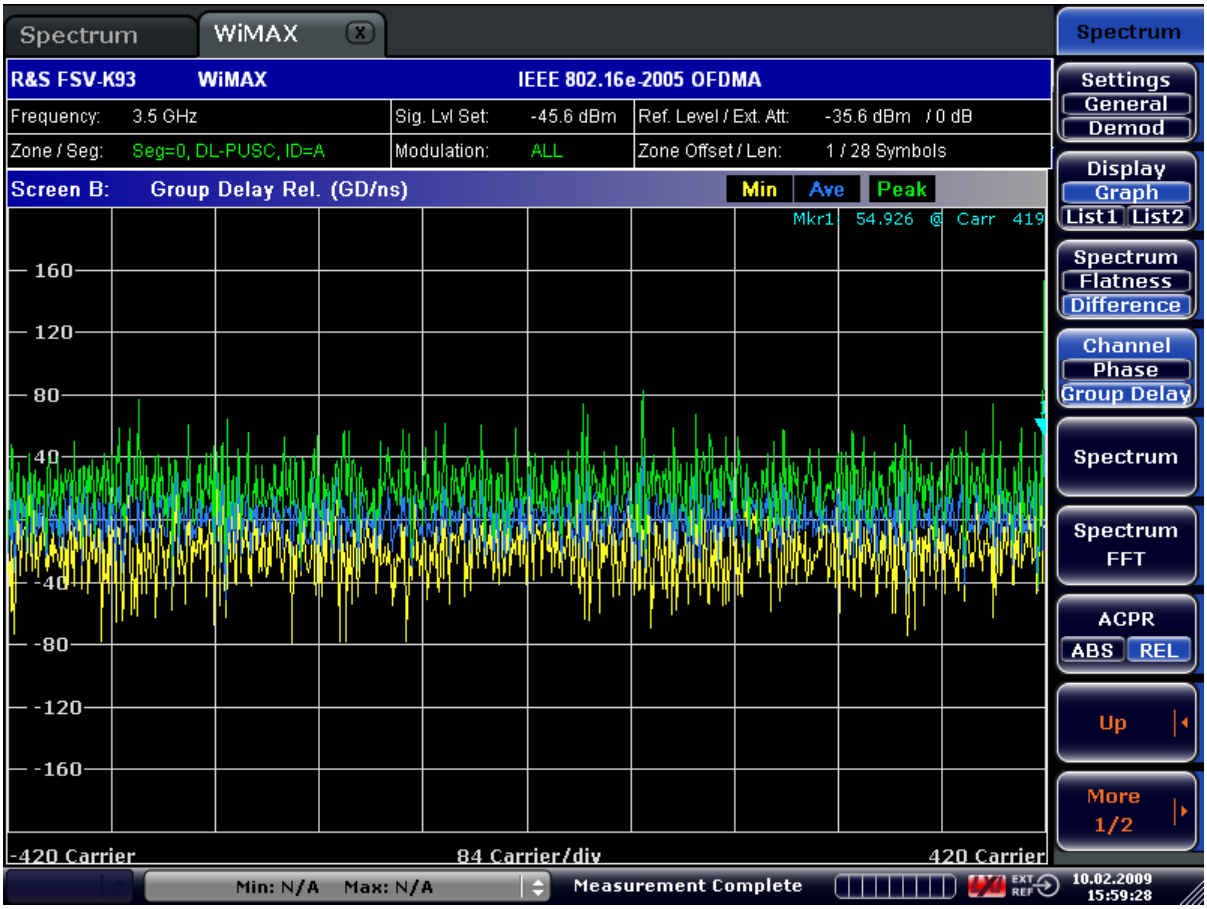


Fig. 4-18: Group Delay for IEEE 802.16e-2005 OFDMA/WiBro

Restrictions on OFDMA/WiBro Group Delay measurements

The measurement requires all useful carriers to be active (for example for a 1024 FFT size, 840 positions are required). This requirement does not depend on the subchannel bitmap, i.e. the bitgroups that are switched on. It solely depends on the FFT size and guard band.

This requirement is affected by the Channel Estimation Range parameters in the Demod Settings:

- - If Downlink (DL) = Preamble Only, then the requirement is automatically met.
- - If Downlink (DL) = Preamble and Payload/Payload Only, then all bitgroups must be switched on and all channels must be covered by data bursts.

Spectrum ← Spectrum
Selects the Spectrum Emission Mask result display, which consists of a graphical and tabular result.

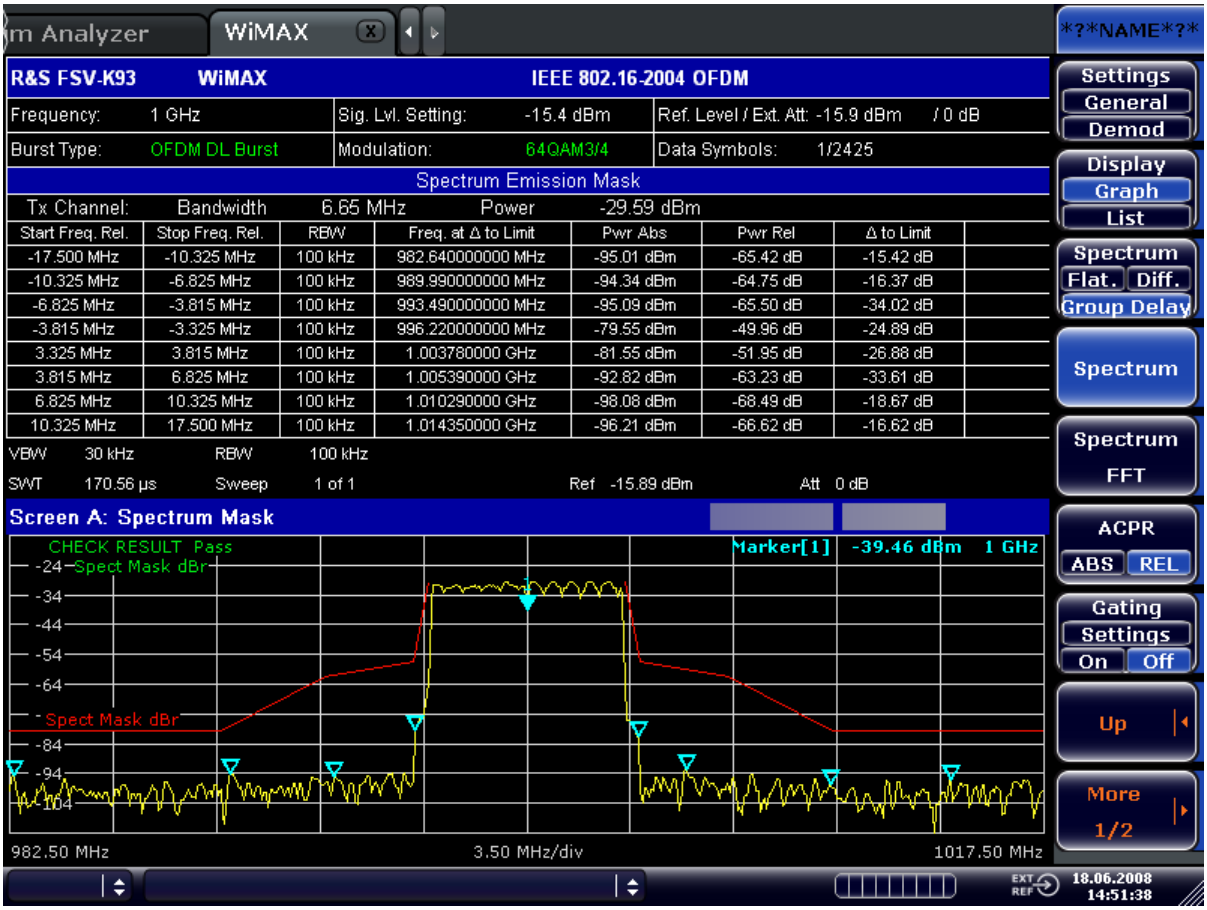
This result display shows power against frequency (as opposed to "Spectrum FFT" on page 73). A limit line representing the spectrum mask specified for the selected standard is displayed and an overall pass/fail status is displayed for the obtained results against this limit line.

For the IEEE 802.16-2004 OFDM, IEEE 802.16e-2005 OFDMA standards, the span of the results is related to the specified sample rate.

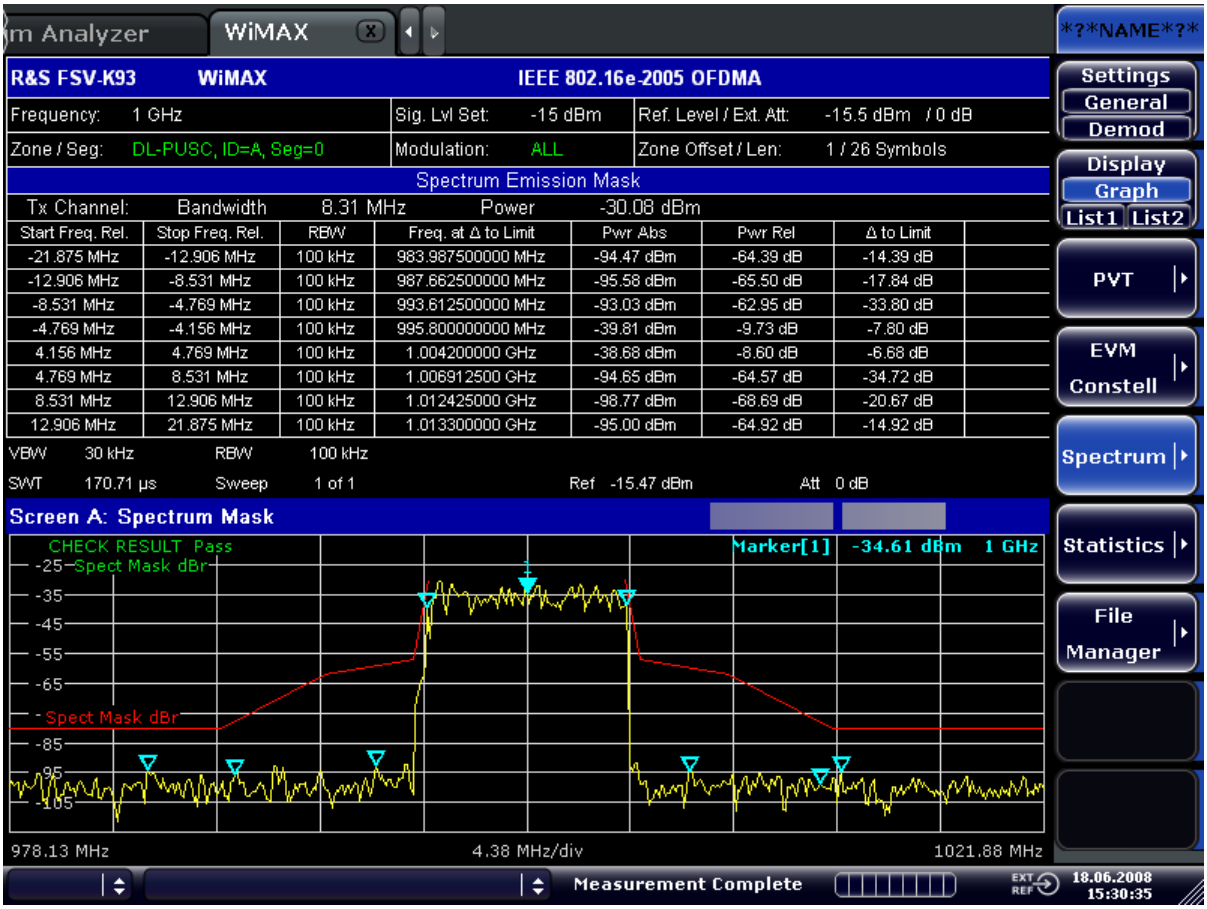
For the IEEE 802.16e-2005 WiBro standard, the table contains the results for each of the individual frequency ranges. On the trace, the highest power value is marked for each of the specified frequency ranges with a marker.

The number of sweeps is set in the General Settings dialog box, Sweep Count field. If the measurement is performed over multiple sweeps both a max hold trace and an average trace are displayed. For the IEEE 802.16e-2005 WiBro standard, the Spectrum Emission Mask measurement is configured via the SEM Settings softkey.

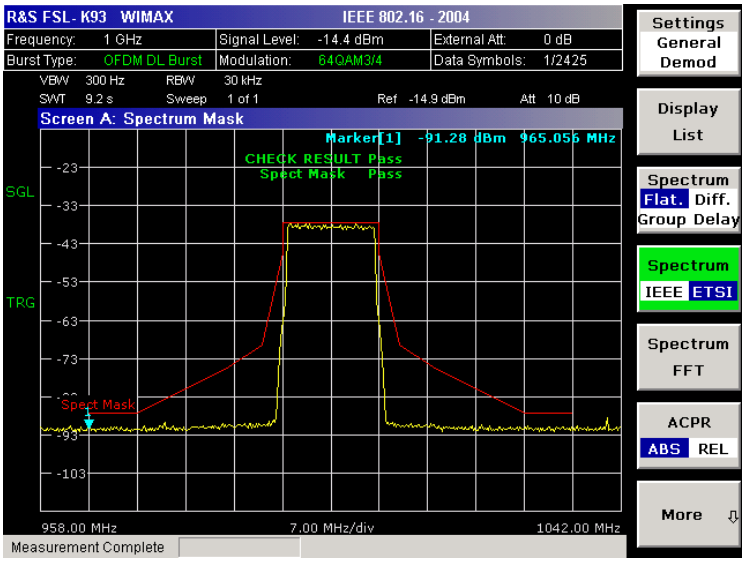
- Spectrum IEEE (IEEE 802.16-2004 OFDM)



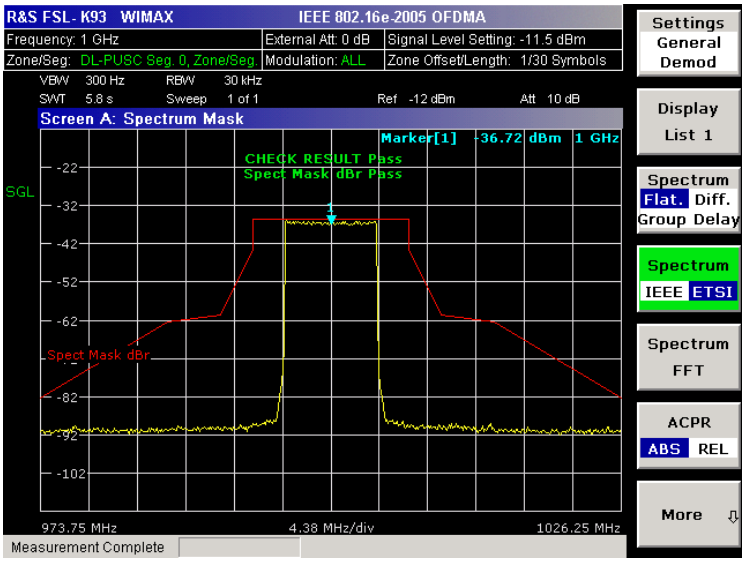
- Spectrum IEEE (IEEE 802.16e-2005 OFDMA)



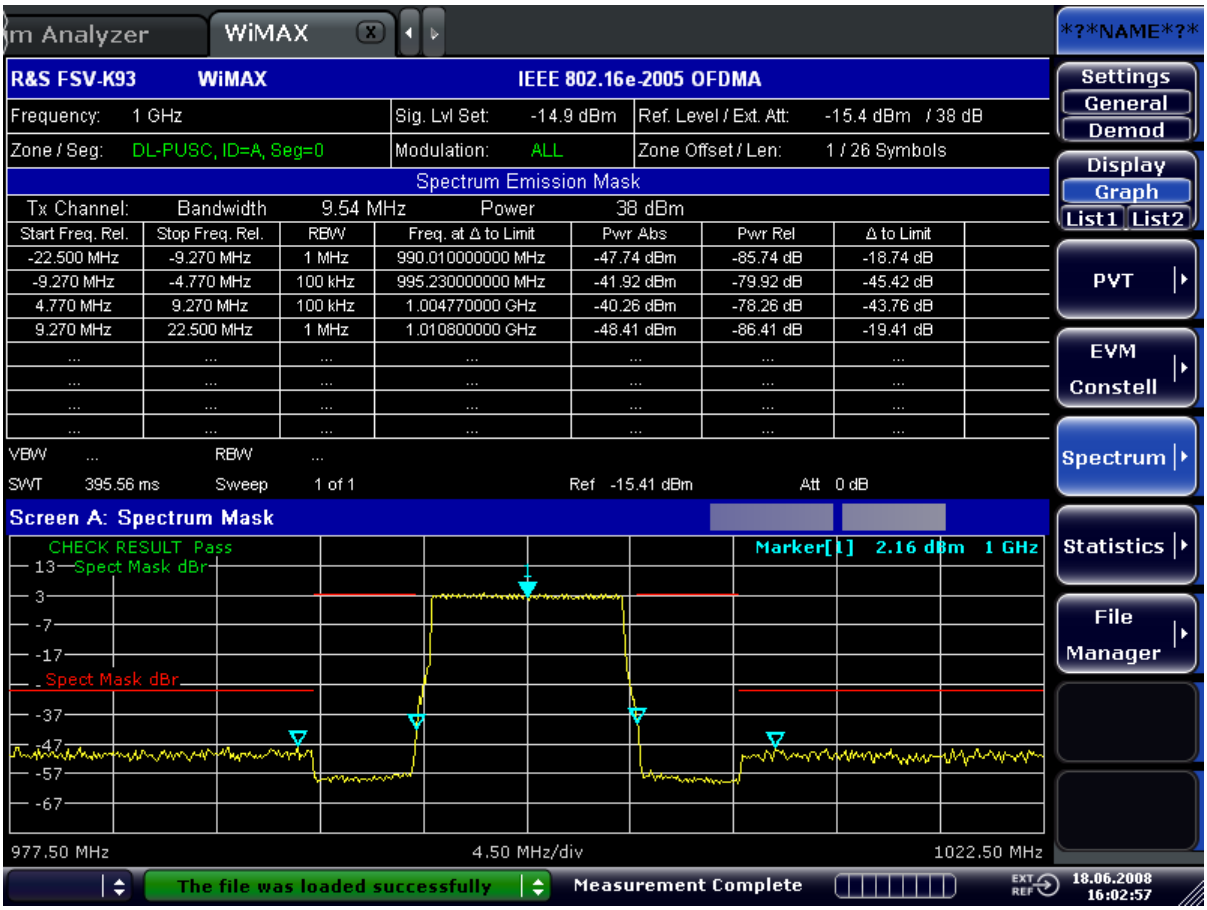
- Spectrum ETSI (IEEE 802.16-2004 OFDM)



- Spectrum ETSI (IEEE 802.16e-2005 OFDMA)



- IEEE 802.16e-2005 WiBro



SCPI command:

`CONFigure:BURSt:SPECtrum:MASK[:IMMediate]` on page 159

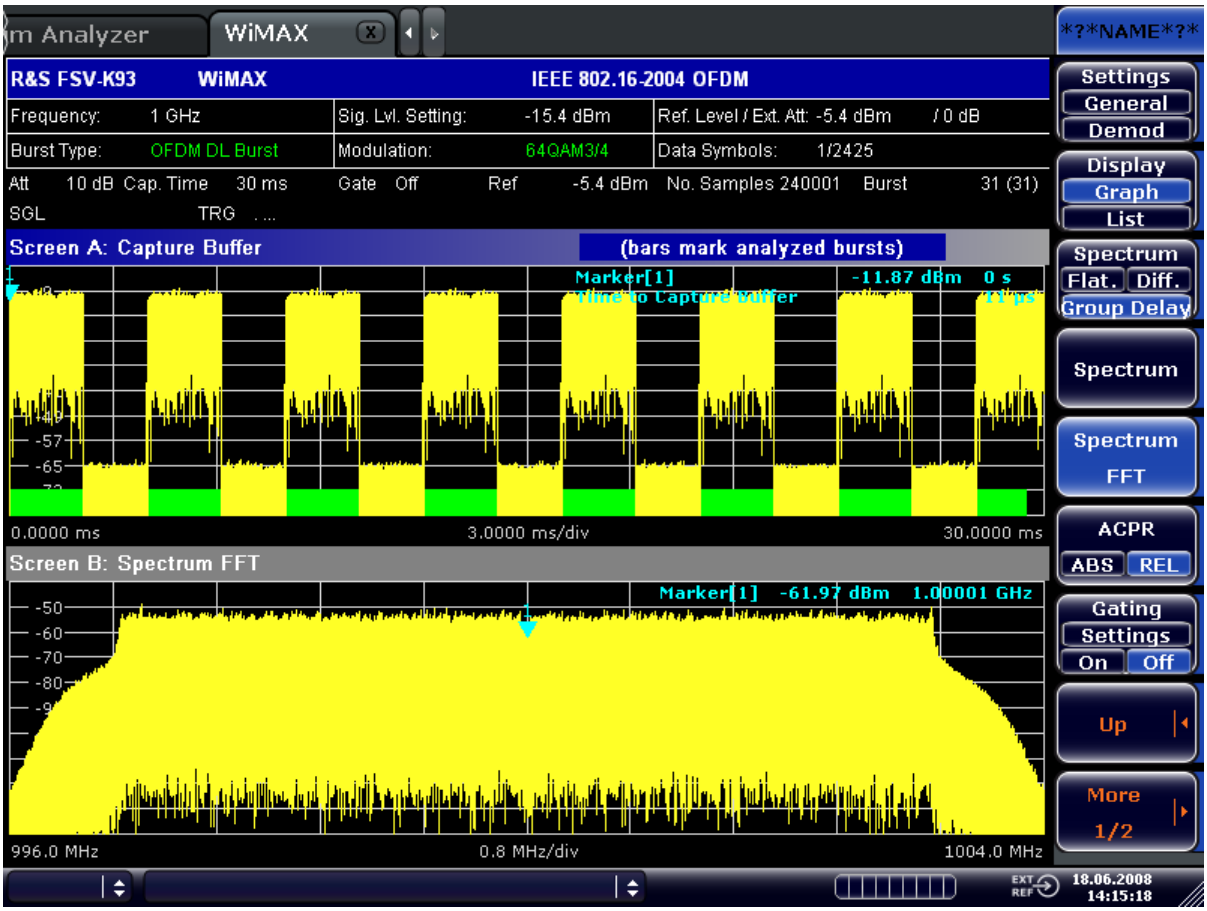
`CONFigure:BURSt:SPECtrum:MASK:SELect` on page 159

Spectrum FFT ← Spectrum

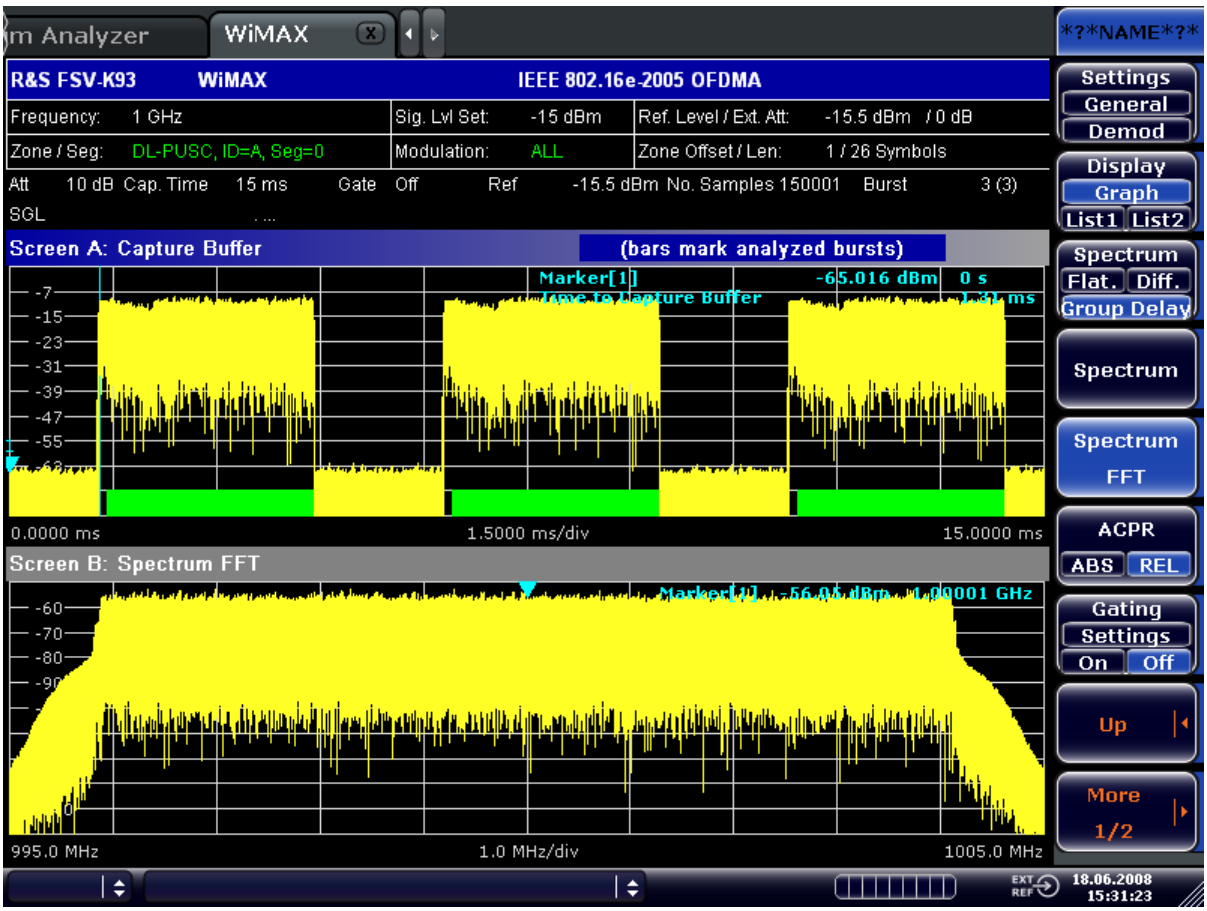
Selects the Spectrum FFT result display (as opposed to "Spectrum" on page 69), either in graphical form ("Display Graph" selected), or in tabular form ("Display List 1/2" selected).

This result display shows the Power vs Frequency results obtained from a FFT performed over the range of data in the Magnitude Capture Buffer which lies within the gate lines. If the gate start or gate length are altered then the results can be updated to reflect these changes by pressing the Refresh softkey in the Sweep menu.

- IEEE 802.16-2004 OFDM



- IEEE 802.16e-2005 OFDMA/WiBro



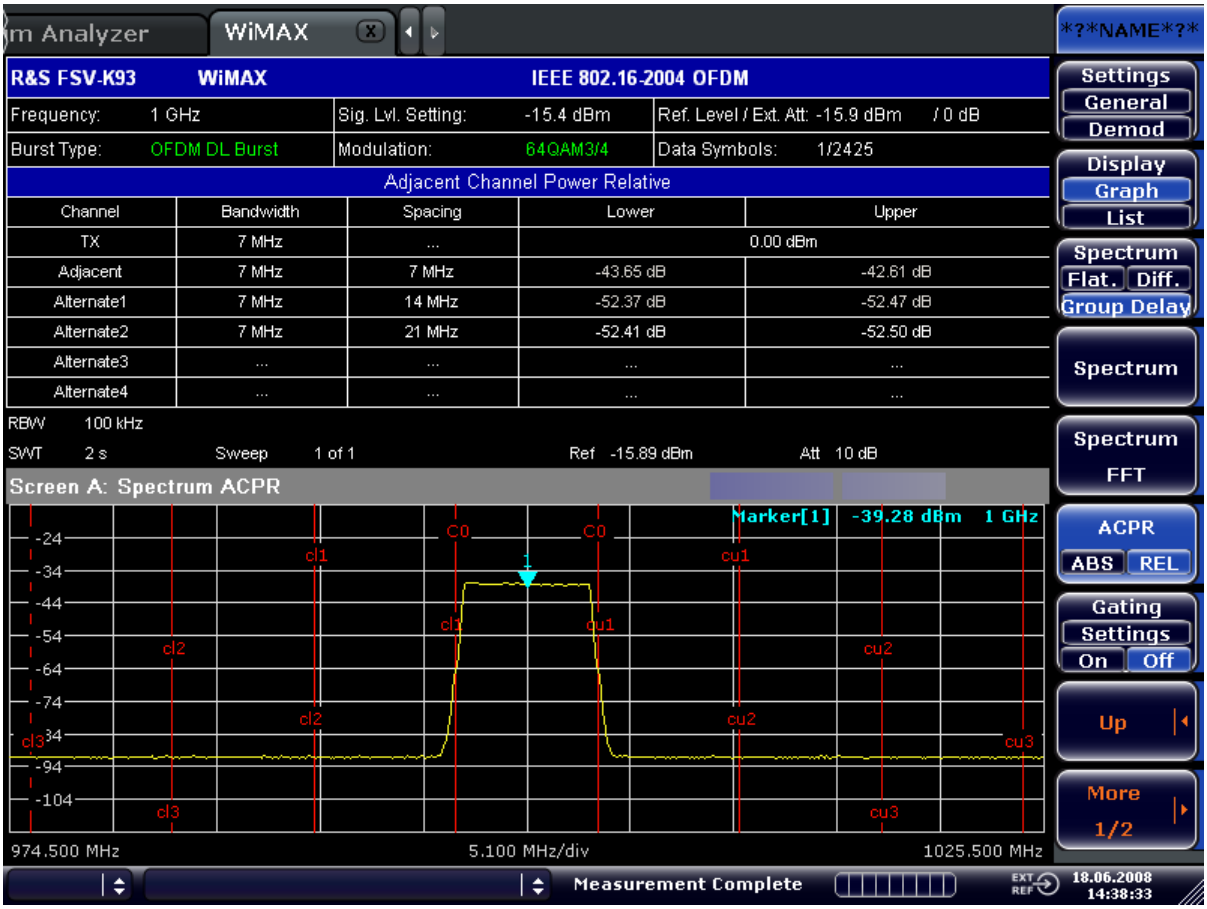
SCPI command:
CONFigure:BURSt:SPECtrum:FFT[:IMMediate] on page 158

ACPR Abs/Rel ← Spectrum
Sets the ACPR (Adjacent Channel Power Relative) result display in graphical form ("Display Graph" selected), or in tabular form ("Display List 1/2" selected).

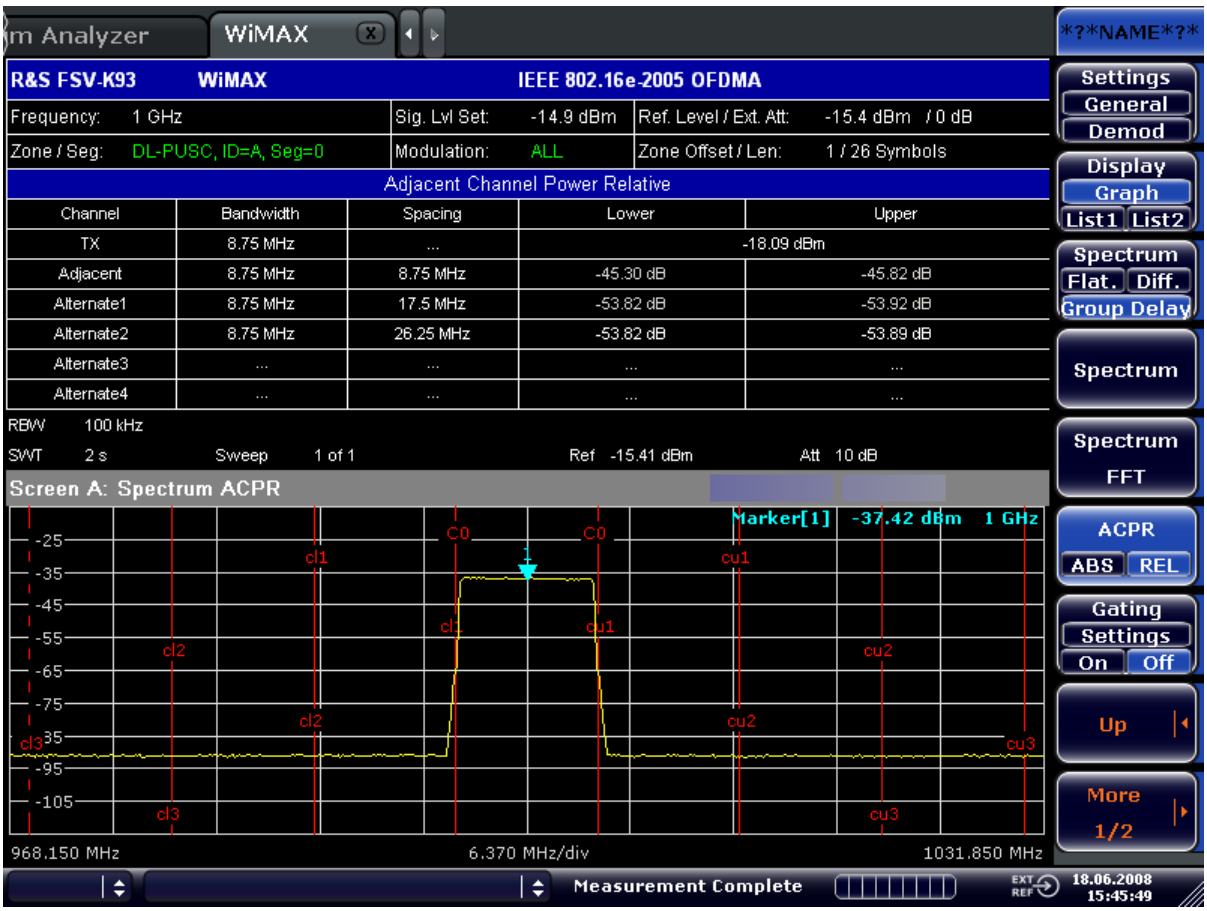
This result display is similar to the Spectrum Mask measurement, and provides information about leakage into adjacent channels. The results show the relative power measured in the three nearest channels either side of the measured channel. This measurement is the same as the adjacent channel power measurement provided by the spectrum analyzer.

The number of sweeps is set in the "General Settings" dialog box, "Sweep Count" field (see chapter 4.2.3.2, "General Settings Dialog Box", on page 85). If the measurement is performed over multiple sweeps both a max hold trace and an average trace are displayed.

- IEEE 802.16-2004 OFDM



- IEEE 802.16e-2005 OFDMA/WiBro



SCPI command:

CONFigure:BURSt:SPECtrum:ACPR[:IMMediate] on page 157

CONFigure:BURSt:SPECtrum:ACPR:SELect on page 158

CALCulate<n>:MARKer<m>:FUNCtion:POWer:RESult[:CURRent] on page 145

CALCulate<n>:MARKer<m>:FUNCtion:POWer:RESult:MAXHold on page 149

SEM Settings ← Spectrum

Opens the "Spectrum Emission Mask Settings" dialog box to configure the Spectrum Emission Mask measurement.

The other parameters are set by default.

SCPI command:

[SENSe:]POWer:SEM:TTA on page 213

[SENSe:]POWer:SEM:MODe on page 212

[SENSe:]POWer:SEM:CLASs on page 212

SEM according to ← SEM Settings ← Spectrum

Specifies how the Spectrum Emission Mask settings and limits are applied. This parameter provides the following settings:

"TTA Standard" as specified in the standard

"ETSI" Settings and limits are as specified in the standard (OFDM/OFDMA)

"USER" as specified in the selected XML file

SCPI command:
[SENSe:]POWer:SEM:TTA on page 213

File Name ← SEM Settings ← Spectrum
When "SEM according to":"User" settings are specified, "File Name" shows the name of the loaded XML file. Clicking the arrow switches to the File Manager to locate an XML file, and automatically selects "SEM according to":"User".

When using "ETSI" or "IEEE" standards, "File Name" indicates the name of the built-in configuration.

Link Direction ← SEM Settings ← Spectrum
Sets the link direction:

"UL" uplink

"DL" downlink

Power Class ← SEM Settings ← Spectrum
Sets the power class

"Auto" automatic selection

"(-INF, 23) dBm,
(23, INF) dBm" power class values for uplink

"(-INF, 29) dBm,
(29, 40) dBm,
(40, INF) dBm" power class values for downlink

SCPI command:
[SENSe:]POWer:SEM:CLASs on page 212

SEM Configuration ← SEM Settings ← Spectrum
The table shows the settings and limits applied over specified frequency ranges around the TX channel. The displayed settings depend on the selected Power Class and Link Direction

ACP Settings ← Spectrum
Opens the "ACP Settings" dialog box to configure the ACPR result display. By default, the ACP settings are derived from the "General Settings" dialog box, "Channel BW" field (see chapter 4.2.3.2, "General Settings Dialog Box", on page 85).

Group	Field	Description
Channels	No. of Channels	Specifies the number of channels adjacent to the transmit channel to be measured. If set to 0, only the transmit channel is measured.
TX/ACP Channel BW	TX	Specifies the bandwidth of the transmit channel to be measured by the ACP measurement.

Group	Field	Description
	Adjacent, Alternate 1, Alternate 2, Alternate 3, Alternate 4	Specifies the bandwidth of the first to fifth channel before and after the transmit channel to be measured.
ACP Channel Spacing	Adjacent, Alternate 1, Alternate 2, Alternate 3, Alternate 4	Specifies the spacing of the first to fifth channel before and after the transmit channel to be measured.

SCPI command:
`[SENSe:]POWer:ACHannel:ACPairs` on page 209
`[SENSe:]POWer:ACHannel:BANDwidth|BWIDth[:CHANnel<channel>]` on page 210
`[SENSe:]POWer:ACHannel:SPACing[:ACHannel]` on page 211
`[SENSe:]POWer:ACHannel:SPACing:ALTernate<channel>` on page 211
`[SENSe:]POWer:ACHannel:BANDwidth|BWIDth:ACHannel` on page 210
`[SENSe:]POWer:ACHannel:BANDwidth|BWIDth:ALTernate<channel>` on page 210

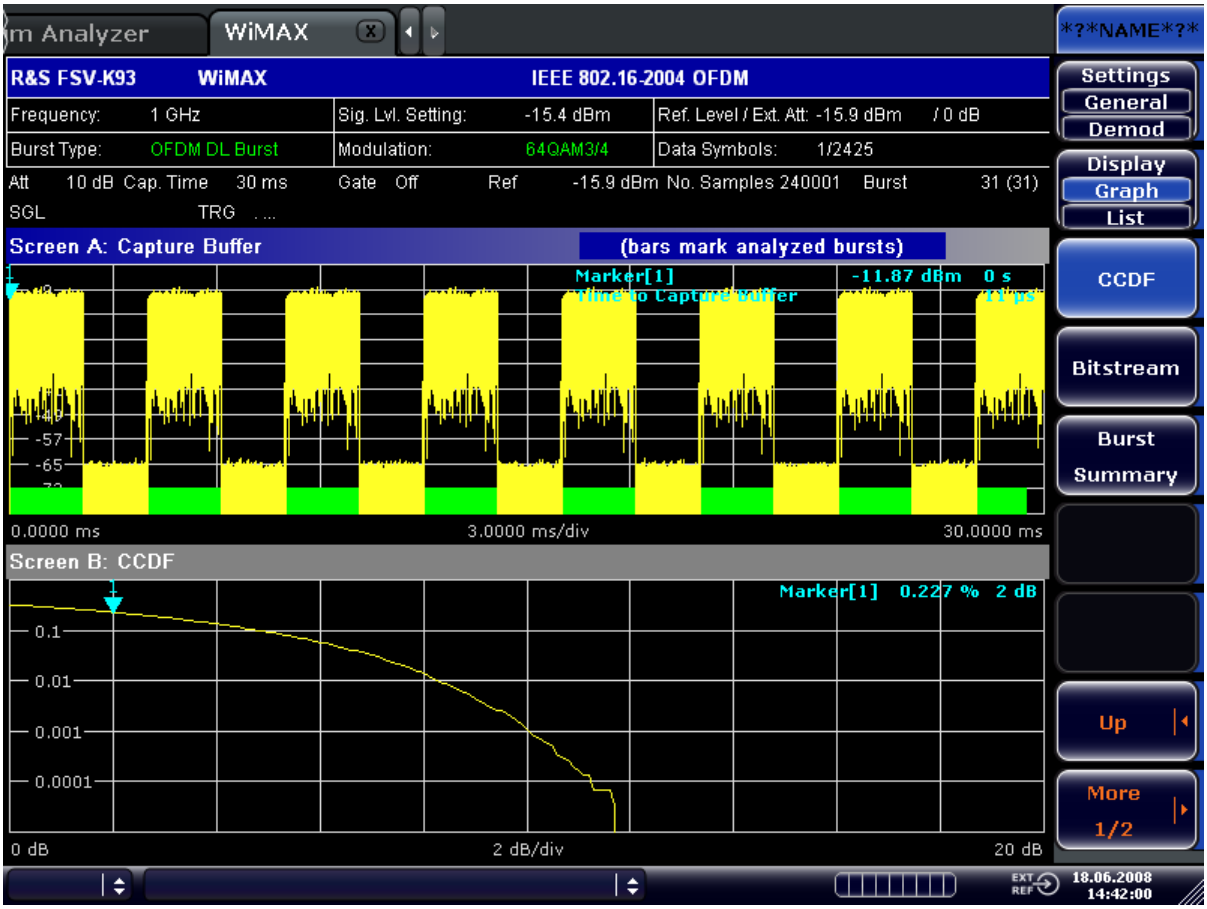
Statistics
Opens a submenu to display statistics measurement results.

CCDF ← Statistics
Sets the CCDF result display.

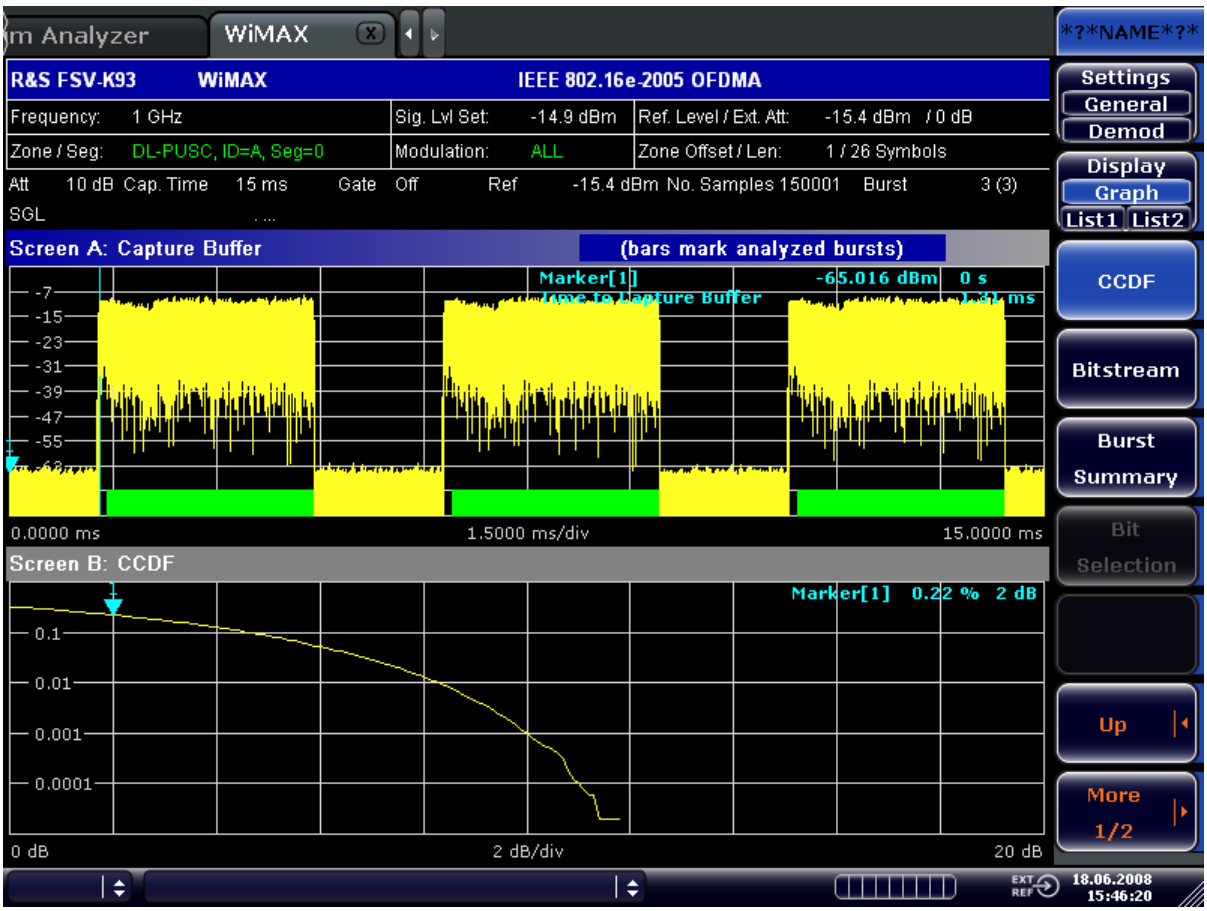
This result display shows the probability of an amplitude within the gating lines exceeding the mean power measured between the gating lines. The x-axis displays power relative to the measured mean power.

If the gate start or gate length are altered then the results can be updated to reflect these changes by pressing the Refresh softkey in the "Sweep" menu.

- IEEE 802.16-2004 OFDM



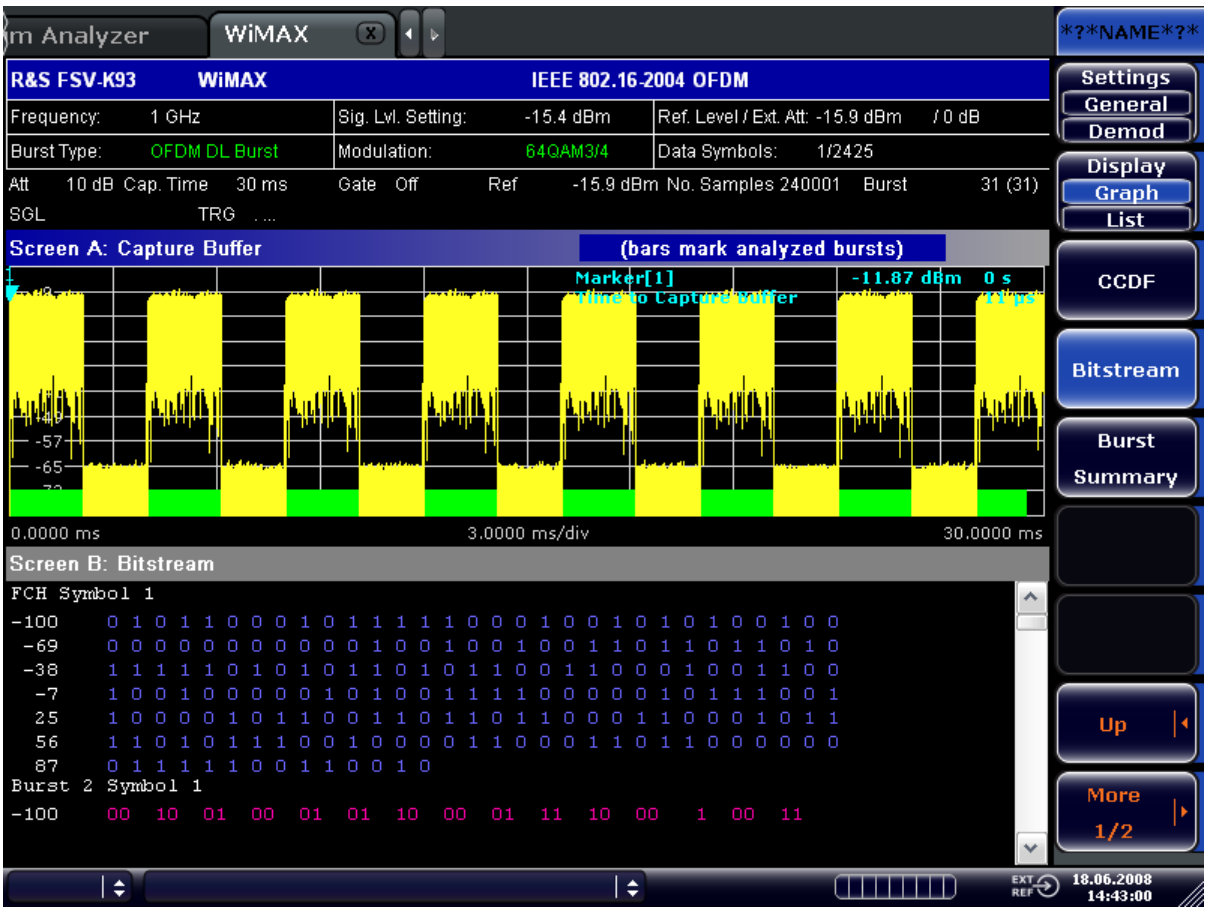
- IEEE 802.16e-2005 OFDMA/WiBro



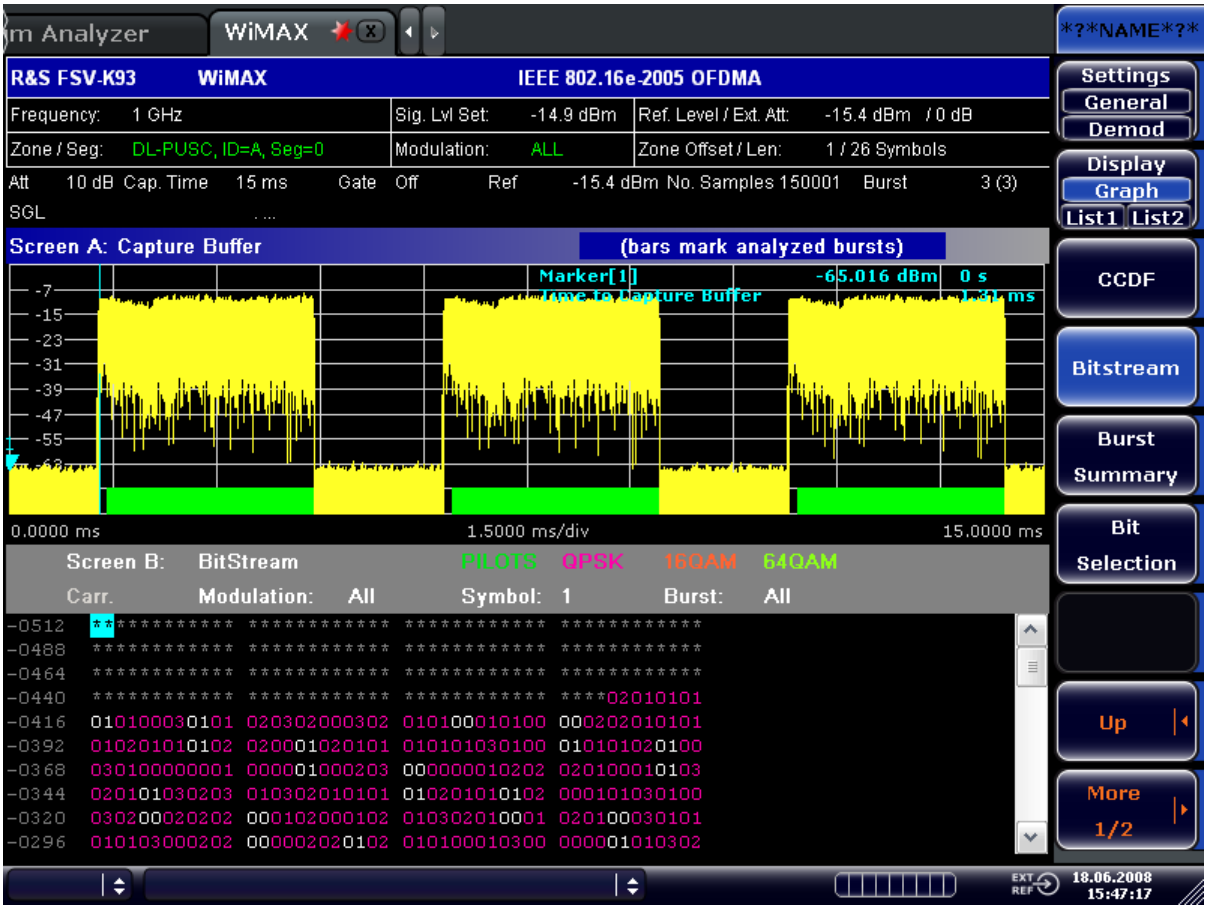
SCPI command:
CONFigure:BURSt:STATistics:CCDF[:IMMediate] on page 162

Bitstream ← Statistics
Sets the Bitstream result display.

- IEEE 802.16-2004 OFDM
  This result display shows the demodulated data stream. These results are grouped by burst and symbol. If no dialog boxes are displayed, the results can be scrolled through using the cursor keys or rotary knob.



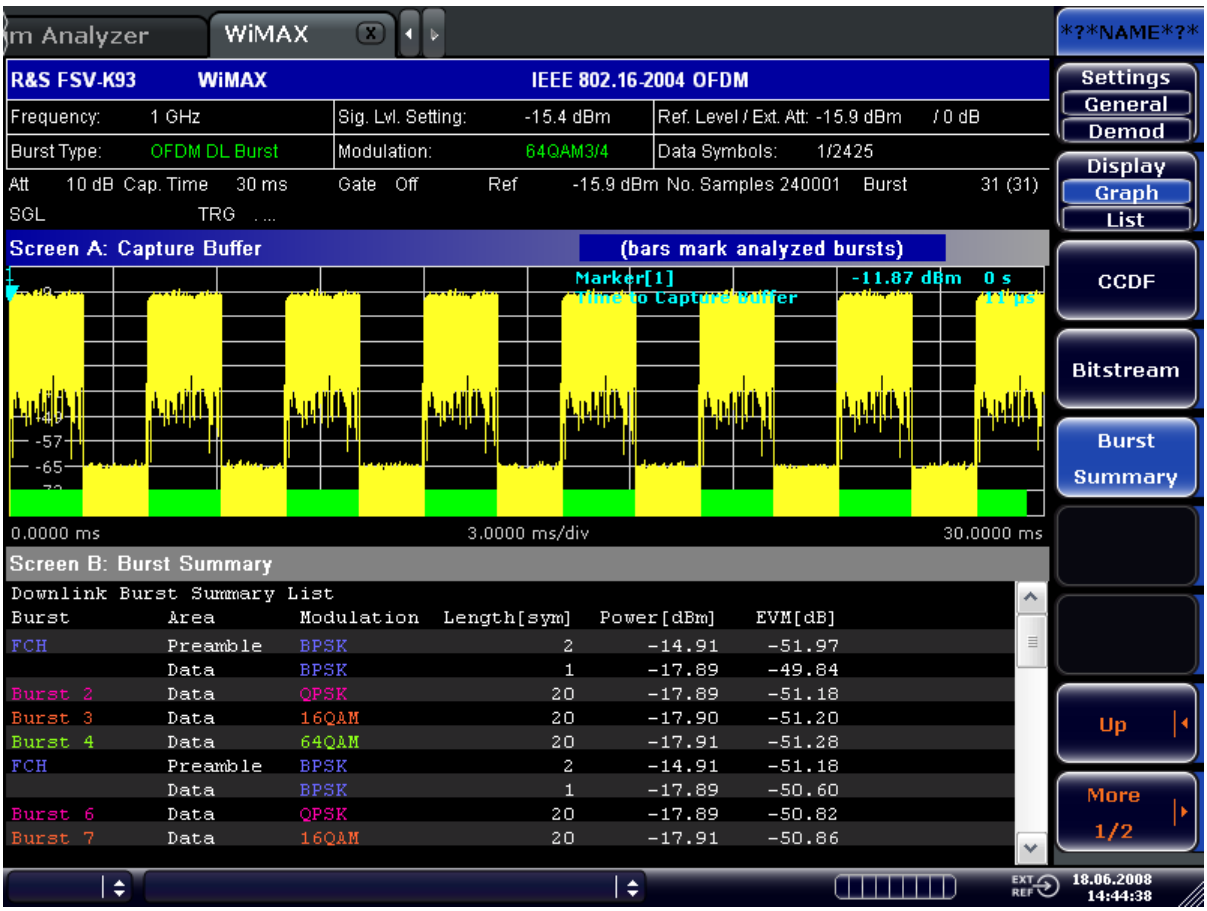
- IEEE 802.16e-2005 OFDMA/WiBro
  This result display shows the modulation symbols of the bursts from the analyzed zone. The different modulation formats are displayed in unique colors. The same color assignment is used in the Constellation vs Symbol result display. The modulation symbols define bit sequences. The mapping is defined in the standard. Signals with erroneous pilot sequences (i.e where the detected pilot sequence does not match that according to the standard) are highlighted with a red background.
  The amount of data displayed in the Bitstream result display can be reduced via the Bit Selection (IEEE 802.16e-2005 OFDMA/WiBro) softkey.



SCPI command:
CONFigure:BURSt:STATistics:BSTReam[:IMMediate] on page 160

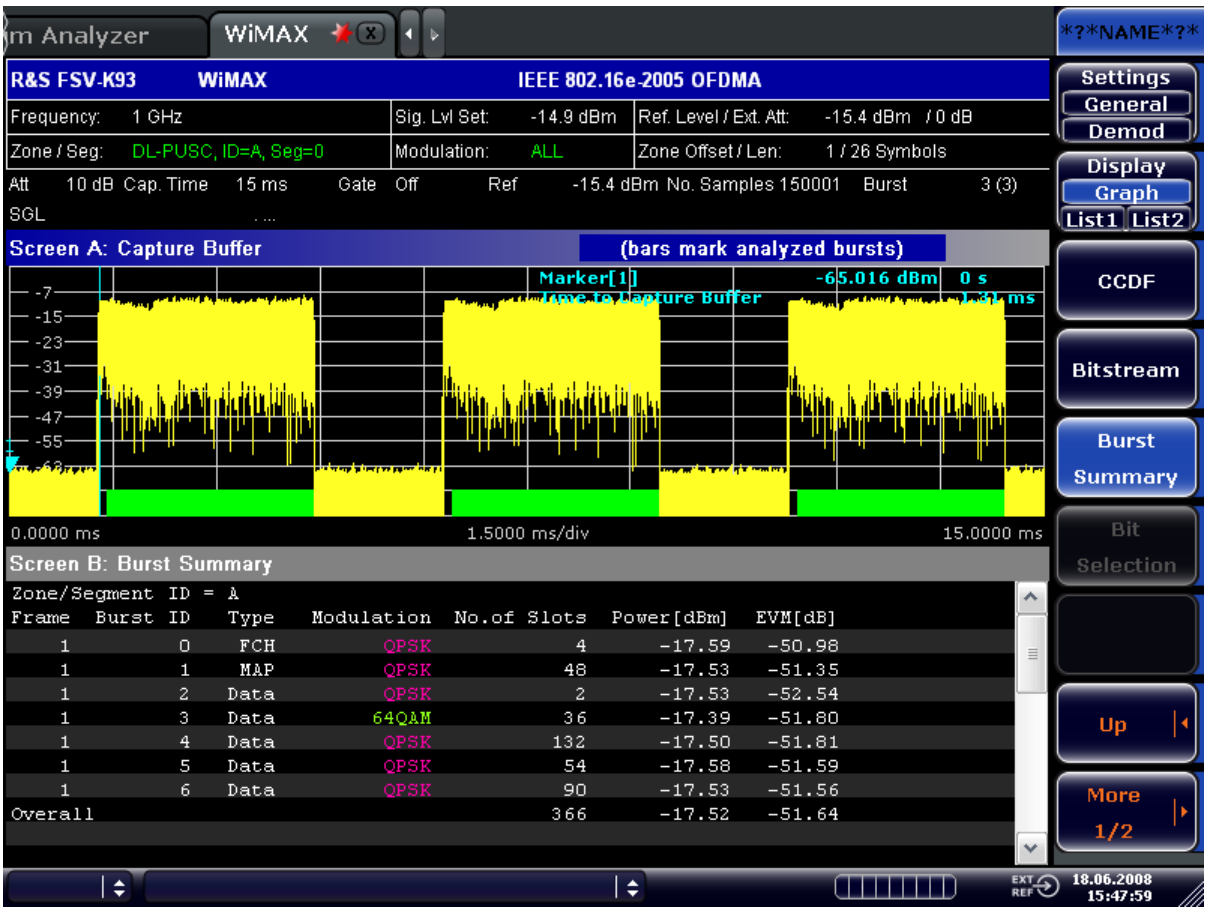
Burst Summary ← Statistics
This result display shows the summary data for the analyzed bursts. If no dialog boxes are displayed, the results can be scrolled through using the cursor keys or rotary knob.

- IEEE 802.16-2004 OFDM



- IEEE 802.16e-2005 OFDMA/WiBro

This result display provides information about the bursts from the analyzed zone, i.e. modulation of the burst, power boosting information, EVM of the burst. Each analyzed zone will produce a set of burst results.



SCPI command:

CONFigure:BURSt:STATistics:BSUMmary[:IMMediate] on page 161

Bit Selection (IEEE 802.16e-2005 OFDMA/WiBro) ← Statistics

Opens a dialog box for filtering the displayed results. The results may be filtered by any combination of modulation, symbol or burst. If the bit selection parameters are changed, the result display is updated accordingly.

This softkey is only available if the Bitstream measurement (Bitstream softkey) is selected.

SCPI command:

CONFigure:BURSt:STATistics:BSTReam:SYMBol:SELect on page 161

CONFigure:BURSt:STATistics:BSTReam:FORMat:SELect on page 161

CONFigure:BURSt:STATistics:BSTReam:BURSt:SELect on page 160

File Manager (IEEE 802.16e-2005 OFDMA/WiBro)

Opens the "File Manager" dialog box. The File Manager allows you to to transfer WiMAX settings from an R&S SMU signal generator via LAN. For step-by-step instructions see chapter 4.2.2.5, "Transfering the Current R&S SMU WiMAX Settings via LAN", on page 45 . The File Manager also offers some general file management support.

The File Manager writes into the directory `C:\R_S\Instr\user\WMAN` and its subdirectories or a USB memory stick only.

Under "File Types", filter the displayed files by selecting:

All (*.*)	All file types are displayed. Use this selection to perform general file management tasks.
SMU WiMax	Only files with the extension WiMAX are displayed.

Depending on the focus, the following softkeys are provided:

- Recall
- New Folder
- Copy
- Paste
- Rename
- Delete File

To close the File Manager, press ESC.

For further information refer to the description of the SAVE/RCL key in the base unit.

SCPI command:
chapter 4.3.15, "MMEMory Subsystem (WiMAX / WiBro, K93)", on page 200

4.2.3.2 General Settings Dialog Box

In the "General Settings" dialog box, all settings related to the overall measurement can be modified. The tab with the advanced settings is only displayed if the "Advanced Settings" option is activated. The "General Settings" dialog box contains the following elements:

General Settings
This tab contains the general measurement settings.

Standard ← General Settings
Displays a list of all installed standards to select the WiMAX/WiBro standard. This is necessary to ensure that the measurements are performed according to the specified standard with the correct limit values and limit lines.

SCPI command:
`CONFigure:STANdard` on page 163

Frequency ← General Settings
Specifies the center frequency of the signal to be measured. If the frequency is modified, the "Channel No" field is updated accordingly.

SCPI command:
`[SENSe:]FREQuency:CENTer` on page 209

Channel No (IEEE 802.16-2004 OFDM) ← General Settings
Specifies the channel to be measured. If the "Channel No" field is modified, the center frequency is derived according to the section in the standard mentioned below and updated.

- For the Licensed Bands {ETSI, MMDS, WCS}:
  Channel numbers are supported according to IEEE Std 802.16-2004 "8.3.10.2 Transmitter channel bandwidth and RF carrier frequencies". For the target frequency bands see IEEE Std 802.16-2004 "B.1 Targeted frequency bands".
- For the License Exempt Bands {U-NII, CEPT}:
  Channel numbers are supported according to IEEE Std 802.16-2004 "8.5.1 Channelization".

SCPI command:
`CONFigure:CHANnel` on page 162

Frequency Band ← General Settings
Specifies the relationship between the "Channel BW" on page 87 and the "Sample Rate" on page 87 parameters.

SCPI command:
`CONFigure:WIMax:FBANd` on page 165

FFT Size N_{FFT} (IEEE 802.16e-2005 OFDMA/WiBro) ← General Settings
Specifies the maximum number of carriers supported by the signal to be measured.

SCPI command:
`CONFigure:WIMax:NFFT` on page 169

Channel BW ← General Settings
Specifies the bandwidth of the channel to be measured.

SCPI command:
`[SENSe:]BANDwidth:CHANnel` on page 203

Fs/BW ← General Settings
Specifies the ration of the Sample Rate (Fs) to Channel Bandwidth (BW). This ration can either be set to auto (as specified by the selected standard), or manually specified.

SCPI command:
`CONFigure:WIMax:FSBWratio:AUTo` on page 168
`CONFigure:WIMax:FSBWratio:FS` on page 168
`CONFigure:WIMax:FSBWratio:BW` on page 168

Sample Rate ← General Settings
Specifies the sample rate used for IQ measurements.

SCPI command:
`TRACe:IQ:SRATe` on page 221

G = T_g/T_b ← General Settings
Specifies the guard time ratio.

SCPI command:
`CONFigure:WIMax:IGRatio` on page 168

Signal Level ← General Settings
Specifies the expected mean level of the RF input signal. If an automatic level detection measurement has been executed the signal level (RF) is updated.

SCPI command:
`CONFigure:POWer:EXPected:RF` on page 163

Auto Level ← General Settings
Activates or deactivates the automatic setting of the reference level for measurements.

"ON" The reference level is measured automatically at the start of each measurement sweep. This ensures that the reference level is always set at the optimal level for obtaining accurate results but will result in slightly increased measurement times. For details about automatic level detection refer to chapter 4.1.1.2, "Performing the Level Detection", on page 16.

"OFF" The reference level is defined manually in the "Signal Level" on page 87 field.

SCPI command:

CONFigure:POWer:AUTO on page 162

CONFigure:POWer:AUTO:SWEep:TIME on page 162

Ext Att ← General Settings

Specifies the external attenuation or gain applied to the RF signal. A positive value indicates attenuation, a negative value indicates gain. All displayed power level values are shifted by this value.

SCPI command:

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet on page 185

Capture Time ← General Settings

Specifies the time (and therefore the amount of data) to be captured in a single measurement sweep.

SCPI command:

[SENSe:]SWEep:TIME on page 217

Burst Count (IEEE 802.16-2004 OFDM) ← General Settings

Activates or deactivates a specified number of bursts for capture and analysis.

On	The data analysis is performed over a number of consecutive sweeps until the required number of bursts has been captured and analyzed.
Off	The data analysis is performed on a single measurement sweep.

SCPI command:

[SENSe:]BURSt:COUNt:STATe on page 204

Analyze Bursts (IEEE 802.16-2004 OFDM) ← General Settings

Specifies the number of bursts to be measured, if the "Burst Count (IEEE 802.16-2004 OFDM)" on page 88 option is activated.

If the number of bursts of the specified type is not contained in a single measurement sweep, the measurement sweeps continue until the requested number of bursts have been captured.

SCPI command:

[SENSe:]ZONE:COUNt:STATe on page 219

Capture Count (IEEE 802.16e-2005 OFDMA/WiBro) ← General Settings

Specifies whether a specified number of subframes are to be captured and analyzed.

If deactivated, data analysis is performed on a single measurement sweep.

If activated, data analysis is performed over a number of consecutive sweeps until the required number of subframes (see "No. Subframes (IEEE 802.16e-2005 OFDMA/ WiBro)" on page 89) have been captured and analyzed.

SCPI command:
[SENSe:]ZONE:COUNt:STATe on page 219

No. Subframes (IEEE 802.16e-2005 OFDMA/WiBro) ← General Settings
Specifies the number of subframes to be measured. If the specified number of subframes are not contained in a single measurement sweep, then measurement sweeps will continue to be performed until the requested number of subframes have been captured.

This setting is only available if "Capture Count (IEEE 802.16e-2005 OFDMA/WiBro)" on page 88is activated.

SCPI command:
[SENSe:]ZONE:COUNt on page 219

Sweep Time ← General Settings
Specifies the sweep time for the Spectrum Mask and Spectrum ACP/ACPR measurements:

- If the "Auto" option is activated, the sweep time is calculated automatically.
- If the "Auto" option is deactivated, specify the sweep time.

SCPI command:
[SENSe:]SWEep:ACPR:TIME on page 214
[SENSe:]SWEep:ACPR:TIME:AUTO on page 214

Sweep Count ← General Settings
Specifies the number of sweeps to be performed for Spectrum ACP/ACPR and Spectrum Mask measurements.

SCPI command:
[SENSe:]SWEep:COUNt on page 215

Trigger Mode ← General Settings
Sets the source of the trigger for the measurement sweep.

"Free Run" The measurement sweep starts immediately.

"External" The measurement sweep starts if the external trigger signal meets or exceeds the external trigger level (a fixed value that cannot be altered) at the input connector EXT TRIGGER/GATE IN on the rear panel.

"Power" The measurement sweep starts if the signal power meets or exceeds the specified power trigger level.

SCPI command:
TRIGger<n>[:SEQuence]:SOURce on page 232

Trigger Offset ← General Settings
Specifies the time offset between the trigger signal and the start of the sweep. A negative value indicates a pre-trigger. This field is not available in the "Free Run" trigger mode.

SCPI command:
TRIGger[:SEQuence]:HOLDoff on page 229

Power Level ← General Settings
Specifies the trigger level if the "Power" trigger mode is set (see "Trigger Mode" on page 89 field).

SCPI command:
`TRIGger[:SEQuence]:LEVel:POWer` on page 230

Power Level Auto ← General Settings
Activates or deactivates the automatic measurement of the power trigger level if the "Power" trigger mode is set (see "Trigger Mode" on page 89 field).

On	The power trigger level is measured automatically at the start of each measurement sweep. This ensures that the power trigger level is always set at the optimal level for obtaining accurate results but will result in a slightly increased measurement times.
Off	The power trigger level is defined manually in the "Power Level" on page 90 field.

SCPI command:
`TRIGger[:SEQuence]:LEVel:POWer:AUTO` on page 231

Advanced Settings
This tab contains advanced measurement settings.

Swap IQ (IEEE 802.16-2004 OFDM) ← Advanced Settings
Activates or deactivates the inverted I/Q modulation.

On	I and Q signals are interchanged.
Off	Normal I/Q modulation.

SCPI command:
`[SENSe:]SWAPiq` on page 214

Input ← Advanced Settings
Defines whether "RF" or "Baseband Digital" input is used for measurements.

"Baseband Digital" is only available if option R&S FSV-B17 (Digital Baseband interface) is installed.

For details see the Digital Baseband Interface description in the base unit document.

Baseband Settings ← Advanced Settings
For "IQ Digital" input, the Baseband Settings can be defined here.

Input Sample Rate ← Baseband Settings ← Advanced Settings
Defines the sample rate of the digital I/Q signal source. This sample rate must correspond with the sample rate provided by the connected device, e.g. a generator.

SCPI command:
`INPut:DIQ:SRATe` on page 198

Full Scale Level ← Baseband Settings ← Advanced Settings
The "Full Scale Level" defines the level that should correspond to an I/Q sample with the magnitude "1".

The level is defined in Volts.

SCPI command:
`INPut:DIQ:RANGe[:UPPer]` on page 197

Auto Level ← Advanced Settings
Activates or deactivates the automatic setting of the reference level for measurements.

"ON" The reference level is measured automatically at the start of each measurement sweep. This ensures that the reference level is always set at the optimal level for obtaining accurate results but will result in slightly increased measurement times. For details about automatic level detection refer to chapter 4.1.1.2, "Performing the Level Detection", on page 16.

"OFF" The reference level is defined manually in the "Auto Level" on page 91 field.

SCPI command:
`CONFigure:POWer:AUTO` on page 162
`CONFigure:POWer:AUTO:SWEep:TIME` on page 162

Auto Track Time ← Advanced Settings
Specifies the sweep time used for the automatic level measurements.

SCPI command:
`CONFigure:POWer:AUTO:SWEep:TIME` on page 162

Ref Level ← Advanced Settings
Specifies the reference level to use for measurements. If the reference level is modified, the signal level is updated accordingly (depending on the currently selected standard and measurement type). If you select a reference level manually, the "Auto Level" on page 91 is deactivated.

SCPI command:
`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel` on page 184

RF Att. ← Advanced Settings
Specifies the settings for the attenuator. This field is only editable if the "Auto Level" on page 91 option is deactivated. If the "Auto Level" on page 91 option is activated, the RF attenuator setting is coupled to the reference level setting.

SCPI command:
`INPut:ATTenuation` on page 197

RSSI, CINR avg. ← Advanced Settings
Specifies the mean and standard deviation for the RSSI and CINR results (see IEEE Std 802.16-2004 "8.3.9.2 RSSI mean and standard deviation", "8.3.9.3 CINR mean and standard deviation").

SCPI command:
`CONFigure:WIMax:AVERaging` on page 163

List Results Unit ← Advanced Settings
Specifies the units for the results in the results summary table.

SCPI command:
`UNIT:TABLe` on page 233

Measure Capture Buffer to … ← Advanced Settings
The "Capture Memory" display provides the "Time to Capture Buffer Start" measurement. This measurement can be performed in 2 different modes.

- For "Measure Capture Buffer to FFT Start", the "Time to Capture Buffer Start" measurement shows the time between the capture buffer start and the FFT start of the first ofdm symbol from the analyzed subframe. For an ideal channel, the FFT start sample is the sample in the center of the cyclic prefix.
- For "Measure Capture Buffer to Frame Start", the "Time to Capture Buffer Start" measurement shows the time between the capture buffer start and the first sample of the first ofdm symbol from the analyzed subframe. This is hold for an ideal channel.

SCPI command:
`CALCulate<n>:MARKer<m>:FUNCtion:TTCapture:STARt` on page 149

SMU Address (IEEE 802.16e-2005 OFDMA/WiBro) ← Advanced Settings
Specifies the TCP/IP address of an external R&S SMU signal generator connected via TCP/IP. This enables the analyzer to download the frame zone setup directly.

SCPI command:
`SYSTem:COMMunicate:TCPip:ADDRess` on page 220

4.2.3.3 Demod Settings Dialog Box

In the "Demod Settings" dialog box, the settings associated with the signal modulation can be modified. The content of the "Demod Settings" dialog box depends on the selected standard:

- IEEE 802.16-2004 OFDM
  The settings under "Burst to Analyze" specify the characteristics of the bursts to be considered in the measurement results. Only the bursts which meet the criteria specified in this group will be included in measurement analysis. The settings under "Tracking" allow various errors in measurement results to be compensated for.
  For IEEE 802.16-2004 OFDM, the "Demod Settings" dialog box contains the following elements:

Group	Setting
Burst to Analyze	"Link Mode (IEEE 802.16-2004 OFDM)" on page 94
	"Use FCH Content (IEEE 802.16-2004 OFDM)" on page 95
	"Mod. Detection (IEEE 802.16-2004 OFDM)" on page 95
	"Demodulator (IEEE 802.16-2004 OFDM)" on page 95
	"Subchannelization (IEEE 802.16-2004 OFDM)" on page 95
	"UL Phys. Modifier (IEEE 802.16-2004 OFDM)" on page 96

Group	Setting
	"Equal Burst Length (IEEE 802.16-2004 OFDM)" on page 96
	"Min Data Symbols (IEEE 802.16-2004 OFDM)" on page 96
	"Max Data Symbols (IEEE 802.16-2004 OFDM)" on page 96
	"Channel Estimation (IEEE 802.16-2004 OFDM)" on page 96
Tracking	"Phase" on page 97
	"Timing" on page 97
	"Level" on page 97

- IEEE 802.16e-2005 OFDMA/WiBro
  The "Demod Settings" dialog box contains three tabs. Use the left/right arrow keys to navigate between the tabs.
  On the "Demod Settings" tab, the channel estimation range is set. The settings under "Bursts to Analyze" specify the characteristics of the bursts to be considered in the measurement results. The settings under "Tracking" allow various errors in measurement results to be compensated for.
  On the "Frame Global" tab, the common settings associated with the frame to be analyzed can be modified.
  On the "Frame Config" tab, the settings associated with the frame configuration can be modified. The "Zone/Segment List" and the "Burst List" are displayed. The content of the selected list is graphically displayed under the "Zone/Segment Map" and the "Burst Map", respectively. To edit the "Frame Config" tab, softkeys are available (see the table below).
  For IEEE 802.16e-2005 OFDMA/WiBro the "Demod Settings" dialog box contains the following elements:

Group	Setting
"Demod Settings"	
Channel Estimation Range	"Downlink (DL) (IEEE 802.16e-2005 OFDMA/WiBro)" on page 97
	"Uplink (UL) (IEEE 802.16e-2005 OFDMA/WiBro)" on page 97
Bursts to Analyze	"Burst Boosting (IEEE 802.16e-2005 OFDMA/WiBro)" on page 97
Tracking Settings	"Phase" on page 97
	"Timing" on page 97
	"Level" on page 97
	"Channel Est. based on (IEEE 802.16e-2005 OFDMA/WiBro)" on page 98
	"Pilots for Tracking (IEEE 802.16e-2005 OFDMA/WiBro)" on page 98
Advanced	"FFT Start Offset (IEEE 802.16e-2005 OFDMA/WiBro)" on page 98

Group	Setting
"Frame Global"	
Frame	"Use for analysis (IEEE 802.16e-2005 OFDMA/WiBro)" on page 99
	"File Name (IEEE 802.16e-2005 OFDMA/WiBro)" on page 100
	"IDCell (IEEE 802.16e-2005 OFDMA/WiBro)" on page 100
DL Subframe	"Preamble Mode (IEEE 802.16e-2005 OFDMA/WiBro)" on page 100
	"Preamble Index (IEEE 802.16e-2005 OFDMA/WiBro)" on page 100
	"Used Subchannel Bitmap (IEEE 802.16e-2005 OFDMA/WiBro)" on page 101
UL Subframe	"UL Control Region Len (IEEE 802.16e-2005 OFDMA/WiBro)" on page 101
	"Frame Number (IEEE 802.16e-2005 OFDMA/WiBro)" on page 101
	"Allocated Subchannel Bitmap (IEEE 802.16e-2005 OFDMA/WiBro)" on page 101

The settings in the "Frame Config" tab are defined using the following softkeys:

"List Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro)" on page 101
"Copy Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro)" on page 105
"Insert Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro)" on page 105
"New Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro)" on page 105
"New Segment (IEEE 802.16e-2005 OFDMA/WiBro)" on page 105
"Delete Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro)" on page 105
"File Manager (IEEE 802.16e-2005 OFDMA/WiBro)" on page 84

Demod Settings tab
This tab contains general demodulation settings.

Link Mode (IEEE 802.16-2004 OFDM) ← Demod Settings tab
Specifies the link mode of bursts that are to be included in measurement analysis. The following link mode types are supported:

UL	Up Link
DL	Down Link

SCPI command:
`CONFigure:WIMax:LMODe` on page 169

Use FCH Content (IEEE 802.16-2004 OFDM) ← Demod Settings tab
Activates or deactivates the decoding of the captured burst data FCH field.

OFF	This is the default setting and cannot be altered currently.
ON	Only the bursts with a modulation format matching the format specified in the "Demodulator" list are included in the results analysis.

Mod. Detection (IEEE 802.16-2004 OFDM) ← Demod Settings tab
Specifies the demodulation of the signal. The following values are supported:

None	No modulation detection is performed. The signal will be analyzed according to the "Demodulator" setting. Therefore the "Demodulator" setting must match with the modulation format of the subframe. This setting excludes the analysis of multiple modulation formats in a subframe.
First Symbol	The first data symbol specifies the modulation format, i.e. the signal will be analyzed according to the modulation format of the first data symbol. This setting supports multiple modulation formats in a subframe. If "First Symbol" is selected, the "Demodulator" setting is disabled and is automatically updated with the modulation scheme detected in the first symbol.
USER	Only bursts matching the setting in the "Demodulator" list are analyzed. This setting supports multiple modulation formats in a subframe.
All	All bursts individual payload modulations are analyzed accordingly. This setting is useful to get an overview of the signal content.

SCPI command:
`[SENSe:]DEMod:FORMat[:BCONtent]:AUTo` on page 208

Demodulator (IEEE 802.16-2004 OFDM) ← Demod Settings tab
Defines the modulation format for signal analysis if the Mod. Detection is set to None or User (see "Link Mode (IEEE 802.16-2004 OFDM)" on page 94 field).

The measurement application does not distinguish between different coding rates for the same modulation format. If the signal to be analyzed contains the profiles (modulation format A, coding rate B) and (modulation format C, coding rate D), the signal to be analyzed must hold the following condition in order to produce correct measurement results:

[A == C ⇒ B == D]

SCPI command:
`[SENSe:]DEMod:FORMat:BANalyze` on page 206

Subchannelization (IEEE 802.16-2004 OFDM) ← Demod Settings tab
Activates or deactivates the subchannelization, if the "Up Link" mode is set (see "Link Mode (IEEE 802.16-2004 OFDM)" on page 94 field). If activated, the subchannel index of uplink bursts is analyzed, defined by the "Index (IEEE 802.16-2004 OFDM)" on page 96 field.

SCPI command:
`[SENSe:]SUBChannel:STATe` on page 213

Index (IEEE 802.16-2004 OFDM) ← Demod Settings tab
Defines the subchannelization index of uplink bursts to be analyzed. Subchannelization index 16 is the default subchannel with full occupation.

SCPI command:
`[SENSe:]SUBChannel` on page 213

UL Phys. Modifier (IEEE 802.16-2004 OFDM) ← Demod Settings tab
Specifies a common UL physical modifier for all uplink bursts.

SCPI command:
`[SENSe:]SUBChannel:ULPHysmod` on page 213

Equal Burst Length (IEEE 802.16-2004 OFDM) ← Demod Settings tab
Activates or deactivates the burst selection for measurement analysis according to the range or specific number of data symbols/bytes.

On	Only bursts with exactly the number of symbols specified in the "Data Symbols (IEEE 802.16-2004 OFDM)" on page 96 field are considered for measurement analysis.
Off	Only bursts within the range of data symbols specified by the "Min Data Symbols (IEEE 802.16-2004 OFDM)" on page 96 and "Max Data Symbols (IEEE 802.16-2004 OFDM)" on page 96 fields are considered for measurement analysis.

SCPI command:
`[SENSe:]DEMod:FORMat:BANalyze:SYMBols:EQUal` on page 206

Data Symbols (IEEE 802.16-2004 OFDM) ← Demod Settings tab
Specifies the number of symbols that a burst must have to be considered for measurement analysis. This field is only available if the "Equal Burst Length (IEEE 802.16-2004 OFDM)" on page 96 option is activated.

SCPI command:
`[SENSe:]DEMod:FORMat:BANalyze:SYMBols:MIN` on page 207

Min Data Symbols (IEEE 802.16-2004 OFDM) ← Demod Settings tab
Specifies the minimum number of data symbols that a burst must have to be considered in measurement analysis. This field is only available if the "Equal Burst Length (IEEE 802.16-2004 OFDM)" on page 96 option is deactivated.

SCPI command:
`[SENSe:]DEMod:FORMat:BANalyze:SYMBols:MIN` on page 207

Max Data Symbols (IEEE 802.16-2004 OFDM) ← Demod Settings tab
Specifies the maximum number of data symbols that a burst must have to be considered in measurement analysis. This field is only available if the "Equal Burst Length (IEEE 802.16-2004 OFDM)" on page 96 option is deactivated.

SCPI command:
`[SENSe:]DEMod:FORMat:BANalyze:SYMBols:MAX` on page 207

Channel Estimation (IEEE 802.16-2004 OFDM) ← Demod Settings tab
Specifies how accurately the EVM results are calculated.

Preamble	The channel estimation is performed in the preamble as required in the standard.
Payload	The channel estimation is performed in the payload.

SCPI command:
[SENSe:]DEMod:CESTimation on page 204

Phase ← Demod Settings tab
Activates or deactivates the compensation for the phase error. If activated, the measurement results are compensated for phase error on a per-symbol basis.

SCPI command:
[SENSe:]TRACking:PHASe on page 218

Timing ← Demod Settings tab
Activates or deactivates the compensation for the timing error. If activated, the measurement results are compensated for timing error on a per-symbol basis.

SCPI command:
[SENSe:]TRACking:TIME on page 219

Level ← Demod Settings tab
Activates or deactivates the compensation for the level error. If activated, the measurement results are compensated for level error on a per-symbol basis.

SCPI command:
[SENSe:]TRACking:LEVel on page 218

Downlink (DL) (IEEE 802.16e-2005 OFDMA/WiBro) ← Demod Settings tab
Specifies how channel estimation is performed for downlink signals.

Preamble Only	The channel estimation is performed in the preamble only.
Preamble and Payload	The channel estimation is performed in the preamble and in the payload (payload comprises pilots and data).
Payload Only	The channel estimation is performed in the payload only.

SCPI command:
[SENSe:]DEMod:CESTimation on page 204

Uplink (UL) (IEEE 802.16e-2005 OFDMA/WiBro) ← Demod Settings tab
Displays the channel estimation performed for uplink signals.

This field is for information purposes only as channel estimation for uplink signals are always performed in payload only (payload comprises pilots and data).

Burst Boosting (IEEE 802.16e-2005 OFDMA/WiBro) ← Demod Settings tab
specifies how the information about the burst boosting factors is derived.

"Predefined" The burst boosting factors are taken from the "Frame Config" dialog.

"Estimated" The measurement application estimates the burst boosting factors from the signal to be analyzed.

SCPI command:
`CONFigure:BURSt:BOOSting` on page 152

Modulation Analysis Scope (IEEE 802.16e-2005 OFDMA/WiBro) ← Demod Settings tab
Displays the modulation formats to be analyzed.

This field is for information purposes only as all detected modulation schemes are analyzed.

Demodulator (IEEE 802.16e-2005 OFDMA/WiBro) ← Demod Settings tab
Displays the modulation scheme detected in the analyzed signal. For signals using multiple modulation schemes, the modulation scheme with the highest data rate is displayed. The field also indicates the limits that are applied to the EVM results in the table or results.

This field is for information purposes only.

SCPI command:
`[SENSe:]DEMod:FORMat:BANalyze` on page 206

Channel Est. based on (IEEE 802.16e-2005 OFDMA/WiBro) ← Demod Settings tab
This setting is used to specify if the processing of the Channel Estimation uses the user-selected Phase, Timing and Level settings or whether these settings are determined by the DSP, in which case all tracking options are used.

SCPI command:
`[SENSe:]DEMod:CESTimation` on page 204

Pilots for Tracking (IEEE 802.16e-2005 OFDMA/WiBro) ← Demod Settings tab
Specifies how, for downlink signals, the pilot sequence is determined for tracking purposes.

For uplink signals, this field is for information purposes only as tracking is performed according to the selected standard.

According to Standard	The pilot sequence is computed according to the standard.
Detected	The pilot sequence uses the values detected in the signal.

SCPI command:
`[SENSe:]TRACking:PILot` on page 218

FFT Start Offset (IEEE 802.16e-2005 OFDMA/WiBro) ← Demod Settings tab
Adds an offset to the FFT starting point determined by the application.

The setting range is from -100 % to +100 % of the cyclic prefix (CP) length. In the case of 0 %, the optimal FFT starting point, determined by the application, is used. This is the default setting.

SCPI command:
`[SENSe:]FFT:OFFSet` on page 209

Rel to CP Cntr (IEEE 802.16e-2005 OFDMA/WiBro) ← Demod Settings tab
Indicates the number of samples the offset corresponds to, relative to the center of the cyclic prefix (CP).

SCPI command:
`[SENSe:]FFT:OFFSet` on page 209

Frame Global tab
This tab contains global frame settings.

Use for analysis (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Global tab
The option specifies whether the analysis should be performed using the current user-defined configuration, or whether automatic determination of the frame configuration should be performed.

Automatic detection of the frame configuration requires several measurement parameters to be correctly configured:

- Frequency
- Sample Rate/Channel Bandwidth
- FFT size
- Guard Time
- IDCell
- Preamble Index (if not in the range 0 – 96)

Note: Loading a WiMAX file automatically sets "Predefined MAP".

"Predefined MAP"	Uses the current user-defined configuration
"Auto Demod DL-MAP"	Performs an additional initial sweep to determine the configuration from the downlink signal.
"Auto Demod UL-MAP/PHY Det."	Uplink signals can be analysed without knowledge about the UL-MAP. The following signals can be measured with auto demodulation detection: • A single UL-PUSC data burst. • A single data burst to the right of a specified control region. The control region itself is ignored. It is specified via the UL Control Region Length field. Selecting "Auto Demod UL-MAP/PHY Det." automatically sets "Pilots for Tracking" (in "Demod Settings") to "Detected" (see "Pilots for Tracking (IEEE 802.16e-2005 OFDMA/WiBro)" on page 98). After a successful auto demod measurement the "Frame Config" dialog contains the frame configuration according to the parameters detected in the signal.

SCPI command:
`[SENSe:]DEMod:FORMat[:BCONtent]:AUTo` on page 208

Analyze Zone ← Use for analysis (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Global tab
This setting is only available if "Use for analysis (IEEE 802.16e-2005 OFDMA/WiBro)" on page 99 is set to auto demodulation. It allows any zone to be analyzed which is available in the signal. In case the specified zone is not available in the signal, the zone to be analyzed is adjusted to the last available zone in the signal.

SCPI command:
`CONFigure:WIMax:FRAMe:ZONEtouse` on page 167

File Name (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Global tab
Displays the name of the loaded *.WIMAX settings file. If no file is loaded the '….' is displayed.

This field is for information purposes only.

IDCell (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Global tab
Specifies the downlink IDCell number and affects the definition of the preamble sequence (in conjunction with the used segments according to the "Used Subchannel Bitmap (IEEE 802.16e-2005 OFDMA/WiBro)" on page 101 setting), the pilot sequence of the first zone and the subchannel definition of the first zone.

If "AUTO" is selected, the IDcell is determined from the signal by the application.

SCPI command:
`CONFigure:WIMax:DLSFrame:IDCell` on page 164

Preamble Mode (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Global tab
Specifies how the preamble index is calculated.

Auto	The preamble index is automatically calculated according to the "IDCell (IEEE 802.16e-2005 OFDMA/WiBro)" on page 100 and "Used Subchannel Bitmap (IEEE 802.16e-2005 OFDMA/WiBro)" on page 101 parameters.
USER	The preamble index can be specified manually, i.e. the preamble pattern is chosen according to the standard using the "Preamble Index (IEEE 802.16e-2005 OFDMA/WiBro)" on page 100 parameter.

SCPI command:
`CONFigure:WIMax:DLSFrame:PREamble:MODe` on page 164

Preamble Index (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Global tab
Specifies the preamble pattern (according to the standard) to be used, if the "Preamble Index (IEEE 802.16e-2005 OFDMA/WiBro)" on page 100 parameter is set to USER.

SCPI command:
`CONFigure:WIMax:DLSFrame:PREamble:INDex` on page 164

Used Subchannel Bitmap (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Global tab
Assigns subchannel groups to segments, see [802.16e-2005], page 360, table 268a "Subchannel index of the six subchannel groups". This table defines how many subchannels are available for the "Burst List" ("Frame Config" tab) belonging to the corresponding segment of a DL-PUSC zone (with Use All Subchannels being false). In the burst list – corresponding to the segment – this selection controls the height of the white area in the burst map.

SCPI command:
`CONFigure:WIMax:DLSFrame:SEGMent<1…3>` on page 165

UL Control Region Len (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Global tab
UL Control Region Length specifies the length, in symbols, of a control region to be found at the start of any UL zone.

The control region will not be analysed, but the length must be specified to allow synchronisation.

SCPI command:
`CONFigure:WIMax:ULSFrame:CRLength` on page 170

Frame Number (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Global tab
Specifies the number of the frame to be analyzed. For UL subframe analysis, the frame number must be constant for the signal to be analyzed.

SCPI command:
`CONFigure:WIMax:ULSFrame:FRAMe` on page 170

Allocated Subchannel Bitmap (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Global tab
Specifies the subchannels to be analyzed.

This parameter is for information purposes only as all subchannels are used in the UL subframe.

Frame Configuration tab
This tab contains frame configuration settings.

List Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Configuration tab
Sets the focus on the The "Zone/Segment List" or the "Burst List" to enter and modify data. To insert, copy, and delete rows, use the softkeys available with the "Frame Config" tab.

The content of the selected list is graphically displayed under the "Zone/Segment Map" and the "Burst Map" respectively.

The "Zone/Segment List" contains the following columns:

Column	Description
ID	Provides a unique ID for the zone. This parameter is read only. If there are any errors in the zone/segment configuration, the background is displayed in red color.
Bursts	Pressing the rotary knob or the ENTER key with focus on this field changes the focus to the "Burst List" and displays the "Burst Map".

Column	Description
Analyze	Defines the zone/segment to be analyzed. Only one zone/segment can be selected for analysis at any given time.
Zone	Defines the zone type. The following types are supported: DL-PUSC, DL-FUSC, DL-AMC 2 x 3, UL-PUSC, UL-AMC 2 x 3
Segment	Defines the segment for a DL-PUSC zone. For DL-FUSC zones, this parameter has no effect.
Length	Defines the length in OFDMA symbols of the zone. The zone length must be a multiple of the symbol numbers per slot. If this is not the case, an error message is displayed in the status bar and the measurement does not start.
Offset	Defines the offset in OFDMA symbols from the start of the subframe. The first DL-PUSC zone starts with 1. The first UL-PUSC zone starts with 0.
PermBase	Specifies the permbase that is required for the calculation of the subchannel – physical carrier assignment permutation.
PRBS_ID	Specifies the permbase ID that is required for the calculation of the pilot sequence.

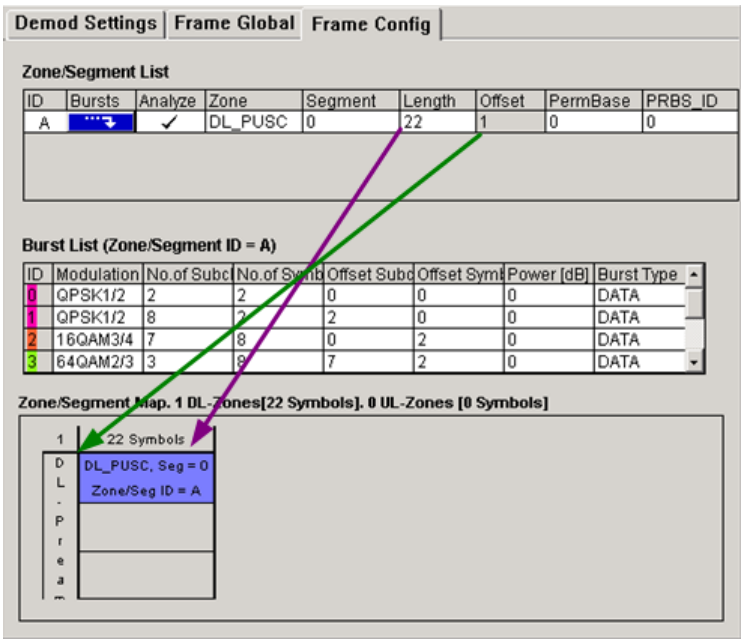


Fig. 4-19: Definition of the Zone Offset [green arrow] and the Zone Length [violet arrow] parameters from the Zone/Segment List

The "Burst List" contains the following parameters, depending on the zone selection:

Column	Description	Zone restrictions
ID	Provides a unique ID for the burst. This parameter is read only. The background color of this parameter reflects the modulation of the burst. If there are any errors in the burst configuration then the background of this item will be red.	
Modulation	Defines the modulation format of the burst. In the "Burst Map", identical modulation formats are displays in the same color.	

Column	Description	Zone restrictions
No. of Subch.	Defines the number of logical subchannels occupied by the burst.	DL_FUSC, DL_PUSC
No. of Symb.	Defines the number of OFDMA symbols occupied by the burst. It must be a multiple of the symbol numbers per slot. If this is not the case, an error message is displayed in the status bar and the measurement does not start.	DL_FUSC, DL_PUSC
Duration [Slots]	Specifies the unit of time for the allocating bandwidth.	UL_PUSC
Auto	If selected, the Offset Subch. and the Offset Symb. parameters are set automatically.	UL_PUSC
Offset Subch.	Defines the offset in logical subchannels from subchannel 0.	
Offset Symb.	Defines the offset in OFDMA symbols. It must be a multiple of the number of symbols per slot. If this is not the case, an error message is displayed in the status bar and the measurement does not start. The start of the zone defines symbol 0.	
Power[dB]	Defines the boosting factor of the burst.	
Burst Type	Defines the burst type from the protocol layer perspective.	DL_FUSC, DL_PUSC

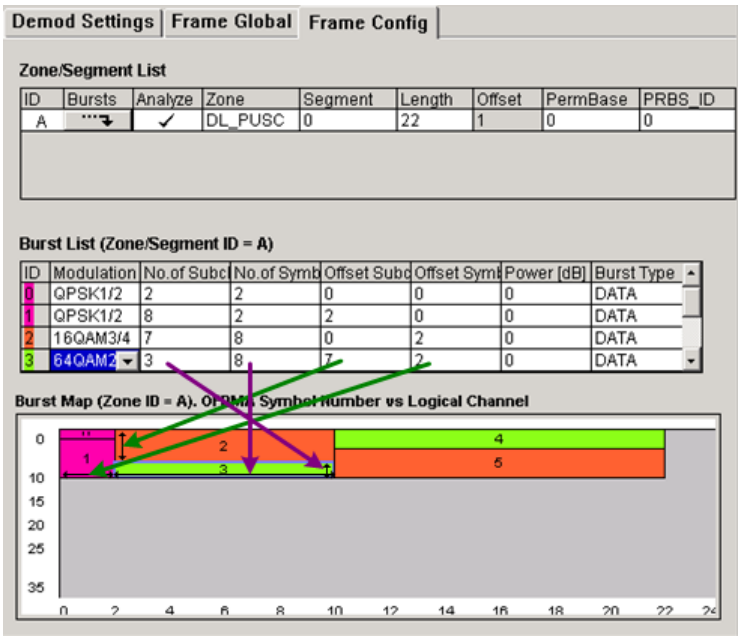


Fig. 4-20: Definition of the Burst Offset [green arrows] and the Burst Length [violet arrows] parameters from the Burst List

Note: If a burst is specified as DL_MAP, the number of slots is specified instead of the number of subchannels and symbols for the burst.

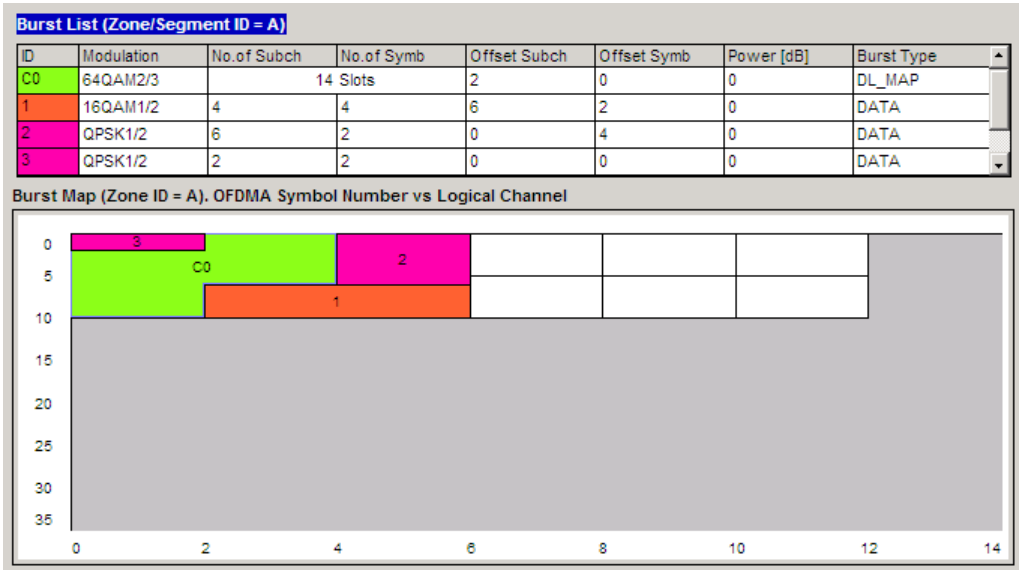


Fig. 4-21: Zone containing a wrapping DL_MAP burst (C0).

Note the shape of the burst, which fills the available symbols in the first column (of two symbols), and then uses the second column.

The "Zone/Segment Map" and the "Burst Map" display areas are located at the bottom of the "Frame Config" tab. They display a graphical view of the selected "Zone/Segment List".

- Zone/Segment Map

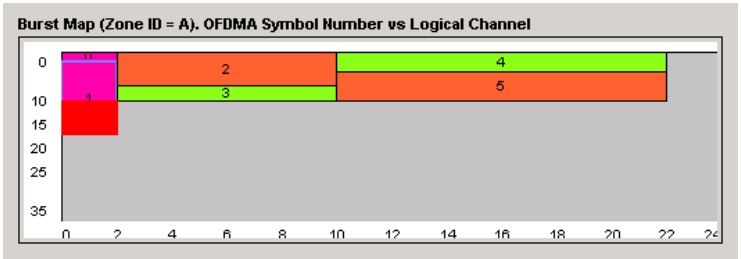
Displays a graphical view of the selected "Zone/Segment List".

- Burst Map

Displays a graphical view of the selected "Burst List". The background color of each burst in the diagram match the modulation format of the burst. Any burst that is incorrectly configured is displayed with a red background. The measurement does only start if the frame definition is correct.

Example:

The "Burst Map" with burst 1 exceeds the available amount of logical subchannels. The area causing the problem is highlighted red.



The configuration is corrected by doing one of the following:

- Reducing the number of subchannels for burst 1 in the "Burst List".
- Assigning more subchannels to the zone/segment to which burst 1 belongs.

- Increasing NFFT.

SCPI command:
CONFigure:WIMax:ZONE<1…26>[:ANALyze]:STATe on page 171 and following

Copy Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Configuration tab
Copies the selected zone or burst to the clipboard.

Insert Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Configuration tab
Pastes the zone or burst below the focused zone or burst.

New Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Configuration tab
Inserts a new zone or burst below the focused zone or burst.

SCPI command:
CONFigure:WIMax:ZONE<1…26>:CONTrol[:DATA] on page 177
CONFigure:WIMax:ZONE<1…26>:BURSt<1…32>:CONTrol[:DATA] on page 171

New Segment (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Configuration tab
Inserts a new segment below the focused zone/segment. This softkey is only available, if the focus is on the "Zone/Segment List".

Delete Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Configuration tab
Deletes the focused zone or burst.

SCPI command:
CONFigure:WIMax:ZONE<1…26>:DELete on page 178
CONFigure:WIMax:ZONE<1…26>:BURSt<1…32>:DELete on page 173

4.2.4 Softkeys of the Sweep Menu – SWEEP Key (R&S FSV-K93)

The following table shows all softkeys available in the "Sweep" menu in "WiMAX" mode (SWEEP key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Run Single/Cont
Selects the sweep mode.

"Single" single sweep mode

"Cont" continuous sweep mode

SCPI command:
INITiate<n>:CONTinuous on page 195

Auto Level
Starts an automatic level detection measurement. After the automatic level detection has been completed, the trace is displayed in the Magnitude Capture Buffer display.

If this softkey is pressed while a measurement is running, the current measurement is aborted and the automatic level detection measurement is started. If the aborted measurement was a continuous measurement, it is resumed after the automatic level detection is completed.

SCPI command:
`CONFigure:POWer:AUTO` on page 162

Refresh
Updates the current measurement results with respect to the current gate settings. This softkey is only available if the measurement results are effected by the gate settings (Spectrum FFT, CCDF, Spectrum Mask, Spectrum ACPR) and if the gate settings are modified after a measurement result has been obtained.

SCPI command:
`INITiate:REFResh` on page 196

4.2.5 Softkeys of the Marker Menu – MKR Key (R&S FSV-K93)

The following table shows all softkeys available in the "Marker" menu in "WLAN" mode (MKR key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description. Close all settings dialog boxes before opening the "Marker" menu.

Marker 1
Opens a dialog box to adjust the marker. The contents of the dialog box depend on the type of graph the marker is adjusted to. After every change, the marker position in the trace and the marker information are updated.

SCPI command:
`CALCulate<n>:MARKer<m>[:STATe]` on page 140
`CALCulate<n>:MARKer<1>:X` on page 144
`CALCulate<n>:MARKer<1>:Y` on page 144
`CALCulate<n>:MARKer<1>:SYMBol` on page 142
`CALCulate<n>:MARKer<1>:CARRier` on page 142

Frame Start Marker
Opens an edit dialog box to define the subframe to which the frame start marker is set. The "Time to Capture Buffer" and "Subframe Length" measurements are based on this frame.

SCPI command:
`CALCulate<n>:MARKer<m>:FUNCtion:TTCapture:FRAMe` on page 146

Ref. Power (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Start Marker
The frame length is calculated for the smoothed trace of the selected subframe where it crosses the threshold:

Ref. Power + Ref. Pwr. Offset

In case of a successful demodulation, the RMS Subframe or Peak Subframe power is derived from the corresponding result summary power. Alternatively, you can specify your own reference power.

SCPI command:
CALCulate<n>:MARKer<m>:FUNCtion:TTCapture:RPTYpe on page 148
CALCulate<n>:MARKer<m>:FUNCtion:TTCapture:RPOWer on page 148

Ref. Pwr. Offset (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Start Marker
The frame length is calculated for the smoothed trace of the selected subframe where it crosses the threshold:

Ref. Power + Ref. Pwr. Offset

"Percentage S/N" uses the specified percentage of the signal to noise ratio S/N, in dB, as reference power offset
Note the S/N is identical to the EVM measurement result and therefore negative or positive.

"User" user-defined reference power offset in dB
In case the reference power offset is positive, the offset is added to the reference power. In case the reference power offset is negative, the offset is subtracted from the reference power.

SCPI command:
CALCulate<n>:MARKer<m>:FUNCtion:TTCapture:RPOType on page 147
CALCulate<n>:MARKer<m>:FUNCtion:TTCapture:RPOFfset on page 147

Averaging (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Start Marker
The frame length is calculated for the smoothed trace of the selected subframe where it crosses the threshold:

Ref. Power + Ref. Pwr. Offset

The odd averaging value defines the number of samples to average, from the orginal trace, in order to calculate the smoothed trace.

SCPI command:
CALCulate<n>:MARKer<m>:FUNCtion:TTCapture:AVERaging on page 146

Unzoom
Cancels the marker zoom.

SCPI command:
CALCulate<n>:MARKer<m>:FUNCtion:ZOOM on page 150

Marker Zoom
Opens an edit dialog box to select the magnification factor for the zoom. The maximum magnification depends on the type of result display.

This function is only available for Magnitude Capture Buffer, PVT, Constellation vs Symbol, Constellation vs Carrier.

SCPI command:
CALCulate<n>:MARKer<m>:FUNCtion:ZOOM on page 150

Marker Off
Switches off all makers in the active result display.

SCPI command:
`CALCulate<n>:MARKer<m>:AOFF` on page 141

4.2.6 Softkeys of the Marker to Menu – MKR-> Key (R&S FSV-K93)

The following table shows all softkeys available in the "Marker To" menu in "WiMAX" mode (MKR-> key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

MKR -> Trace
Opens an edit dialog box to enter the number of the trace, on which the marker is to be placed. This softkey is available for all result displays with more than one trace.

SCPI command:
`CALCulate<n>:MARKer<m>:TRACe` on page 143

4.2.7 Softkeys of the Lines Menu – LINES Key (R&S FSV-K93)

The following table shows all softkeys available in the "Lines" menu in "WiMAX" mode (LINES key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

This menu is only available if the result summary lists are displayed (see chapter 4.2.2.3, "Result Summary List", on page 40 and Display Graph/List softkey).

Command
"Default Current" on page 108
"Default All" on page 108

Default Current
Resets all limits for the current modulation scheme to the values specified in the selected standard.

SCPI command:
chapter 4.3.6, "CALCulate:LIMit Subsystem (WiMAX/WiBro, K93)", on page 122

Default All
Resets all limits for all modulation schemes to the values specified in the selected standard.

SCPI command:
chapter 4.3.6, "CALCulate:LIMit Subsystem (WiMAX/WiBro, K93)", on page 122

4.2.8 Softkeys of the Trace Menu – TRAC Key (R&S FSV-K93)

The following table shows all softkeys available in the "Trace" menu in "WiMAX" mode (TRACE key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Display Graph/List
Configures the result display. The measurement results are displayed either in form of a list of measurement points or as a graphical trace.

For details on the result displays refer to chapter 4.2.2.3, "Result Summary List", on page 40 and chapter 4.2.2.4, "Result Display Graph", on page 43.

SCPI command:
`DISPlay[:WINDow<n>]:TABLe` on page 181

Screen Focus A/B
Selects the active screen for IQ measurement results in split and full screen mode. Only the markers of an active screen can be controlled.

SCPI command:
`DISPlay[:WINDow<n>]:SELect` on page 181

Screen Size Full/Split
Changes the display between split and full screen for IQ measurement results. Frequency sweep measurement results are always displayed in full screen.

SCPI command:
`DISPlay:FORMat` on page 181

4.2.9 Softkeys of the Input/Output Menu for WiMAX Measurements

The following chapter describes all softkeys available in the "Input/Output" menu for WiMAX measurements.

Note that the digital baseband functions are only available if the optional Digital Baseband Interface (R&S FSV-B17) is installed.

For details see the base unit description.

EXIQ
Opens a configuration dialog box for an optionally connected R&S EX-IQ-BOX and a submenu to access the main settings quickly.

If the optional R&S DigIConf software is installed, the submenu consists only of one key to access the software. **Note that R&S DigIConf requires a USB connection (not LAN!) from the analyzer to the R&S EX-IQ-BOX in addition to the Digital Baseband Interface connection. R&S DigIConf version 2.10 or higher is required.**

For typical applications of the R&S EX-IQ-BOX see also the description of the Digital Baseband Interface (R&S FSV-B17) in the base unit manual.

For details on configuration see the "R&S®Ex I/Q Box - External Signal Interface Module Manual".

For details on installation and operation of the R&S DigIConf software, see the "R&S®EX-IQ-BOX Digital Interface Module R&S®DigIConf Software Operating Manual".

TX Settings ← EXIQ
Opens the "EX-IQ-BOX Settings" dialog box to configure the analyzer for digital output to a connected device ("Transmitter" Type).

RX Settings ← EXIQ
Opens the "EX-IQ-BOX Settings" dialog box to configure the analyzer for digital input from a connected device ("Receiver" Type).

Send To ← EXIQ
The configuration settings defined in the dialog box are transferred to the R&S EX-IQ-BOX.

Firmware Update ← EXIQ
If a firmware update for the R&S EX-IQ-BOX is delivered with the analyzer firmware, this function is available. In this case, when you select the softkey, the firmware update is performed.

R&S Support ← EXIQ
Stores useful information for troubleshooting in case of errors.

This data is stored in the `C:\R_S\Instr\user\Support` directory on the instrument.

If you contact the Rohde&Schwarz support to get help for a certain problem, send these files to the support in order to identify and solve the problem faster.

DigIConf ← EXIQ
Starts the optional R&S DigIConf application. This softkey is only available if the optional software is installed.

To return to the analyzer application, press any key on the front panel. The application is displayed with the "EXIQ" menu, regardless of which key was pressed.

For details on the R&S DigIConf application, see the "R&S®EX-IQ-BOX Digital Interface Module R&S®DigIConf Software Operating Manual".

Note: If you close the R&S DigIConf window using the "Close" icon, the window is minimized, not closed.

If you select the "File > Exit" menu item in the R&S DigIConf window, the application is closed. Note that in this case the settings are lost and the EX-IQ-BOX functionality is no longer available until you restart the application using the "DigIConf" softkey in the analyzer once again.

SCPI command:
Remote commands for the R&S DigIConf software always begin with `SOURce:EBOX`. Such commands are passed on from the analyzer to the R&S DigIConf automatically which then configures the R&S EX-IQ-BOX via the USB connection.
All remote commands available for configuration via the R&S DigIConf software are described in the "R&S®EX-IQ-BOX Digital Interface Module R&S®DigIConf Software Operating Manual".
Example 1:
```
SOURce:EBOX:*RST
SOURce:EBOX:*IDN?
```
Result:
"Rohde&Schwarz,DigIConf,02.05.436 Build 47"
Example 2:
```
SOURce:EBOX:USER:CLOCk:REFerence:FREQuency 5MHZ
```
Defines the frequency value of the reference clock.

4.3 Remote Commands of the WiMAX/WiBro Measurements (R&S FSV-K93)

This section describes the remote commands specific to the WiMAX IEEE 802.16 OFDM, OFDMA Measurements option (R&S FSV-K93). This option includes the functionality of the WiMAX 802.16 OFDM Measurements option (R&S FSV-K93). Accordingly both options are described together in this section, differentiated by the corresponding standards:

- WiMAX 802.16 OFDM Measurements (R&S FSV-K93)
  - IEEE 802.16-2004/Cor 1-2005 OFDM physical layer mode
    The corresponding remote control mode is OFDM. In chapter "Instrument Functions", the short forms IEEE 802.16-2004 OFDM is used to reference this standard.
- WiMAX IEEE 802.16 OFDM, OFDMA Measurements option (R&S FSV-K93)
  - IEEE 802.16-2004/Cor 1-2005, IEEE 802.16e-2005 OFDMA physical layer mode
    The corresponding remote control mode is OFDMA. In chapter "Instrument Functions", the short form IEEE 802.16e-2005 OFDMA is used to reference this standard.
  - IEEE 802.16-2004/Cor 1-2005, IEEE 802.16e-2005 based WiBro
    The corresponding remote control mode is WiBro. In chapter "Instrument Functions", the short form IEEE 802.16e-2005 WiBro is used to reference this standard.

For details on conventions used in this chapter refer to chapter 4.3.1, "Notation", on page 113.

For further information on analyzer or basic settings commands, refer to the corresponding subsystem in the base unit description.

Subsystems of the WiMAX, WiBro Measurements options (K93)

4.3.1 Notation

In the following sections, all commands implemented in the instrument are first listed and then described in detail, arranged according to the command subsystems. The notation is adapted to the SCPI standard. The SCPI conformity information is included in the individual description of the commands.

Individual Description

The individual description contains the complete notation of the command. An example for each command, the *RST value and the SCPI information are included as well.

The options and operating modes for which a command can be used are indicated by the following abbreviations:

Abbreviation	Description
A	signal analysis
A-F	signal analysis – span > 0 only (frequency mode)
A-T	signal analysis – zero span only (time mode)
ADEMOD	analog demodulation (option R&S FSV-K7)
BT	Bluetooth (option R&S FSV-K8)
CDMA	CDMA 2000 base station measurements (option R&S FSV-K82)
EVDO	1xEV-DO base station analysis (option R&S FSV-K84)
GSM	GSM/Edge measurements (option R&S FSV-K10)
IQ	IQ Analyzer mode
OFDM	WiMAX IEEE 802.16 OFDM measurements (option R&S FSV-K93)
OFDMA/WiBro	WiMAX IEEE 802.16e OFDMA/WiBro measurements (option R&S FSV-K93)
NF	Noise Figure measurements (R&S FSV-K30)

PHN	Phase Noise measurements (R&S FSV-K40)
PSM	Power Sensor measurements (option R&S FSV-K9)
SFM	Stereo FM measurements (optionR&S FSV-K7S)
SPECM	Spectogram mode (option R&S FSV-K14)
TDS	TD-SCDMA base station / UE measurements (option R&S FSV-K76/K77)
VSA	Vector Signal Analysis (option R&S FSV-K70)
WCDMA	3GPP Base Station measurements (option R&S FSV-K72), 3GPP UE measurements (option R&S FSV-K73)
WLAN	WLAN TX measurements (option R&S FSV-K91)

The signal analysis (spectrum) mode is implemented in the basic unit. For the other modes, the corresponding options are required.

Upper/Lower Case Notation

Upper/lower case letters are used to mark the long or short form of the key words of a command in the description (see chapter 5 "Remote Control – Basics"). The instrument itself does not distinguish between upper and lower case letters.

Special Characters

|	A selection of key words with an identical effect exists for several commands. These keywords are indicated in the same line; they are separated by a vertical stroke. Only one of these keywords needs to be included in the header of the command. The effect of the command is independent of which of the keywords is used.

Example:

```
SENSe:FREQuency:CW|:FIXed
```

The two following commands with identical meaning can be created. They set the frequency of the fixed frequency signal to 1 kHz:

```
SENSe:FREQuency:CW 1E3
```

```
SENSe:FREQuency:FIXed 1E3
```

A vertical stroke in parameter indications marks alternative possibilities in the sense of "or". The effect of the command differs, depending on which parameter is used.

Example: Selection of the parameters for the command

```
[SENSe<1…4>:]AVERage<1…4>:TYPE VIDeo | LINear
```

[]	Key words in square brackets can be omitted when composing the header. The full command length must be accepted by the instrument for reasons of compatibility with the SCPI standards. Parameters in square brackets can be incorporated optionally in the command or omitted as well.

{}	Parameters in braces can be incorporated optionally in the command, either not at all, once or several times.

Description of Parameters

Due to the standardization, the parameter section of SCPI commands consists always of the same syntactical elements. SCPI has therefore specified a series of definitions, which are used in the tables of commands. In the tables, these established definitions are indicated in angled brackets (<…>) and is briefly explained in the following (see also chapter 5 "Remote Control – Basics", section "Parameters").

<Boolean>

This keyword refers to parameters which can adopt two states, "on" and "off". The "off" state may either be indicated by the keyword OFF or by the numeric value 0, the "on" state is indicated by ON or any numeric value other than zero. Parameter queries are always returned the numeric value 0 or 1.

<numeric_value> <num>

These keywords mark parameters which may be entered as numeric values or be set using specific keywords (character data). The following keywords given below are permitted:

- MAXimum: This keyword sets the parameter to the largest possible value.
- MINimum: This keyword sets the parameter to the smallest possible value.
- DEFault: This keyword is used to reset the parameter to its default value.
- UP: This keyword increments the parameter value.
- DOWN: This keyword decrements the parameter value.

The numeric values associated to MAXimum/MINimum/DEFault can be queried by adding the corresponding keywords to the command. They must be entered following the quotation mark.

Example:

SENSe:FREQuency:CENTer? MAXimum

Returns the maximum possible numeric value of the center frequency as result.

<arbitrary block program data>

This keyword is provided for commands the parameters of which consist of a binary data block.

4.3.2 Common Commands

Common commands are described in the IEEE 488.2 (IEC 625-2) standard. These commands have the same effect and are employed in the same way on different devices. The headers of these commands consist of "*" followed by three letters. Many common commands are related to the Status Reporting System.

Available common commands:

***CAL**

Calibration Query

Initiates a calibration of the instrument and subsequently queries the calibration status. Responses > 0 indicate errors.

***CLS**

CLear Status

Sets the status byte (STB), the standard event register (ESR) and the `EVENt` part of the `QUEStionable` and the `OPERation` registers to zero. The command does not alter the mask and transition parts of the registers. It clears the output buffer.

Usage: Setting only

***ESE** <Value>

Event Status Enable

Sets the event status enable register to the specified value. The query returns the contents of the event status enable register in decimal form.

Parameters:
<Value>
Range: 0 to 255

***ESR?**

Event Status Read

Returns the contents of the event status register in decimal form and subsequently sets the register to zero.

Return values:
<Contents>
Range: 0 to 255
Usage: Query only

***IDN?** <Format>

IDeNtification: returns the instrument identification.

Query parameters:
<Format> LEGacy | NEW

LEGacy
"Rohde&Schwarz,<device type>,**<serial number>/<model>**,<firmware version>"

NEW
"Rohde&Schwarz,<device type>,**<part number>/<serial number>**,<firmware version>"

Example: LEGacy format:
`Rohde&Schwarz,R&S FSV-7,101768/007,1.05`
NEW format:
`Rohde&Schwarz,R&S FSV-7,1307.9002K07/101768,1.05`

Usage: Query only

***IST?**

Individual STatus query

Returns the contents of the IST flag in decimal form. The IST flag is the status bit which is sent during a parallel poll.

Return values:
<ISTflag> 0 | 1

Usage: Query only

***OPC**

OPeration Complete

Sets bit 0 in the event status register when all preceding commands have been executed. This bit can be used to initiate a service request. The query form writes a "1" into the output buffer as soon as all preceding commands have been executed. This is used for command synchronization.

***OPT?**

OPTion identification query

Queries the options included in the instrument. For a list of all available options and their description refer to the CD-ROM.

Return values:

<Options> The query returns a list of all installed options, separated by commas, where:
B<number> describes hardware options
K<number> describes software options

Example: B4,B5,B6,B7,B8,B10,B22,B30,B31,K7,K9

Usage: Query only

***PCB** <Address>

Pass Control Back

Indicates the controller address to which remote control is returned after termination of the triggered action.

Setting parameters:

<Address>

Range: 0 to 30

Usage: Setting only

***PRE** <Value>

Parallel poll Register Enable

Sets parallel poll enable register to the indicated value. The query returns the contents of the parallel poll enable register in decimal form.

Parameters:

<Value>

Range: 0 to 255

***PSC** <Action>

Power on Status Clear

Determines whether the contents of the `ENABle` registers are preserved or reset when the instrument is switched on. Thus a service request can be triggered when the instrument is switched on, if the status registers ESE and SRE are suitably configured. The query reads out the contents of the "power-on-status-clear" flag.

Parameters:

<Action> 0 | 1

0
The contents of the status registers are preserved.

1
Resets the status registers.

***RST**

ReSeT

Sets the instrument to a defined default status. It is equivalent to `SYSTem:PRESet`. The default settings are indicated in the description of commands.

See "Initializing the Configuration - PRESET Key".

Usage: Setting only

***SRE** <Contents>

Service Request Enable

Sets the service request enable register to the indicated value. This command determines under which conditions a service request is triggered.

Parameters:

<Contents> Contents of the service request enable register in decimal form. Bit 6 (MSS mask bit) is always 0.

Range: 0 to 255

***STB?**

STatus Byte query

Reads the contents of the status byte in decimal form.

Usage: Query only

***TRG**

TRiGger

Triggers all actions waiting for a trigger event. In particular, *TRG generates a manual trigger signal (Manual Trigger). This common command complements the commands of the `TRIGger` subsystem.

`*TRG` corresponds to the `INITiate:IMMediate` command. For details, see the "Remote Control - Description of Analyzer Commands", "TRIGger Subsystem".

Usage: Event

***TST?**

self TeST query

Triggers selftests of the instrument and returns an error code in decimal form (see Service Manual supplied with the instrument). "0" indicates no errors occured.

Usage: Query only

***WAI**

WAIt to continue

Prevents servicing of the subsequent commands until all preceding commands have been executed and all signals have settled (see also command synchronization and *OPC).

Usage: Event

4.3.3 ASCII Formats for Returned Values

The results are output as a list of result strings separated by commas.

OFDM results

<min EVM all bursts>,<average EVM all bursts>,<max EVM all bursts>

<min EVM data carriers>,<average EVM data carriers>,<max EVM data carriers>

<min EVM pilots>,<average EVM pilots>,<max EVM pilots>

<min IQ offset>,<average IQ offset>,<maximum IQ offset>

<min gain imbalance>,<average gain imbalance>,<max gain imbalance>

<min quadrature offset>,<average quadrature offset>,<max quadrature offset>

<min frequency error>,<average frequency error>,<max frequency error>

<min symbol error>,<average symbol error>,<max symbol error>

<min burst power>,<average burst power>,<max burst power>

<min crest factor>,<average crest factor>,<max crest factor>

<min SS timing>,<average SS timing>,<max SS timing>

<min RSSI>,<average RSSI>,<max RSSI>

<min RSSI Standard Deviation>,<average RSSI Standard Deviation>,<max RSSI Standard Deviation>

<min CINR>,<average CINR>,<max CINR>

<min CINR Standard Deviation>,<average CINR Standard Deviation>,<max CINR Standard Deviation>

OFMDA Uplink results

<min BER pilots>,<average BER pilots>,<max BER pilots>

<min EVM all bursts>,<average EVM all bursts>,<max EVM all bursts>

<min EVM data carriers>,<average EVM data carriers>,<max EVM data carriers>

<min EVM pilots>,<average EVM pilots>,<max EVM pilots>

<min IQ offset>,<average IQ offset>,<maximum IQ offset>

<min gain imbalance>,<average gain imbalance>,<max gain imbalance>

<min quadrature offset>,<average quadrature offset>,<max quadrature offset>

<min frequency error>,<average frequency error>,<max frequency error>

<min symbol error>,<average symbol error>,<max symbol error>

<min power all>,<average power all>,<max power all>

<min power data>,<average power data>,<max power data>

<min power pilots>,<average power pilots>,<max power pilots>

<min crest factor>,<average crest factor>,<max crest factor>

OFDMA Downlink results

<min BER pilots>,<average BER pilots>,<max BER pilots>

<min EVM all bursts>,<average EVM all bursts>,<max EVM all bursts>

<min EVM data carriers>,<average EVM data carriers>,<max EVM data carriers>

<min EVM pilots>,<average EVM pilots>,<max EVM pilots>

<min IQ offset>,<average IQ offset>,<maximum IQ offset>

<min gain imbalance>,<average gain imbalance>,<max gain imbalance>

<min quadrature offset>,<average quadrature offset>,<max quadrature offset>

<min frequency error>,<average frequency error>,<max frequency error>

<min symbol error>,<average symbol error>,<max symbol error>

<min power DL preamble>,<average power DL preamble>,<max power DL preamble>

<min power all>,<average power all>,<max power all>

<min power data>,<average power data>,<max power data>

<min power pilots>,<average power pilots>,<max power pilots>

<min crest factor>,<average crest factor>,<max crest factor>

<min RSSI>,<average RSSI>,<max RSSI>,<RSSI Standard Deviation>

<min CINR>,<average CINR>,<max CINR>,<CINR Standard Deviation>

4.3.4 ABORt subsystem

ABORt

This command aborts a current measurement and resets the trigger system.

Example: `ABOR;INIT:IMM`

Mode: all

4.3.5 CALCulate:BURSt Subsystem (WiMAX/WiBro, K93)

The `CALCulate:BURSt` subsystem checks the IQ measurement results.

Commands of the CALCulate:BURSt Subsystem

CALCulate<n>:BURSt[:IMMediate]

This command forces the IQ measurement results to be recalculated according to the current settings.

Suffix:

<n> 1...4
window

Example: `CALC1:BURS`
Starts the recalculation of the IQ measurement results.

Usage: Event

Mode: OFDM, OFDMA/WiBro

4.3.6 CALCulate:LIMit Subsystem (WiMAX/WiBro, K93)

The CALCulate:LIMit subsystem contains commands for the limit lines and the corresponding limit checks.

Commands of the CALCulate:LIMit Subsystem

CALCulate<n>:LIMit<m>:FAIL?

This command queries the limit check result of the limit line indicated in the selected measurement window. To obtain a valid result, a complete sweep must be performed. A synchronization with `*OPC, *OPC?` or `*WAI` is therefore recommended.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Return values:

<Result> 0 | 1

0
PASSED

1
FAILED

Example: `INIT;*WAI`
Starts a new sweep and waits for its end.
`CALC2:LIM1:FAIL?`
Queries the result of the check for limit line 1 in screen B.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

Table 4-1: Limit line suffix

Suffix	Limit
1 to 2	These indexes are not used
3	ETSI Spectrum Mask limit line
4	IEEE Spectrum Mask limit line
5	Spectrum Flatness (Upper) limit line
6	Spectrum Flatness (Lower) limit line
7	Spectrum Flatness Difference (Upper) limit line
8	Spectrum Flatness Difference (Lower) limit line

CALCulate<n>:LIMit<m>:BURSt:ALL

This command sets or returns all the limit values.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Return values:

<Result> The results are input or output as a list of values separated by commas in the (ASCII) format described in table 4-2.

Example: `CALC:LIM:BURS:ALL?`
All limit values are returned.

Mode: OFDM, OFDMA/WiBro

Table 4-2: ASCII format for burst results

Result input/output in ASCII format	Description
<average EVM all bursts>, <max EVM all bursts>	dB or % depending on selected units ("UNIT:TABLe")
<average EVM data carriers >, <max EVM data carriers >	dB or % depending on selected units ("UNIT:TABLe")
<average Frequency Error>, <max Frequency Error>	Down Link Mode: Hz; .Up Link Mode: %
<average Symbol Error>, <max Symbol Error>	Down Link Mode: ppm; Up Link Mode: %

Result input/output in ASCII format	Description
<average SS Timing>, <maximum SS Timing >	only returned in Up Link mode
<average IQ Offset>, <max IQ Offset>	dB or % depending on selected units ("UNIT:TABLe")

CALCulate<n>:LIMit<m>:BURSt:ALL:RESult?

This command returns all the limit results.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Return values:

<Return values> 0 | 1

0
PASSED

1
FAILED

The results are output as a list of result strings separated by commas. For the output order see `CALCulate<n>:LIMit<m>:BURSt:ALL` on page 124 command.

Example: `CALC:LIM:BURS:ALL:RES?`
All limit values are returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:BERPilot[:AVERage] <BitErrorRate>

This command sets the average bit error rate for pilot carriers limit.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Parameters:
<BitErrorRate>
Range: -1000000 to 1000000
Default unit: %

Example: `CALC:LIM:BURS:BERP -25.0`
Average bit error rate for pilot carriers limit is set to -25.0 dB.

Mode: OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:BERPilot[:AVERage]:RESult?

This command returns the bit error rate for pilot carriers limit result.

Suffix:
<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Return values:
<Result> 0 | 1

0
PASSED

1
FAILED

Example: `CALC:LIM:BURS:BERP:RES?`
Average EVM for all carrier limit result is returned.

Usage: Query only

Mode: OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:BERPilot:MAXimum <BitErrorRate>

This command sets the maximum bit error rate limit.

Suffix:
<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Parameters:
<BitErrorRate>
Range: -1000000 to 1000000
Default unit: %

Example: CALC:LIM:BURS:EVM:ALL:MAX?
Maximum EVM for all carrier limit is returned.

Mode: OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:BERPilot:MAXimum:RESult?

This command returns the maximum error vector magnitude limit result. This is a combined figure that represents the pilot, data and the free carrier.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Return values:

<Result> 0 | 1

0
PASSED

1
FAILED

Example: CALC:LIM:BURS:EVM:ALL:MAX:RES?
Maximum EVM for all carrier limit result is returned.

Usage: Query only

Mode: OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:EVM:ALL[:AVERage] <Limit>

This command sets the average error vector magnitude limit. This is a combined figure that represents the pilot, data and the free carrier.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Parameters:

<Limit>

Range: -1000000 to 1000000
Default unit: dB or %
If no unit is specified the unit specified by the UNIT:TABLe on page 233 command is used.

Example: CALC:LIM:BURS:EVM:ALL -25.0
Average EVM for all carrier limit is set to -25.0 dB.

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:EVM:ALL[:AVERage]:RESult?

This command returns the average error vector magnitude limit result. This is a combined figure that represents the pilot, data and the free carrier.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Return values:

<Result> 0 | 1

0
PASSED

1
FAILED

Example: CALC:LIM:BURS:EVM:ALL:RES?
Average EVM for all carrier limit result is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:EVM:ALL:MAXimum <Limit>

This command sets the maximum error vector magnitude limit. This is a combined figure that represents the pilot, data and the free carrier.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Parameters:

<Limit>

Range: -1000000 to 1000000
Default unit: dB or %
If no unit is specified the unit specified by the UNIT:TABLe on page 233 command is used.

Example: CALC:LIM:BURS:EVM:ALL:MAX?
Maximum EVM for all carrier limit is returned.

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:EVM:ALL:MAXimum:RESult?

This command returns the maximum error vector magnitude limit result. This is a combined figure that represents the pilot, data and the free carrier.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Return values:

<Result> 0 | 1

0
PASSED

1
FAILED

Example: CALC:LIM:BURS:EVM:ALL:MAX:RES?
Maximum EVM for all carrier limit result is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:EVM:DATA[:AVERage] <Limit>

This command sets the average error vector magnitude limit for the data carrier.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Parameters:

<Limit>

Range: -1000000 to 1000000 dB
Default unit: %
If no unit is specified the unit specified by the UNIT:TABLe on page 233 command is used.

Example: CALC:LIM:BURS:EVM:DATA -30.0
Average EVM for data carrier limit is set to -30.0 dB.

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:EVM:DATA[:AVERage]:RESult?

This command returns the average Error Vector Magnitude limit result summary for the data carrier in dB.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Return values:

<Return values> 0 | 1

0
PASSED

1
FAILED

Example: `CALC:LIM:BURS:EVM:DATA:RES?`
Average EVM for data carrier limit result is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:EVM:DATA:MAXimum <Limit>

This command sets the maximum error vector magnitude limit for the data carrier.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Parameters:

<Limit>

Range: -1000000 to 1000000 dB
Default unit: %
If no unit is specified the unit specified by the `UNIT:TABLe` on page 233 command is used.

Example: `CALC:LIM:BURS:EVM:DATA:MAX?`
Maximum EVM for data burst limit is returned.

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:EVM:DATA:MAXimum:RESult?

This command returns the maximum Error Vector Magnitude limit result summary for the data carrier in dB.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Return values:

<Result> 0 | 1

0
PASSED

1
FAILED

Example: `CALC:LIM:BURS:EVM:DATA:MAX:RES?`
Maximum EVM for data carrier limit result is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:FERRor[:AVERage] <Limit>

This command sets the average frequency error limit.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Parameters:

<Limit>

Range: -1000000 to 1000000
Default unit: Hz or %
If no unit is specified the unit depends on the current Up/Down Link Mode: Hz in Down Link mode, % in Up Link mode.

There is no relationship between the Down Link and Up Link values. Setting a Down Link value in Up Link mode does not change the displayed limit value.

Example: `CALC:LIM:BURS:FERR 10000`
The average frequency error limit is set to 10000 Hz.

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:FERRor[:AVERage]:RESult?

This command returns the average frequency error limit result.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Return values:

<Return values> 0 | 1

0
PASSED

1
FAILED

Example: `CALC:LIM:BURS:FERR:RES?`
Average frequency error limit result is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:FERRor:MAXimum <Limit>

This command sets the maximum frequency error limit.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Parameters:

<Limit>

Range: -1000000 to 1000000
Default unit: Hz or %
If no unit is specified the unit depends on the current Up/Down Link Mode: Hz in Down Link mode, % in Up Link mode.

There is no relationship between the Down Link and Up Link values. Setting a Down Link value in Up Link mode does not change the displayed limit value.

Example: CALC:LIM:BURS:FERR:MAX?
Maximum frequency error limit is returned.

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:FERRor:MAXimum:RESult?

This command returns the maximum frequency error limit result.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Return values:

<Return values> 0 | 1

0
PASSED

1
FAILED

Example: CALC:LIM:BURS:FERR:MAX:RES?
Maximum frequency error limit result is returned

Usage: Query only

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:IQOFfset[:AVERage] <Limit>

This command sets the average IQ offset error limit.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Parameters:

<Limit>

Range: -1000000 to 1000000
Default unit: dB or %
If no unit is specified the unit specified by the UNIT:TABLe on page 233 command is used.

Example: CALC:LIM:BURS:IQOF -10.0
Average IQ offset error limit is set to -10.0 dB.

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:IQOFfset[:AVERage]:RESult?

This command returns the average IQ offset error limit result.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Return values:

<Return values> 0 | 1

0
PASSED

1
FAILED

Example: `CALC:LIM:BURS:IQOF:RES?`
Average IQ offset error limit result is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:IQOFfset:MAXimum <Limit>

This command sets the maximum IQ offset error limit.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Parameters:

<Limit>

Range: -1000000 to 1000000
Default unit: dB or %
If no unit is specified the unit specified by the `UNIT:TABLe` on page 233 command is used.

Example: `CALC:LIM:BURS:IQOF:MAX 15.0DB`
Maximum IQ offset error limit is set to 15.0 dB.

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:IQOFfset:MAXimum:RESult?

This command returns the maximum IQ offset error limit result.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Return values:

<Return values> 0 | 1

0
PASSED

1
FAILED

Example: `CALC:LIM:BURS:IQOF:MAX:RES?`
Maximum IQ offset error limit result is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:SSTiming[:AVERage] <Limit>

This command is only supported for reasons of compatibility with the FSP family. It sets the average Subscriber Station Timing limit.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Parameters:

<Limit> 0PCT

Example: `CALC:LIM:BURS:SST 0`
The average SS Timing limit is set to 0 %.

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:SSTiming[:AVERage]:RESult?

This command returns the average Subscriber Station Timing limit result.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Return values:

<Return values> 0 | 1

0
PASSED

1
FAILED

Example: `CALC:LIM:BURS:SST:RES?`
Average SS Timing limit result is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:SSTiming:MAXimum <Limit>

This command is only supported for reasons of compatibility with the FSP family. It sets the maximum Subscriber Station Timing limit.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Parameters:

<Limit> 0PCT

Example: `CALC:LIM:BURS:SST:MAX?`
Maximum SS Timing limit is returned.

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:SSTiming:MAXimum:RESult?

This command returns the maximum Subscriber Station Timing limit.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Return values:

<Return values> 0 | 1

0
PASSED

1
FAILED

Example: `CALC:LIM:BURS:SST:MAX:RES?`
Maximum SS Timing limit result is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:SYMBolerror[:AVERage] <Limit>

This command sets the average symbol error limit.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Parameters:

<Limit> <numeric_value>

Range: -1000000 to 1000000
Default unit: ppm or %
If no unit is specified the unit depends on the current Up/Down Link Mode: ppm in Down Link mode, % in Up Link mode.

There is no relationship between the Down Link and Up Link values. Setting a Down Link value in Up Link mode does not change the displayed limit value.

Example: `CALC:LIM:BURS:SYMB 10000`
The average symbol error limit is set to 10000 Hz.

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:SYMBolerror[:AVERage]:RESult?

This command returns the average symbol error limit result.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Return values:

<Return values> 0 | 1

0
PASSED

1
FAILED

Example: `CALC:LIM:BURS:SYMB:RES?`
Average symbol error limit result is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:SYMBolerror:MAXimum <Limit>

This command sets the maximum symbol error limit.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Parameters:

<Limit> <numeric_value>

Range: -1000000 to 1000000
Default unit: %
If no unit is specified the unit depends on the current Up/Down Link Mode: ppm in Down Link mode, % in Up Link mode.

There is no relationship between the Down Link and Up Link values. Setting a Down Link value in Up Link mode does not change the displayed limit value.

Example: `CALC:LIM:BURS:SYMB:MAX?`
Maximum symbol error limit is returned.

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:BURSt:SYMBolerror:MAXimum:RESult?

This command returns the maximum symbol error limit result.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Return values:

<Return values> 0 | 1

0
PASSED

1
FAILED

Example: `CALC:LIM:BURS:SYMB:MAX:RES?`
Maximum symbol error limit result is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:SPECtrum:MASK:CHECk:X?

This command returns the x-value at the maximum overstepping of the spectrum mask limits.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Example: `CALC:LIM:SPEC:MASK:CHEC:X?`
Returns the frequency at the maximum overstepping.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:LIMit<m>:SPECtrum:MASK:CHECk:Y?

This command returns the y-value at the maximum overstepping of the spectrum mask limits.

Suffix:

<n> 1...4
window
Note
No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8
Specifies the limit lines according to table 4-1.

Example: `CALC:LIM:SPEC:MASK:CHEC:Y?`
Returns the power at the maximum overstepping.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

4.3.7 CALCulate:MARKer Subsystem (WiMAX / WiBro, K93)

The CALCulate:MARKer subsystem checks the marker functions of the instrument.

The following subsystem is included:

chapter 4.3.7.2, "CALCulate:MARKer:FUNCtion Subsystem (WiMAX / WiBro, K93)", on page 145

Commands of the CALCulate:MARKer Subsystem

4.3.7.1 Commands of the CALCulate:MARKer Subsystem (WiMAX / WiBro, K93)

CALCulate<n>:MARKer<m>[:STATe] <State>

This command activates a marker in the specified window. If no indication is made, marker 1 is selected automatically. If activate, the marker is switched to normal mode.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> depends on mode
marker number; For applications that do not have more than 1 marker, the suffix <m> is irrelevant.

Parameters:

<State> ON | OFF

*RST: OFF

Example: `CALC:MARK3 ON`
Switches on marker 3 or switches to marker mode.

Mode: all

CALCulate<n>:MARKer<m>:AOFF

This command switches off all active markers, delta markers, and marker measurement functions in the specified window.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> depends on mode
irrelevant

Example: `CALC:MARK:AOFF`
Switches off all markers.

Mode: all

CALCulate<n>:MARKer<m>:BURSt <BurstNumber>

This command positions the selected marker in the specified measurement window to the indicated burst. This command is only available for the Constellation vs Symbol result display.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Parameters:

<BurstNumber> 1 to <number of captured bursts in capture buffer>

Example: `CALC2:MARK:BURS 2`
Positions marker 1 in screen B to burst 2.
`CALC2:MARK:BURS?`
Outputs the symbol value of marker 1 in screen B.

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:MARKer<1>:CARRier <Carrier>

This command positions the selected marker to the indicated carrier.

This command is query only for the following result displays:

- Constellation vs Symbol
- Constellation vs Carrier

Suffix:

<n> 1...4
irrelevant

Parameters:

<Carrier> <numeric_value>

Example: `CALC:MARK:CARR -7`
Positions marker 1 to carrier -7.
`CALC:MARK:CARR?`
Outputs the carrier value of marker 1.

Mode: WLAN, OFDM, OFDMA/WiBro

CALCulate<n>:MARKer<1>:MAXimum

This command sets the selected marker to the maximum peak value in the current trace. This command is only available for the Spectrum Flatness result display.

Suffix:

<n> 1...4
window

Example: `CALC2:MARK:MAX`
Set marker 1 in screen B to maximum value in trace.

Mode: WLAN, OFDM, OFDMA/WiBro

CALCulate<n>:MARKer<1>:MINimum

This command sets the selected marker to the minimum peak value in the current trace. This command is only available for the Spectrum Flatnes result display.

Suffix:

<n> 1...4
window

Example: `CALC2:MARK:MIN`
Set marker 1 in screen B to minimum value in trace.

Mode: WLAN, OFDM, OFDMA/WiBro

CALCulate<n>:MARKer<1>:SYMBol <Symbol>

This command positions the selected marker to the indicated symbol.

This command is query only for the following result displays:

- Constellation vs Symbol

- Constellation vs Carrier

Suffix:

<n> 1...4
window

Parameters:

<Symbol> 1 to <number of symbols in selected burst>

Example: `CALC2:MARK:SYMB 2`
Positions marker 1 in screen B to symbol 2.
`CALC2:MARK:SYMB?`
Outputs the symbol value of marker 1 in screen B.

Mode: WLAN, OFDM, OFDMA/WiBro

CALCulate<n>:MARKer<m>:TRACe <TraceNumber>

This command assigns the selected marker to the indicated measurement curve in the selected measurement window.

This command is only available for the following result displays:

- Constellation versus Carrier
- EVM vs Symbol
- EVM vs Carrier
- Frequency Error vs Preamble
- Phase Error vs Preamble
- PVT Rising / Falling
- Spectrum Flatness
- Spectrum Flatness Difference
- Spectrum Mask, if Max Hold trace is displayed
- Spectrum ACP/ACPR, if Max Hold trace is displayed

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Parameters:

<TraceNumber>

Range: 1 to 3
*RST: 1

Example: `"CALC2:MARK:TRAC 2`
Assigns marker 1 in screen B to trace 2.

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:MARKer<1>:X <Position>

This command positions the selected marker to the indicated inphase (Constellation vs Symbol), frequency (Spectrum FFT, Spectrum Mask, Spectrum APCR), time (Magnitude Capture Buffer, Auto level, PVT Full Burst, PVT Rising / Falling), power (CCDF), sub-carrier (Constellation vs Carrier, EVM vs Carrier, Spectrum Flatness) or symbol (EVM vs Symbol) in the selected measurement window.

This command is query only for the following result displays:

- Constellation vs Symbol
- Constellation vs Carrier

Suffix:

<n> 1...4
window

Parameters:

<Position> 1 to <maximum range for selected measurement>

Example: `CALC:MARK:X 2ms`
Positions marker 1 in screen A to time 2ms.

Mode: WLAN, OFDMA/WiBro

CALCulate<n>:MARKer<1>:Y <Position>

This command positions the selected marker to the indicated quadrature (Constellation vs Symbol), magnitude of I or Q (Constellation vs Carrier), EVM (EVM vs Carrier) or abs (Spectrum Flatness) in the selected measurement window.

This command is query only for the following result displays:

- Auto Level
- Constellation vs Symbol
- Constellation vs Carrier
- EVM vs Symbol
- PVT Full
- PVT Rising/Falling
- Magnitude Capture Buffer
- Spectrum Mask
- Spectrum ACP/ACPR
- Spectrum FFT
- CCDF

Suffix:

<n> 1...4
window

Parameters:

<Position> <numeric_value> in percent or dB

Example: `CALC2:MARK:Y -2`
Positions marker 1 in screen B to -2.
`CALC:MARK:Y?`
Outputs the measured value of marker 1.

Mode: WLAN; OFDMA/WiBro

4.3.7.2 CALCulate:MARKer:FUNCtion Subsystem (WiMAX / WiBro, K93)

The measurement window is selected by CALCulate 1 (screen A) or 2 (screen B).

Commands of the CALCulate:MARKer:FUNCtion Subsystem

CALCulate<n>:MARKer<m>:FUNCtion:POWer:RESult[:CURRent]?

This command queries the current result values of the adjacent channel power measurement. An ACPR (Adjacent channel power relative) measurement must have previously been run, for there to be summary data available.

Results are output separated by commas. Adjacent channel power values are output in dB.

The order is as follows:

- Power of main channel
- Power of lower adjacent channel
- Power of upper adjacent channel
- Power of lower alternate adjacent channel 1
- Power of upper alternate adjacent channel 1
- Power of lower alternate adjacent channel 2
- Power of upper alternate adjacent channel 2
- Power of lower alternate adjacent channel 3
- Power of upper alternate adjacent channel 3
- Power of lower alternate adjacent channel 4
- Power of upper alternate adjacent channel 4

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Example: `CALC2:MARK:FUNC:POW:RES?`

Usage: Query only

Mode: OFDMA/WiBro

CALCulate<n>:MARKer<m>:FUNCtion:TTCapture?

This command returns the time to the start of the first frame in the capture buffer.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Example: `CALC:MARK:TTC?`
Returns the time to the start of the first frame in the capture buffer.

Usage: Query only

Mode: OFDMA/WiBro

CALCulate<n>:MARKer<m>:FUNCtion:TTCapture:AVERaging <Factor>

This command sets the smoothing factor of the "subframe length" calculation.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Parameters:

<Factor> Odd number

*RST: 11

Example: `CALC:MARK:FUNC:TTC:AVER 129`

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:MARKer<m>:FUNCtion:TTCapture:FRAMe <Frames>

This command sets or returns the frame upon which the "Time to Capture Buffer Marker" measurement is based. This frame corresponds to the one defined using the "Frame Start Marker" on page 106 softkey.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Parameters:

<Frames> Integer from 1 to the highest number of detected subframes.

*RST: 1

If 0 is returned for a query, no subframes were detected.

Example: `CALC2:MARK:FUNC:TTC:FRAM 2`

Measurement is based on subframe 2.

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:MARKer<m>:FUNCtion:TTCapture:LENGth?

This command returns the result of the "subframe length" calculation.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Example: `CALC:MARK:FUNC:TTC:LENG?`

Usage: Query only

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:MARKer<m>:FUNCtion:TTCapture:RPOFfset <Offset>

This command sets the reference power offset of the "subframe length" calculation.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Parameters:

<Offset>

*RST: 5

Example: `CALC:MARK:FUNC:TTC:RPOF 5`

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:MARKer<m>:FUNCtion:TTCapture:RPOType <OffsetType>

This command sets the type of the reference power offset of the "subframe length" calculation.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Parameters:

<OffsetType>

PSN
The offset is calculated as a percentage of the "EVM Data and Pilots" result.

USER
The offset is user-defined.

*RST: PSN

Example: `CALC:MARK:FUNC:TTC:RPOT USER`

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:MARKer<m>:FUNCtion:TTCapture:RPOWer <Power>

This command sets the reference power of the "subframe length" calculation if the reference power type is "USER" (see `CALCulate<n>:MARKer<m>:FUNCtion:TTCapture:RPTYpe` on page 148).

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Parameters:

<Power> Reference power

*RST: 0

Example: `CALC:MARK:FUNC:TTC:RPOW -20`

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:MARKer<m>:FUNCtion:TTCapture:RPTYpe <PowerType>

This command sets the type of the reference power for the "subframe length" calculation. The following types are available:

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Parameters:

<PowerType>

RMS
The reference power is relative to the RMS power of the subframe.

PEAK
The reference power is relative to the peak power of the subframe.

USER
The reference power is user-defined.

*RST: RMS

Example: `CALC:MARK:FUNC:TTC:RPTY RMS`

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:MARKer<m>:FUNCtion:TTCapture:STARt <Mode>

Defines the mode for the "Time to Capture Buffer Start" measurement.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Parameters:

<Mode> FFT | FRAM

FFT
The "Time to Capture Buffer Start" measurement shows the time between the capture buffer start and the FFT start of the first ofdm symbol from the analyzed subframe. For an ideal channel, the FFT start sample is the sample in the center of the cyclic prefix.

FRAMe
The "Time to Capture Buffer Start" measurement shows the time between the capture buffer start and the first sample of the first ofdm symbol from the analyzed subframe. This is hold for an ideal channel.

*RST: FRAM

Example: `CALC:MARK:FUNC:TTC:STAR FFT`

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:MARKer<m>:FUNCtion:TTCapture[:TIMe]?

This command returns the "Capture buffer to frame start" time for the subframe selected by the `CALCulate<n>:MARKer<m>:FUNCtion:TTCapture:FRAMe` command or the Frame Start Marker softkey.

Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

Example: `CALC2:MARK:FUNC:TTC?`

Usage: Query only

Mode: OFDM, OFDMA/WiBro

CALCulate<n>:MARKer<m>:FUNCtion:POWer:RESult:MAXHold?

This command queries the maximum result values of the adjacent channel power measurement. An ACPR (Adjacent channel power relative) measurement must have previously been run with more than one sweep to provide the summary data.

For details on the output refer to `CALCulate<n>:MARKer<m>:FUNCtion:POWer:RESult[:CURRent]` on page 145.

Suffix:
<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m> marker number
Example: CALC:MARK:FUNC:POW:RES:MAXH?
Usage: Query only
Mode: OFDMA/WiBro

CALCulate<n>:MARKer<m>:FUNCtion:ZOOM <Factor>

This command defines the factor to be zoomed around the marker 1 in the selected measurement window. The default value is 1, where the full trace is shown. This command is available for the following result displays:

- Constellation vs Carrier
- Constellation vs Symbol
- PVT Full Burst
- PVT Rising / Falling
- Magnitude Capture Buffer

Suffix:
<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m> marker number

Parameters:
<Factor>
Range: 1 to 1000000
*RST: 1
Example: CALC:MARK:FUNC:ZOOM 2
Zooms 50 % in screen A.
CALC:MARK:FUNC:ZOOM 4
Zooms 25 % in screen A.
CALC:MARK:FUNC:ZOOM 1
Deactivates zooming in screen A.
Mode: WLAN, OFDMA/WiBro

4.3.8 CONFigure Subsystem (WiMAX / WiBro, K93)

The CONFigure subsystem contains commands for configuring complex measurement tasks. The CONFigure subsystem is closely linked to the functions of the FETCH subsystem, where the measurement results are queried.

CONFigure:ADDRess:SMU <IPAddress>

This remote control command is used to specify the IP address of the SMU to which WiMax settings can be uploaded or downloaded.

Parameters:

<IPAddress> String representing IP address

Example: `CONF:ADDR:SMU '192.168.1.68'`

Mode: OFDMA/WiBro

CONFigure:BURSt:BOOSting <BurstData>

This remote control configures whether the signal is analysed using the burst power specified in the burst map or if the burst power is estimated.

Parameters:

<BurstData> PREDefined|ESTimated

PREDefined
uses the burst power as defined in the burst map

ESTimated
estimates the burst power

*RST: PRED

Example: `CONF:BURS:BOOS EST`
Analysis estimates the burst power.

Mode: OFDMA/WiBro

CONFigure:BURSt:CONSt:BURSt:SELect <Mode>

This command selects bursts and pilots. It is only available if the Constellation vs Symbol measurement is selected (see `CONFigure:BURSt:CONSt:CSYMbol[:IMMediate]` on page 154 command).

Parameters:

<Mode> 0 to 9999 | ALL | PILOTS

0 to 9999
burst number

ALL
all bursts

PILOTS
only pilots

Example: `CONF:BURS:CONS:CSYM`
Configures the Constellation vs Symbol measurement type.
`CONF:BURS:CONS:BURS:SEL 1`
Selects burst 1.
`INIT`
Starts a Constellation vs Symbol measurement. The results of the selected burst (1) are calculated.

Mode: OFDMA/WiBro

CONFigure:BURSt:CONSt:CARRier:SELect <Mode>

This command selects carriers and pilots. It is only available if the Constellation vs Symbol measurement is selected (see `CONFigure:BURSt:CONSt:CSYMbol[:IMMediate]` on page 154 command).

Parameters:

<Mode> -100 to 100 | ALL | PILOTS

-100 to 100
carrier number

ALL
all carriers

PILOTS
only pilots

*RST: ALL

Example: `CONF:BURS:CONS:CSYM`
Configures the Constellation vs Symbol measurement type.
`CONF:BURS:CONS:CARR:SEL -26`
Carrier -26 is selected.
`INIT`
Starts a Constellation vs Symbol measurement. The results of the selected carrier (-26) are calculated.

Mode: OFDM, OFDMA/WiBro

CONFigure:BURSt:CONSt:CCARrier[:IMMediate]

This command configures the Constellation vs Carrier measurement type.

Example: `CONF:BURS:CONS:CCAR`
Configures the Constellation vs Carrier measurement type.
`INIT`
Starts a Constellation vs Carrier measurement.

Usage: Event

Mode: OFDM

CONFigure:BURSt:CONSt:CSYMbol[:IMMediate]

This command configures the Constellation vs Symbol measurement type.

Example: `CONF:BURS:CONS:CSYM`
Configures the Constellation vs Symbol measurement type.
`INIT`
Starts a Constellation vs Symbol measurement.

Usage: Event

Mode: OFDM, OFDMA/WiBro

CONFigure:BURSt:CONSt:FORMat:SELect <Mode>

This command selects the modulation format. It is only available if the Constellation vs Symbol measurement is selected (see `CONFigure:BURSt:CONSt:CSYMbol[:IMMediate]` on page 154 command).

Parameters:

<Mode> ALL |QPSK | QAM16 | QAM64

Example: `CONF:BURS:CONS:CSYM`
Configures the Constellation vs Symbol measurement type.
`CONF:BURS:CONS:FORM:SEL QPSK`
Selects the QPSK modulation formats.
`INIT`
Starts a Constellation vs Symbol measurement. The results of the selected modulation formats (QPSK) are calculated.

Mode: OFDMA/WiBro

CONFigure:BURSt:CONSt:SYMBol:SELect <Mode>

This command selects the symbol. It is only available if the Constellation vs Symbol measurement is selected (see `CONFigure:BURSt:CONSt:CSYMbol[:IMMediate]` on page 154 command).

Parameters:

<Mode> 0 to 9999 | ALL

0 to 9999
symbol number

ALL
all symbols

Example: `CONF:BURS:CONS:CSYM`
Configures the Constellation vs Symbol measurement type.
`CONF:BURS:CONS:SYMB:SEL 1`
Selects symbol 1.
`INIT`
Starts a Constellation vs Symbol measurement. The results of the selected symbol (1) are calculated.

Mode: OFDMA/WiBro

CONFigure:BURSt:EVM:ECARrier[:IMMediate]

This command configures the EVM vs Carrier measurement type.

Example: `CONF:BURS:EVM:ECAR`
Configures the EVM vs Carrier measurement type.
`INIT`
Starts a EVM vs Carrier measurement.

Usage: Event

Mode: OFDM, OFDMA/WiBro

CONFigure:BURSt:EVM:ESYMbol[:IMMediate]

This command configures the EVM vs Symbol measurement type.

Example: CONF:BURS:EVM:ESYM
Configures the EVM vs Symbol measurement type.
INIT
Starts a EVM vs Symbol measurement.

Usage: Event

Mode: OFDM, OFDMA/WiBro

CONFigure:BURSt:PREamble[:IMMediate]

This command configures the Phase or Frequency vs Preamble measurement type. The selection between the two measurements is made using the CONFigure:BURSt:PREamble:SELect on page 156 command.

Example: CONF:BURS:PRE
Configures the Phase or Frequency vs Preamble measurement type.
CONF:BURS:PRE:SEL FREQ
The measurement results are interpreted as Frequency Error vs Preamble.
INIT
Starts a Frequency Error vs Preamble measurement.

Usage: Event

Mode: OFDM, OFDMA/WiBro

CONFigure:BURSt:PREamble:SELect <Mode>

This command configures the interpretation of the preamble measurement results.

Parameters:
<Mode> PHASe | FREQuency

Example: CONF:BURS:PRE
Configures the Phase or Frequency vs Preamble measurement type.
CONF:BURS:PRE:SEL FREQ
The measurement results are interpreted as Frequency Error vs Preamble.

Mode: OFDM, OFDMA/WiBro

CONFigure:BURSt:PVT[:IMMediate]

This command configures the Power vs Time (PVT) measurement type. For further settings of the Power vs Time measurement see the CONFigure:BURSt:PVT:BURSt on page 157 and CONFigure:BURSt:PVT:SELect on page 157 commands.

Example: CONF:BURS:PVT
Configures the Power vs Time measurement type.
INIT
Starts a Power vs Time measurement.

Usage: Event

Mode: OFDM, OFDMA/WiBro

CONFigure:BURSt:PVT:BURSt <Burst>

This command specifies the burst that is used for the Power vs Time measurement results.

Parameters:
<Burst>
Range: 1 to 10922

Example: `CONF:BURS:PVT`
Configures the Power vs Time measurement type.
`CONF:BURS:PVT:BURS 1`
Uses burst 1 for the Power vs Time measurement results.

Mode: OFDM

CONFigure:BURSt:PVT:SELect <Mode>

This command configures the interpretation of the Power vs Time (PVT) measurement results. The available measurement types depend on the selected standard.

Parameters:
<Mode>
FULL
PVT Full Burst (OFDM)
PVT Full Subframe(OFDMA/WiBro)

EDGE
PVT Start and End (OFDM)
PVT Rising / Falling (OFDMA/WiBro)

*RST: FULL

Example: `CONF:BURS:PVT`
Configures the Power vs Time measurement type.
`CONF:BURS:PVT:SEL FULL`
The measurement results are interpreted as full burst.

Mode: OFDM, OFDMA/WiBro

CONFigure:BURSt:SPECtrum:ACPR[:IMMediate]

This command configures the ACPR (adjacent channel power relative) measurement type.

Example: `CONF:BURS:SPEC:ACPR`
Configures the ACPR measurement type.
`INIT`
Starts an ACPR measurement.

Usage: Event

Mode: OFDM, OFDMA/WiBro

CONFigure:BURSt:SPECtrum:ACPR:SELect <Mode>

This command specifies the type of ACP measurement to be performed.

Parameters:

<Mode> ABSolute | RELative

*RST: REL

Example: `CONF:BURS:SPEC:ACPR:SEL ABS`
Specifies the ACP measurement type absolute.

Mode: OFDM, OFDMA/WiBro

CONFigure:BURSt:SPECtrum:FFT[:IMMediate]

This command configures the FFT (Fast Fourier Transform) measurement type.

Example: `CONF:BURS:SPEC:FFT`
Configures the FFT measurement type.
`INIT`
Starts an FFT measurement.

Usage: Event

Mode: OFDM, OFDMA/WiBro

CONFigure:BURSt:SPECtrum:FLATness[:IMMediate]

This command configures the Spectrum Flatness measurement type. For settings for the Spectrum Flatness measurement see the `CONFigure:BURSt:SPECtrum:FLATness:SELect` on page 158 command.

Example: `CONF:BURS:SPEC:FLAT`
Configures the Spectrum Flatness measurement type.
`INIT`
Starts a Spectrum Flatness measurement.

Usage: Event

Mode: OFDM, OFDMA/WiBro

CONFigure:BURSt:SPECtrum:FLATness:SELect <Mode>

This command configures the interpretation of the Spectrum Flatness measurement results.

Parameters:

<Mode> FLATness | GRDelay | DIFFerence

FLATness
spectrum flatness

GRDelay
group delay

DIFFerence
flatness difference

*RST: FLAT

Example: `CONF:BURS:SPEC:FLAT`
Configures the Spectrum Flatness measurement type.
`CONF:BURS:SPEC:FLAT:SEL GRD`
Configures the group delay for the Spectrum Flatness measurement.

Mode: OFDM, OFDMA/WiBro

CONFigure:BURSt:SPECtrum:MASK[:IMMediate]

This command configures the Spectrum Mask measurement type. For settings for the Spectrum Mask measurement see `CONFigure:BURSt:SPECtrum:MASK:SELect` on page 159 command.

Example: `CONF:BURS:SPEC:MASK`
Configures the Spectrum Mask measurement type.
`INIT`
Starts a Spectrum Mask measurement.

Usage: Event

Mode: OFDM, OFDMA/WiBro

CONFigure:BURSt:SPECtrum:MASK:SELect <Mode>

This command configures the interpretation of the Spectrum Mask measurement results..

Parameters:

<Mode> IEEE | ETSI | ETSI301021 | ETSI30254401 [,BW5M | BW10M]

IEEE
interpretation according to IEEE standard

ETSI | ETSI301021
interpretation according to ETSI EN 301021 SEM standard

ETSI30254401 | ETSI30254401,BW5M
interpretation according to ETSI EN 30254401 SEM standard for 5MHz BW

ETSI30254401,BW10M
interpretation according to ETSI EN 30254401 SEM standard for 10MHz BW

Example: CONF:BURS:SPEC:MASK
Configures the Spectrum Mask measurement type.
CONF:BURS:SPEC:MASK:SEL ETSI
The measurement results are interpreted using the ETSI standard.

Mode: OFDM, OFDMA/WiBro

CONFigure:BURSt:SPECtrum:PHASe:PREamble[:IMMediate]

This command configures the measurement type to be "Preamble Channel Frequency Response: Phase". After this command has been executed, the specified measurement is only started after you execute the INITiate command.

Example: CONF:BURS:SPEC:PHAS:PRE

Mode: OFDMA/WiBro DL

CONFigure:BURSt:STATistics:BSTReam[:IMMediate]

This command configures the Bitstream measurement type.

Example: CONF:BURS:STAT:BSTR
Configures the Bitstream measurement type.
INIT
Starts a Bitstream measurement.

Usage: Event

Mode: OFDM, OFDMA/WiBro

CONFigure:BURSt:STATistics:BSTReam:BURSt:SELect <Mode>

This command selects bursts and pilots. It is only available if the Bitstream measurement is selected (see CONFigure:BURSt:STATistics:BSTReam[:IMMediate] on page 160 command).

Parameters:

<Mode> 0 to 9999 | ALL | PILOTS

0 to 9999
burst number

ALL
all bursts

PILOTS
only pilots

*RST: ALL

Example: CONF:BURS:STAT:BSTR
Configures the Bitstream measurement type.
CONF:BURS:STAT:BSTR:BURS:SEL 1
Selects burst 1.
INIT
Starts a Bitstream measurement. The results of the selected burst (1) are calculated.

Mode: OFDMA/WiBro

CONFigure:BURSt:STATistics:BSTReam:FORMat:SELect <Mode>

This command selects the modulation format. It is only available if the Bitstream measurement is selected (see `CONFigure:BURSt:STATistics:BSTReam[:IMMediate]` on page 160 command).

Parameters:

<Mode> ALL | QPSK | QAM16 | QAM64

*RST: ALL

Example:
`CONF:BURS:STAT:BSTR`
Configures the Bitstream measurement type.
`CONF:BURS:STAT:BSTR:FORM:SEL QPSK`
Selects the QPSK modulation formats.
`INIT`
Starts a Bitstream measurement. The results of the selected modulation formats (QPSK) are calculated.

Mode: OFDMA/WiBro

CONFigure:BURSt:STATistics:BSTReam:SYMBol:SELect <Mode>

This command selects the symbol. It is only available if the Bitstream measurement is selected (`CONFigure:BURSt:STATistics:BSTReam[:IMMediate]` on page 160).

Parameters:

<Mode> 0 to 9999 | ALL

0 to 9999
symbol number

ALL
all symbols

Example:
`CONF:BURS:STAT:BSTR`
Configures the Bitstream measurement type.
`CONF:BURS:STAT:BSTR:SYMB:SEL 1`
Selects symbol 1.
`INIT`
Starts a Bitstream measurement. The results of the selected symbol (1) are calculated.

Mode: OFDMA/WiBro

CONFigure:BURSt:STATistics:BSUMmary[:IMMediate]

This command configures the Burst Summary measurement type.

Example:
`CONF:BURS:STAT:BSUM`
Configures the Burst Summary measurement type.
`INIT`
Starts a the Burst Summary measurement.

Usage: Event

Mode: OFDM, OFDMA/WiBro

CONFigure:BURSt:STATistics:CCDF[:IMMediate]

This command configures the CCDF (conditional cumulative distribution functions) measurement type.

Example: `CONF:BURS:STAT:CCDF`
Configures the CCDF measurement type.
`INIT`
Starts a CCDF measurement.

Usage: Event

Mode: OFDM, OFDMA/WiBro

CONFigure:CHANnel <Channel>

This command specifies the measurement input channel. It automatically causes the internal measurement frequency to be recalculated.

Parameters:
<Channel>
Range: 0 to 3153
*RST: 0

Example: `CONF:CHAN 9`
Defines the frequency of channel 9 as measurement range.

Mode: OFDM

CONFigure:POWer:AUTO <Mode>

This command switches on or off the automatic power level detection.

Parameters:
<Mode> ON | OFF | ONCE

Example: `CONF:POW:AUTO ON`
At the start of every measurement sweep the input power level is detected automatically.

Mode: OFDM, OFDMA/WiBro

CONFigure:POWer:AUTO:SWEep:TIME <SweepTime>

This command specifies the sweep time for the automatic power level detection.

Parameters:
<SweepTime> 1ms to 1s

*RST: 100 ms

Example: `CONF:POW:AUTO ON`
At the start of every measurement sweep the input power level is detected automatically.
`CONF:POW:AUTO:SWE:TIME 200MS`
The sweep time is set to 200 ms power level.

Mode: OFDM, OFDMA/WiBro

CONFigure:POWer:EXPected:RF <PowerLevel>

This command specifies the input power level of the source signal that will be supplied at the analyzer RF input.

Parameters:
<PowerLevel>
Range: -999.99 to 999.99
*RST: -30 dBm
Default unit: dBm

Example: `CONF:POW:EXP:RF -20`
Assumes an input signal strength of -20 dBm.

Mode: OFDM, OFDMA/WiBro

CONFigure:STANdard <Standard>

This command specifies the Wireless LAN standard to be measured.

Parameters:
<Standard> 0 | 1 | 2

0
IEEE 802.16-2004 = OFDM

1
IEEE 802.16e-2005 = OFDMA

2
IEEE 802.16e-2005 = WiBro

*RST: 1

Example: `CONF:STAN 0`
The measurements will be performed according to IEEE 802.16-2004.

Mode: OFDM, OFDMA/WiBro

CONFigure:WIMax:AVERaging <Value>

This command specifies the RSSI, CINR averaging parameter.

Parameters:
<Value>
Range: 0.000001 to 0.999999
*RST: Parameters

Example: CONF:WIM:AVER 0.1
Sets the value to 0.1

Mode: OFDMA/WiBro

CONFigure:WIMax:DLSFrame:IDCell
CONFigure:WIMax:Frame:IDCell <IDCellNo>

This command specifies the downlink.IDCell number, which in turn is used as the "DL_PermBase" parameter for the permutation equations to partly set the sub-carrier randomizer initialisation vector.

Parameters:
<IDCellNo>
*RST: 0

Example: CONF:WIM:DLSFFRAMe:IDC 0

Mode: OFDM, OFDMA/WiBro

CONFigure:WIMax:DLSFrame:PREamble:INDex <PreamblePattern>

This command specifies the preamble pattern (according to the standard) to be used.

Parameters:
<PreamblePattern> integer from 0 to 113

Example: CONF:WIM:DLSF:PRE:MOD USER
Deactivates the automatic calculation of the preamble index.
CONF:WIM:DLSF:PIND 31
Specifies the preamble pattern.

Mode: OFDMA/WiBro

CONFigure:WIMax:DLSFrame:PREamble:MODe <Mode>

This command specifies how the preamble index is calculated.

Parameters:
<Mode> AUTO | USER

AUTO
The preamble index is automatically calculated according to the parameters set by the CONFigure:WIMax:DLSFrame:IDCell on page 164 and CONFigure:WIMax:DLSFrame:SEGMent<1…3> on page 165 commands.

USER
The preamble index can be specified manually, i.e. the preamble pattern is chosen by the CONFigure:WIMax:DLSFrame:PREamble:INDex on page 164 command according to the standard.

*RST: USER

Example: CONF:WIM:DLSF:PRE:MOD AUTO
Activates the automatic calculation of the preamble index.

Mode: OFDMA/WiBro

CONFigure:WIMax:DLSFrame:SEGMent<1…3> <LogSubchannel>

This command specifies the allowed logical subchannel usage of the transmission spectrum for one of the three downlink PUSC segments.

Note that the indexes specified on the instrument are based on 0, whereas under remote control they are based on 1. This means the first segment on the instrument is labeled segment 0 and would be accessed with the command `CONF:WIM:DLSF:SEGM1`.

Parameters:

<LogSubchannel>

Range: 0 to 63
*RST: 0

Example: `CONF:WIM:DLSF:SEGM1 63`
Specifies the logical subchannel usage of the transmission spectrum for the first downlink PUSC segment to 63.

Mode: OFDMA/WiBro

CONFigure:WIMax:FBANd <MeasType>

This command configures the Phase or Frequency vs Preamble measurement type.

Return values:

<Result> ETSI | ETSI2 | MMDS | MMDS2 | WCS | WCS2 | CEPT | CEPT2 | UNII | UNII2

ETSI
3.410-4.200 GHz Licensed Band

ETSI2
10.000-10.680 GHz Licensed Band

MMDS
2.150-2.162 GHz Licensed Band

MMDS2
2.500-2.690 GHz Licensed Band

WCS
2.305-2.320 GHz Licensed Band

WCS2
2.345-2.360 GHz Licensed Band

CEPT
5.470-5.725 GHz License Exempt Band

CEPT2
5.725-5.875 GHz License Exempt Band

UNII
5.250-5.350 GHz License Exempt Band

UNII2
5.725-5.825 GHz License Exempt Band

Setting parameters:

<MeasType> ETSI | ETSI1 | ETSI2 | MMDS | MMDS1 | MMDS2 | WCS | WCS1 | WCS2 | CEPT | CEPT1 | CEPT2 | UNII | UNII1 | UNII2

ETSI | ETSI1
3.410-4.200 GHz Licensed Band

ETSI2
10.000-10.680 GHz Licensed Band

MMDS | MMDS1
2.150-2.162 GHz Licensed Band

MMDS2
2.500-2.690 GHz Licensed Band

WCS | WCS1
2.305-2.320 GHz Licensed Band

WCS2
2.345-2.360 GHz Licensed Band

CEPT | CEPT1
5.470-5.725 GHz License Exempt Band

CEPT2
5.725-5.875 GHz License Exempt Band

UNII | UNII1
5.250-5.350 GHz License Exempt Band

UNII2
5.725-5.825 GHz License Exempt Band

Example:

```
CONF:WIM:FBAN ETSI
```
Configures the frequency band to be ETSI 3.41GHz – 4.2GHz.
```
CONF:WIM:FBAN?
```
After frequency band is set to ETSI this will return "ETSI" as the current frequency band.
```
CONF:WIM:FBAN ETSI1
```
Configures the frequency band to be ETSI 3.41GHz – 4.2GHz.
```
CONF:WIM:FBAN?
```
After frequency band is set to ETSI1 this will return "ETSI" as the current frequency band.
```
CONF:WIM:FBAN ETSI2
```
Configures the frequency band to be ETSI 10.0GHz – 10.68GHz.
```
CONF:WIM:FBAN?
```
After frequency band is set to ETSI2 this will return "ETSI2" as the current frequency band.
```
INIT
```
Starts a Phase or Frequency vs Preamble measurement.

Mode: OFDM, OFDMA/WiBro

CONFigure:WIMax:Frame:IDCell:AUTO <State>

This command specifies that the IDCell number is determined by analysis.

Parameters:

<State> ON | OFF

*RST: 0

Example: `CONF:WIM:FRAMe:IDC:AUTO 1`

Mode: OFDM, OFDMA/WiBro

CONFigure:WIMax:FRAMe:PREDefmap:CONFig
CONFigure:WIMax:FRAMe:PREDefmap:IQDL
CONFigure:WIMax:FRAMe:PREDefmap:IQUL
CONFigure:WIMax:FRAMe:PREDefmap:SMU <State>

This command defines the predefined map mode for auto demod.

- **CONFig**: frame configuration settings used
- **IQDL**: downlink; determined by a loaded IQW file
- **IQUL**: uplink, determined by an IQW file
- **SMU**: the current SMU or equivalent generator settings are used

Parameters:

<State> ON | OFF

*RST: 0

Example: `CONF:WIM:FRAMe:PREDefmap CONFig 1`

Mode: OFDM, OFDMA/WiBro

CONFigure:WIMax:FRAMe:ZONEtouse <Zone>

This command configures the zone to be used for auto demodulation.

Parameters:

<Zone> LAST | Z1 | Z2 | Z3 | Z4 | Z5 | Z6 | Z7 | Z8 | Z9 | Z10 | Z11 | Z12 | Z13I | Z14 | Z15 | Z16 | Z18 | Z19 | Z20 | Z21 | Z22 | Z23 | Z24 | Z25 | Z26

LAST
The last available zone.

Z1 | ... | Z26
Zone number 1 to zone 26.

*RST: Z1

Example: `CONF:WIM:FRAMe:ZONe LAST`
Last zone is used
`CONF:WIM:FRAMe:ZONe Z2`
Zone 2 is used

Mode: OFDM, OFDMA/WiBro

CONFigure:WIMax:FSBWratio:AUTo <State>

This remote control command only switches the Fs/BS ratio to automatic (as per standard) or to user defined values. User mode is only available when the Frequency Band is set to UNSPECIFIED.

Parameters:

<State> ON | OFF

*RST: on

Example: `CONF:WIM:FSBW:AUTO ON`
Sets FS/BW ratrion to auto.

Mode: OFDM, OFDMA/WiBro

CONFigure:WIMax:FSBWratio:BW

This remote control command sets the Channel Bandwidth (BW) part of the ratio used to calculate the relationship between the Channel Bandwidth (BW) and the Sample Rate (Fs). Ratio = Fs/BW.

.

Parameters:

*RST: 7

Example: CONF:WIM:FSBW:BW 1.5
Sets the Channel Bandwidth ratio to 1.5.

Mode: OFDM, OFDMA/WiBro

CONFigure:WIMax:FSBWratio:FS

This remote control command sets the Sample Rate (Fs) part of the ratio used to calculate the relationship between the Channel Bandwidth (BW) and the Sample Rate (FS). Ratio = Fs/BW.

.

Parameters:

*RST: 8

Example: CONF:WIM:FSBW:FS 2
Sets the Channel Bandwidth ratio to 1.5.

Mode: OFDM, OFDMA/WiBro

CONFigure:WIMax:IGRatio <NoGuardSamples>

This command specifies the number of guard samples.

Parameters:

<NoGuardSamples> Value | 4 | 8 | 16 | 32

Value
Guard samples (Tg/Tb)

4
1/4

8
1/8

16
1/16

32
1/32

valid range:

$\frac{T_g}{T_b}$ {1/32, 1/16, 1/8, 1/4}

The ration can be set to one of four values – 4, 8, 16 or 32. The table below shows the relationship between these values and the number of guard samples.

Example: `CONF:WIM:IGR 16`
Sets the number of guard samples to 1/16.

Mode: OFDM, OFDMA/WiBro

CONFigure:WIMax:LMODe <Mode>

This command specifies only to analyze the Down Link or Up Link bursts during a measurement.

Parameters:

<Mode> UL | DL

Example: `CONF:WIM:LMOD UL`
Only the Up Link bursts are analyzed.

Mode: OFDM, OFDMA/WiBro

CONFigure:WIMax:NFFT <FFTSize>

This command specifies the current FFT size.

Parameters:

<FFTSize> FFT128 | FFT512 | FFT1024 | FFT2048

FFT128
FFT size of 128 carriers

FFT512
FFT size of 512 carriers

FFT1024
FFT size of 1024 carriers

FFT2048
FFT size of 2048 carriers

*RST: FFT1024

Example: `CONF:WIM:NFFT FFT2048`
Sets the FFT size to 2048 carriers.

Mode: OFDMA/WiBro

CONFigure:WIMax:TDDFrame:TTG <TransitionGap>

This command specifies the TDD frame TX Transition Gap (TTG).

Parameters:

<TransitionGap>

Range: 0 to 2
*RST: 5us
Default unit: seconds

Example: `CONF:WIM:TDDF:TTG 10us`
Specifies the TDD frame TX Transition Gap as 10 µs.

Mode: OFDMA/WiBro

CONFigure:WIMax:ULSFrame:CRLength <Length>

This remote control command is used to specify the Control Region length for the uplink frame.

Parameters:

<Length>

Range: 0 to 30
*RST: 0

Example: `CONF:WIM:ULSF:CRL 0`
Set the uplink control region length to 0.

Mode: OFDMA/WiBro

CONFigure:WIMax:ULSFrame:FRAMe <FrameNumber>

This command selects the frame number of the uplink frame in which the UL map that specifies the uplink burst was transmitted.

Parameters:
<FrameNumber>
Range: 0 to 10
*RST: 0
Example: `CONF:WIM:ULSF:FRAM 0`
Selects frame number 0.
Mode: OFDMA/WiBro

CONFigure:WIMax:ULSFrame:SEGMent<1..3>:BITMap<1..18>

This remote control command is used to specify the allowable logical sub channel bitmap usage of the transmission spectrum for one of the three uplink segments.

Parameters:
*RST: 0
Example: `CONF:WIM:ULSF:SEGM1:BITM1?`
Mode: OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>[:ANALyze]:STATe <State>

This command sets a zone for analysis. This will come into effect when the next measurement is executed.

Parameters:
<State> ON | OFF
Example: `CONF:WIM:ZONE1:ANAL ON`
Sets zone 1 for analysis.
Mode: OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:BURSt<1…32>:CONTrol[:DATA] <Modulation>, <Subchannels>, <Symbols>, <Slot Duration>, <Subchannel Offset>, <Symbol Offset>, <Burst Power>, <Burst Type>

This command associates a burst definition with a specific zone. A zone may have up to 32 bursts defined within it.

New bursts can only be appended to the end of the existing burst list. For example if 4 bursts are already defined, then the suffix required to enter a new burst is 5.

Parameters:

<Modulation> AUTO | QPSK | QPSK_1_2 | QPSK_3_4 | QAM16 | QAM16_1_2 | QAM16_3_4 | QAM64 | QAM64_1_2 | QAM64_2_3 | QAM64_3_4 | QAM64_5_6

modulation scheme

AUTO
Auto Detect – modulation is detected when the signal is analysed

QPSK
QPSK_1_2

QPSK_1_2
QPSK code rate 1/2

QPSK_3_4
QPSK code rate 3/4

QAM16
QAM16_1_2

QAM16_1_2
16 QAM code rate 1/2

QAM16_3_4
16 QAM code rate 3/4

QAM64
QAM64_1_2

QAM64_1_2
64 QAM code rate 1/2

QAM64_2_3
64 QAM code rate 2/3

QAM64_3_4
64 QAM code rate 3/4

QAM64_5_6
64 QAM code rate 5/6

<Subchannels> <numeric_value>

number of subchannels used by the burst

<Symbols> <numeric_value>

number of symbols used by the burst

<Slot Duration> <numeric_value>

slot duration (only applies to uplink bursts; ignored by downlink bursts)

<Subchannel Offset> <numeric_value>

subchannel offset of the burst

<Symbol Offset> <numeric_value>

symbol offset of the burst

<Burst Power> <numeric_value>
boosting power of the burst

<Burst Type> FCH | DLMAP | ULMAP | DATA | HARQ | FASTfeedback
burst type

Example: `CONF:WIM:ZONE1:BURS1:CONT QAM16_1_2,5,10,20,0,0,0,DATA`
Defines a 16 QAM 1/2 burst using 5 subchannels and 10 symbols.
`CONF:WIM:ZONE1:BURS1:CONT QAM16_1_2,0,0,6,0,0,0,DLMAP`
To define a 16 QAM 1/2 DL Map burst of 6 slots in length.

Mode: OFDM, OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:BURSt<1…32>:COUNt?

This command returns the current count of user defined bursts within the specified zone.

This command is only a query and therefore has no *RST value.

Example: `CONF:WIM:ZONE1:BURS1:COUN?`
Returns the user defined bursts within zone 1.

Usage: Query only

Mode: OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:BURSt<1…32>:DELete

This command deletes a specific burst from within the specified zone.

Example: `CONF:WIM:ZONE1:BURS1:DEL`
Deletes burst 1 from zone 1.

Mode: OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:BURSt<1…32>:FORMat <Modulation>

This command specifies the burst modulation format for the specified zone.

Parameters:

<Modulation> AUTO | QPSK | QPSK_1_2 | QPSK_3_4 | QAM16 | QAM16_1_2 | QAM16_3_4 | QAM64 | QAM64_1_2 | QAM64_2_3 | QAM64_3_4 | QAM64_5_6

modulation scheme

AUTO
Auto Detect – modulation is detected when the signal is analysed

QPSK
QPSK_1_2

QPSK_1_2
QPSK code rate 1/2

QPSK_3_4
QPSK code rate 3/4

QAM16
QAM16_1_2

QAM16_1_2
16 QAM code rate 1/2

QAM16_3_4
16 QAM code rate 3/4

QAM64
QAM64_1_2

QAM64_1_2
64 QAM code rate 1/2

QAM64_2_3
64 QAM code rate 2/3

QAM64_3_4
64 QAM code rate 3/4

QAM64_5_6
64 QAM code rate 5/6

Example: `CONF:WIM:ZONE1:BURS1:FORM QAM64_3D4`
Sets the burst modulation format to QAM64_3D4.

Mode: OFDM, OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:BURSt<1…32>:OFFSet:AUTO <State>

This command allows, for the specified zone and burst, the logical subchannel and symbol offsets to be automatically calculated so that they are contiguous. The command only applies to uplink bursts.

Parameters:

<State> ON | OFF

Example: `CONF:WIM:ZONE1:BURS1:OFFS:AUTO ON`
Activates the automatic calculation of the logical subchannel and symbol offsets.

Mode: OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:BURSt<1…32>:POWer <BoostingPower>

This command specifies, for the specified zone and burst, the boosting power associated with the burst.

Parameters:
<BoostingPower>
Range: -80 to 10

Example: `CONF:WIM:ZONE1:BURS1:POW 0`
Sets the boosting power associated with the burst to 0.

Mode: OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:BURSt<1…32>:RESet

This remote control command removes all burst data associated with a specific zone. The burst index is ignored.

Example: `CONF:WIM:ZONE1:BURS1:RESet`

Mode: OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:BURSt<1…32>:SLOT:DURation <Duration>

This command defines, for the specified zone and burst, the duration of an uplink burst in slots in seconds. The command has no effect on downlink bursts.

Parameters:
<Duration>
Range: 1 to 3000

Example: `CONF:WIM:ZONE1:BURS1:SLOT:DUR 10`
Sets the duration of uplink burst 1 to 10.

Mode: OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:BURSt<1…32>:SUBChannel:COUNt <NoSubchannels>

This command defines, for the specified zone and burst, the number of logical subchannels used by the burst.

Parameters:
<NoSubchannels>
Range: 1 to 60

Example: `CONF:WIM:ZONE1:BURS1:SUBC:COUN 5`
Sets the number of logical subchannels used by burst 1 to 5.

Mode: OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:BURSt<1…32>:SUBChannel:OFFSet <Offset>

This command defines, for the specified zone and burst, the logical subchannels offset for the burst. This, together with the symbol offset, can be used to specify the frequency bandwidth in use by specific bursts.

Parameters:
<Offset>
Range: 0 to 60

Example: `CONF:WIM:ZONE1:BURS1:SUBC:OFFS 5`
Sets the subchannels offset for burst 1 to 5.

Mode: OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:BURSt<1…32>:SYMBol:COUNt <NoSymbols>

This command defines, for the specified zone and burst, the number of symbols used by the burst.

Parameters:
<NoSymbols>
Range: 1 to 1000

Example: `CONF:WIM:ZONE1:BURS1:SYMB:COUN 5`
Sets the number of symbols used by burst 1 to 5.

Mode: OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:BURSt<1…32>:SYMBol:OFFSet <Offset>

This command defines, for the specified zone and burst, the symbol offset for the burst. This, together with the logical subchannel offset, can be used to specify the frequency bandwidth in use by specific bursts.

Parameters:
<Offset>
Range: 0 to 1000

Example: `CONF:WIM:ZONE1:BURS1:SYMB:OFFS 5`
Sets the symbol offset for burst 1 to 5.

Mode: OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:BURSt<1…32>:TYPE <Type>

For the specified zone and burst, this command specifies the type of burst from the protocol layer perspective, i.e. if the burst contains signaling information or if it is just a data burst.

Parameters:

<Type> FCH | DLMAP | ULMAP | DATA

FCH
frame control header

DLMAP
downlink map

ULMAP
uplink map

DATA
data burst

Example: `ONF:WIM:ZONE1:BURS1:TYPE DATA`
Burst 1 is a data burst.

Mode: OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:CONTrol[:DATA]
<Analyze>,<Type>,,<Length>,<Offset>,<Permbase>,<PRBS_ID>

This command adds a new zone. Up to 26 user zones can be defined.

New zones can only be appended to the end of the existing defined zones. For example, if 4 zones are already defined, then the suffix required to enter a new zone is 5.

Parameters:

<Analyze> ON | OFF

Specifies whether the zone is too be marked for analysis.

<Type> DLFUSC | DLPUSC | ULPUSC

Zone type
DLFUSC
downlink FUSC (Fully Used Subchanneliziation) zone

DLPUSC
downlink PUSC (Partial Used Subchanneliziation) zone

ULPUSC
uplink PUSC zone

 0 | 1 | 2

downlink PUSC zone segment

<Length> <numeric_value>

zone symbol length

<Offset> <numeric_value>

zone symbol offset

<Permbase> <numeric_value>

permbase to be used for channel decoding

<PRBS_ID> <numeric_value>
PRBS to be used for channel decoding

Example: `CONF:WIM:ZONE1:CONT ON,DLFUSC,0,10,0,0,0`
Adds a DL_PUSC zone with a length of 10 symbols.

Mode: OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:CONTrol:STCConfig <Coding>

This remote control specifies the space time coding.

Parameters:

<Coding> **NOSTC**
No space time coding

TX2
Two antennas

*RST: NOSTC

Example: `CONF:WIM:ZONE1:CONT:STCC TX2`

Mode: OFDM, OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:COUNt?

This command returns the current count of the specified zone.

Example: `CONF:WIM:ZONE1:COUN?`
Returns the count of zone 1.

Usage: Query only

Mode: OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:DELete

This command deletes a specific zone. If the specified zone is within a larger list of zones, then all following zones will be shuffled down to take up the space occupied by the deleted zone.

Example: `CONF:WIM:ZONE1:DEL`
Deletes zone 1.

Usage: Event

Mode: OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:IDSegment <SegmentNumber>

This command specifies the segment number associated with the zone. This is only valid for PUSC zones and will have no effect on other zone types.

Parameters:

<SegmentNumber> 0 | 1 | 2

Example: `CONF:WIM:ZONE1:IDS 0`
Sets the segment number for zone 1 to 0.

Mode: OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:PERMbase <PermBase>

This command specifies the perm base which is used in the permutation equations for the specified zone.

Parameters:
<PermBase>
Range: 0 to 31

Example: `CONF:WIM:ZONE1:PERM 0`
For zone 1, perm base 0 is used in the permutation equations.

Mode: OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:PRBS <BinarySequence>

This command specifies a known PRBS (pseudo random binary sequence) modulated data sequence that is in use by the DUT of the specified zone.

Parameters:
<BinarySequence> 0, 1, 2, 3

Example: `CONF:WIM:ZONE1:PRBS 0`
Sets the PRBS to 0.

Mode: OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:RESet

This remote control command removes all zone and burst data. The zone index is ignored.

Example: `CONF:WIM:ZONE1:RESet`

Mode: OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:SYMB:OFFSet <Offset>

This command specifies the symbol offset associated with the specified zone. This is used to analyze signals which contain multiple zones and allows any zone in a subframe to be set up for analysis.

Parameters:
<Offset>
Range: 1 to 1000

Example: `CONF:WIM:ZONE1:SYMB:OFFS 0`
Sets the symbol offset for zone 1 to 0.

Mode: OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:SYMB:COUNt <NoSymbols>

This command specifies the number of symbols defined to the specified zone.

Parameters:

<NoSymbols>

Range: 1 to 1000

Example: `CONF:WIM:ZONE1:SYMB:COUNT 10`

Sets the number of symbols for zone 1 to 10.

Mode: OFDMA/WiBro

CONFigure:WIMax:ZONE<1…26>:TYPE <ZoneType>

This command specifies the zone type of the specified zone.

Parameters:

<ZoneType> DLFUSC | DLPUSC | ULPUSC

DLFUSC
downlink FUSC zone

DLPUSC
downlink PUSC zone

ULPUSC
uplink PUSC zone

Example: `CONF:WIM:ZONE1:TYPE DLPUSC`

Specifies zone 1 as downlink PUSC zone.

Mode: OFDMA/WiBro

4.3.9 DISPlay Subsystem (WiMAX / WiBro, K93)

The DISPlay subsystem controls the selection and presentation of textual and graphic information as well as of measurement data on the display. In contrast to the basic device, the WiMAX IEEE 802.16 OFDM, OFDMA Measurements option supports the split screen modus.

Commands of the DISPlay Subsystem

DISPlay:FORMat <Format>

This command switches the measurement result display between FULL SCREEN and SPLIT SCREEN.

Parameters:

<Format> SINGle | SPLit

SPLit
Show 2 or more screens on the display

SINGle
Show only 1 screen on the display

*RST: SPL

Example: `DISP:FORM:SING`

Mode: all

DISPlay[:WINDow<n>]:SELect

This command selects whether window A or B is active (see also `DISPlay[:WINDow<n>]:SSELect` on page 181)

Suffix:

<n> 1 | 2
window; 1 = window A, 2 = window B

Example: `DISP:WIND1 SEL`
Sets window A active.

Mode: OFDMA/WiBro

DISPlay[:WINDow<n>]:SSELect

This command selects whether window A or B is active.

Suffix:

<n> 1 | 2
window; 1 = window A, 2 = window B

Example: `DISP:WIND1:SSEL`
Sets window A active.

Mode: OFDM, OFDMA/WiBro

DISPlay[:WINDow<n>]:TABLe <State>

This command shows or hides the results table.

Suffix:

<n> 1...4
window

Parameters:

<State> ON | OFF

*RST: OFF

Example: `DISP:TABL OFF`
Hides the results table.

Mode: OFDM, OFDMA/WiBro

DISPlay[:WINDow<n>]:TABLe:LIST <PageNumber>

This command displays the requested page for the results table. The number of available pages depends on the selected standard (e.g. OFDM has 1 page, OFDMA has 2 pages).

Suffix:
<n> 1...4
window

Parameters:
<PageNumber>
Range: 1 to 2
*RST: 1

Example: `DISP:TABL:LIST 1`
Selects page 1 of the table of results.

Mode: OFDM, OFDMA/WiBro

DISPlay[:WINDow<n>]:TABLe:UNIT <Unit>

This command specifies the unit for the parameters listed in the results table.

Suffix:
<n> 1...4
window

Parameters:
<Unit> DB | PCT

DB
results returned in dB

PCT
results returned in percent

*RST: DB

Example: `DISP:TABL:UNIT DB`
Results are returned in dB.

Mode: OFDM, OFDMA/WiBro

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:AUTO <Mode>

This command switches on or off automatic scaling of the Y-axis for the specified trace display. Automatic scaling sets the Y-axis to automatically scale to best fit the measurement results.

This command is query only for the following result displays:

- Constellation vs Symbol
- Constellation vs Carrier

Suffix:
<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<t> only 1 trace

Parameters:
<Mode> ON | OFF | ONCE

ON
Automatic scaling is on.

OFF
Automatic scaling is off.

ONCE
Automatic scaling is performed once, then switched off again.

*RST: OFF

Example: `DISP:WIND2:TRAC:Y:SCAL:AUTO ONCE`
Activates automatic scaling of the Y-axis for the active trace

Mode: CDMA, EVDO, OFDM, OFDMA/WiBro, PHN

DISPlay[:WINDow<n>]:TRACe1:Y[:SCALe]:PDIVision <ScaleDivision>

This command sets the size of each y scale division for trace 1. It has no affect if automatic scaling of the y-axis is enabled (see `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:AUTO` on page 182).

This command is query only for the following result displays:

- Constellation vs Symbol
- Constellation vs Carrier

Suffix:
<n> 1...4 window

Parameters:
<ScaleDivision>

Range: 1E-6 to 10E12
*RST: 3

Example: `DISP:WIND2:TRAC1:Y:AUTO OFF`
Switches off automatic scaling of the y-axis for the active trace.
`DISP:WIND2:TRAC1:Y:PDIV 2`
Sets the y scale division to size 2.

Usage: SCPI conform

Mode: OFDM, OFDMA/WiBro

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel[:RF] <Level>

This command specifies the reference level applied to an RF measurement.

Suffix:
<n> irrelevant
<t> irrelevant

Parameters:
<Level> <numeric_value> in dBm, range specified in data sheet
*RST: 0 dB

Example: `DISP:TRAC:Y:RLEV 10`
Reference level of the analyzer is 10 dB
`DISP:TRAC:Y:RLEV:RF -10`
Reference level of the analyzer is -10 dB

Usage: SCPI conform

Mode: OFDM, OFDMA/WiBro

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel?

This command queries the current internal instrument reference level used when performing measurements.

Suffix:
<n> irrelevant.
<t> irrelevant

Example: `DISP:TRAC:Y:RLEV?`
Returns the current reference level in use.

Usage: Query only
SCPI conform

Mode: OFDM, OFDMA/WiBro

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:IQ <Level>

This command can be used to retrieve or set the current internal instrument reference level for baseband input used when performing measurements.

Suffix:
<n> irrelevant
<t> irrelevant

Parameters:
<Level> <numeric value> in V
*RST: 1 V

Example: `DISP:TRAC:Y:IQ?`
Returns the current baseband reference level in use.
`DISP:TRAC:Y:RLEV:IQ 1`
Sets the instrument reference level to 1.

Mode: OFDM, OFDMA/WiBro

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet <Value>

This command sets the reference level offset.

Suffix:

<n> irrelevant.

<t> irrelevant

Parameters:

<Value> -200dB to 200dB

*RST: 0dB

Example: `DISP:TRAC:Y:RLEV:OFFS -10dB`

Mode: ALL

4.3.10 FETCh Subsystem (WiMAX / WiBro, K93)

The FETCh subsystem contains commands for reading out results of complex measurement tasks. This subsystem is closely linked to the CONFigure and SENSe subsystems.

FETCh:BURSt:ALL?

This command returns all the results. The results are output as a list of result strings separated by commas in ASCII format. Different sets of results are obtained depending on the used standard and uplink/downlink mode. For details on the format refer to chapter 4.3.3, "ASCII Formats for Returned Values", on page 120.

The units for the EVM results are specified with the `UNIT:EVM` command.

Example: `FETC:BURS:ALL?`
All calculated results are returned

Usage: Query only

Mode: OFDM, OFDMA/WiBro

FETCh:BURSt:BERPilot:AVERage?
FETCh:BURSt:BERPilot:MINimum?
FETCh::BURSt:BERPilot:MAXimum?

These commands return the determined BER values for pilots (average, minimum or maximum value). The result is returned in ASCII format. For details on the format refer to chapter 4.3.3, "ASCII Formats for Returned Values", on page 120 .

Example: `FETC:BURS:BERP:MAX?`
The calculated maximum BER value is returned.

Usage: Query only

Mode: OFDMA/WiBro

FETCh:BURSt:CINR?

This command returns all the CINR results separated by commas. For details on the format refer to chapter 4.3.3, "ASCII Formats for Returned Values", on page 120 .

Example: `FETC:BURS:CINR?`
The calculated CINR results from the most recent measurement are returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

FETCh:BURSt:CINR:AVERage?
FETCh:BURSt:CINR:MINimum?
FETCh:BURSt:CINR:MAXimum?

These commands return the determined CINR (carrier to interference and noise ratio) standard deviation value (average, minimum or maximum value). The result is returned in ASCII format. For details on the format refer to chapter 4.3.3, "ASCII Formats for Returned Values", on page 120 .

Example: `FETC:BURS:RSS:MAX?`
The calculated maximum CINR value is returned.

Usage: Query only

Mode: OFDMA/WiBro

FETCh:BURSt:COUNt[:ALL]?

This command returns the number of bursts analyzed in the last sweep.

Example: `FETC:BURS:COUN?`
The number of analyzed bursts in the most recent measurement is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

FETCh:BURSt:CRESt:AVERage?
FETCh:BURSt:CRESt:MAXimum?
FETCh:BURSt:CRESt:MINimum?

These commands return the determined crest factor (average, minimum or maximum value) in dBm. The crest factor is the ratio of peak power to average power.

Example: `FETC:BURS:CRES:MAX?`
The calculated maximum crest factor from the most recent measurement is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

FETCh:BURSt:EVM:ALL:AVERage?
FETCh:BURSt:EVM:ALL:MAXimum?
FETCh:BURSt:EVM:ALL:MINimum?

This command returns the Error Vector Magnitude (EVM) measurement results summary (average, minimum or maximum value) in dB. The EVM result is based on the pilot and data subcarriers.

Example: `FETC:BURS:EVM:ALL:MIN?`
The minimum Error Vector Magnitude value is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

FETCh:BURSt:EVM:DATA:AVERage?
FETCh:BURSt:EVM:DATA:MAXimum?
FETCh:BURSt:EVM:DATA:MINimum?

This command returns the Error Vector Magnitude measurement results summary (average, minimum or maximum value) for the data carrier in dB.

Example: `FETC:BURS:EVM:DATA:MAX?`
The maximum EVM recorded for the data carrier is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

FETCh:BURSt:EVM:PILot:AVERage?
FETCh:BURSt:EVM:PILot:MAXimum?
FETCh:BURSt:EVM:PILot:MINimum?

This command returns the Error Vector Magnitude measurement results summary for the EVM pilot carrier in dB.

Example: `FETC:BURS:EVM:PIL:MAX?`
The maximum EVM recorded for the EVM pilot carrier is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

FETCh:BURSt:EVM:PREamble:AVERage?
FETCh:BURSt:EVM:PREamble:MAXimum?
FETCh:BURSt:EVM:PREamble:MINimum?

This command returns the Error Vector Magnitude (EVM) measurement results summary for the preamble carriers in dB.

Note this is a OFDMA/WiBro DL result only!

Example: `FETC:BURS:EVM:PRE:MAX?`
The maximum EVM recorded for the preamble carriers is returned.

Usage: Query only

Mode: OFDMA/WiBro

FETCh:BURSt:FERRor:AVERage?
FETCh:BURSt:FERRor:MAXimum?
FETCh:BURSt:FERRor:MINimum?

This command returns the measured average, minimum or maximum frequency errors in Hz.

Example: `FETC:BURS:FERR:MAX?`
The maximum frequency error from the most recent measurement is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

FETCh:BURSt:GIMBalance:AVERage?
FETCh:BURSt:GIMBalance:MAXimum?
FETCh:BURSt:GIMBalance:MINimum?

This command returns the measured average, minimum or maximum IQ imbalance errors in dB.

Example: `FETC:BURS:GIMB:MAX?`
The maximum IQ Imbalance error from the most recent measurement is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

FETCh:BURSt:IQOFfset:AVERage?
FETCh:BURSt:IQOFfset:MAXimum?
FETCh:BURSt:IQOFfset:MINimum?

This command returns the measured average, minimum or maximum IQ offset errors in dB.

Example: `FETC:BURS:IQOF:MAX?`
The maximum IQ Offset error from the most recent measurement is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

FETCh:BURSt:QUADoffset:AVERage?
FETCh:BURSt:QUADoffset:MAXimum?
FETCh:BURSt:QUADoffset:MINimum?

This command returns the accuracy in terms of the phase error of symbols within a burst.

Example: `FETC:BURS:QUAD:MAX?`
The maximum angle error recorded for a symbol during the measurement.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

FETCh:BURSt:RMS:ALL:AVERage?
FETCh:BURSt:RMS:ALL:MAXimum?
FETCh:BURSt:RMS:ALL:MINimum?

This command returns the average, minimum or maximum RMS burst power in dBm for all carriers measured during the measurement.

Example: `FETC:BURS:RMS:ALL:MAX?`
The maximum RMS burst power for all carriers recorded during the most recent measurement is returned.

Usage: Query only

Mode: OFDM

FETCh:BURSt:RMS:AVERage?
FETCh:BURSt:RMS:MAXimum?

FETCh:BURSt:RMS:MINimum?

This command returns the average, minimum or maximum RMS burst power in dBm measured during the measurement.

Example: `FETC:BURS:RMS:MAX?`
The maximum burst power recorded for the most recent measurement is returned.

Usage: Query only

Mode: OFDM

FETCh:BURSt:RMS:DATA:AVERage?
FETCh:BURSt:RMS:DATA:MAXimum?
FETCh:BURSt:RMS:DATA:MINimum?

This command returns the average, minimum or maximum RMS burst power in dBm for data carriers measured during the measurement.

Example: `FETC:BURS:RMS:DATA:MAX?`
The maximum RMS burst power for data carriers from the most recent measurement is returned.

Usage: Query only

Mode: OFDM

FETCh:BURSt:RMS:DLPReamble:AVERage?
FETCh:BURSt:RMS:DLPReamble:MAXimum?
FETCh:BURSt:RMS:DLPReamble:MINimum?

This command returns the average, minimum or maximum RMS burst power in dBm for the downlink preamble measured during the measurement.

Example: `FETC:BURS:RMS:DLPR:MAX?`
The maximum RMS burst power for the downlink preamble from the most recent measurement is returned.

Usage: Query only

Mode: OFDM

FETCh:BURSt:RMS:PILot:AVERage?
FETCh:BURSt:RMS:PILot:MAXimum?
FETCh:BURSt:RMS:PILot:MINimum?

This command returns the average, minimum or maximum RMS burst power in dBm for pilot carriers measured during the measurement.

Example: `FETC:BURS:RMS:PIL:MAX?`
The maximum RMS burst power for pilot carriers from the most recent measurement is returned.

Usage: Query only

Mode: OFDM

FETCh:BURSt:RSSI?

This command returns all the received signal strength indicator (RSSI) results separated by commas. For details on the format refer to chapter 4.3.3, "ASCII Formats for Returned Values", on page 120 .

Example: `FETC:BURS:RSSI?`
The calculated RSSI results from the most recent measurement is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

FETCh:BURSt:RSSi:AVERage?
FETCh:BURSt:RSSi:MAXimum?
FETCh:BURSt:RSSi:MINimum?

This command returns the average, minimum or maximum RSSI (received signal strength indicator) standard deviation value. This is an estimate of the total received power of the frame preamble of the segment of the connected BS. For details on the format refer to chapter 4.3.3, "ASCII Formats for Returned Values", on page 120 .

Example: `FETC:BURS:RSS:MAX?`
The maximum RSSI deviation value from the most recent measurement is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

FETCh:BURSt:SYMBolerror:AVERage?
FETCh:BURSt:SYMBolerror:MAXimum?
FETCh:BURSt:SYMBolerror:MINimum?

This command returns the percentage of symbols that were outside permissible demodulation range within a burst.

Example: `FETC:BURS:SYMB:MAX?`
The maximum number of symbols that were out of range per burst is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

FETCh:BURSt:TDOMain:PREamble?

This command returns the minimum, average and maximum preamble time domain values. The result is returned in (ASCII) format.

Example: `FETC:BURS:TDOM:PRE?`
Returns the minimum, average and maximum preamble time domain values.

Usage: Query only

Mode: OFDMA/WiBro

FETCh:BURSt:TDOMain:PREamble:AVERage?
FETCh:BURSt:TDOMain:PREamble:MAXimum?
FETCh:BURSt:TDOMain:PREamble:MINimum?

This command returns the average, minimum or maximum preamble time domain value. For details on the format refer to chapter 4.3.3, "ASCII Formats for Returned Values", on page 120 .

Example: `FETC:BURS:RSS:MAX?`
The maximum preamble value from the most recent measurement is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

FETCh:BURSt:TDOMain:SUBFrame?

This command returns the minimum, average and maximum subframe time domain values. The result is returned in (ASCII) format.

Example: `FETC:BURS:TDOM:SUBF?`
Returns the minimum, average and maximum subframe time domain values.

Usage: Query only

Mode: OFDMA/WiBro

FETCh:BURSt:TDOMain:SUBFrame:AVERage?
FETCh:BURSt:TDOMain:SUBFrame:MAXimum?
FETCh:BURSt:TDOMain:SUBFrame:MINimum?

This command returns the average, minimum or maximum subframe time domain value. For details on the format refer to chapter 4.3.3, "ASCII Formats for Returned Values", on page 120 .

Example: `FETC:BURS:RSS:MAX?`
The maximum subframe value from the most recent measurement is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

FETCh:BURSt:TDOMain:ZONE?

This command returns the minimum, average and maximum zone time domain values. The result is returned in (ASCII) format.

Example: `FETC:BURS:TDOM:ZONE?`
Returns the minimum, average and maximum zone time domain values.

Usage: Query only

Mode: OFDMA/WiBro

FETCh:BURSt:TDOMain:ZONE:AVERage?
FETCh:BURSt:TDOMain:ZONE:MAXimum?
FETCh:BURSt:TDOMain:ZONE:MINimum?

This command returns the average, minimum or maximum zone time domain value. For details on the format refer to chapter 4.3.3, "ASCII Formats for Returned Values", on page 120 .

Example: `FETC:BURS:RSS:MAX?`
The maximum zone value from the most recent measurement is returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

FETCh:BURSt:USERror:AVERage?
FETCh:BURSt:USERror:MAXimum?
FETCh:BURSt:USERror:MINimum?

This command returns Unmodulate Subcarrier Error for the analysed zone..

Example: `FETC:BURS:USER:MAX?`
The maximum unmodulated subcarrier error is returned.

Usage: Query only

Mode: OFDMA/WiBro

FETCh:SYMBol:COUNt?

This command returns the number of symbol in each analyzed burst found in the last measurement sweep. The results are output as a list of result strings separated by commas in the following (ASCII) format:

<Symbols in 1st burst>,< Symbols in 2nd burst >,…, < Symbols in last burst >

Example: `FETC:SYMB:COUN?`
The calculated symbols in the analyzed bursts for the most recent measurement are returned.

Usage: Query only

Mode: OFDM, OFDMA/WiBro

FETCh:ZONE:COUNt?

This command returns the current number of zones found during measurement analysis.

Example: `FETC:ZONE:COUN?`
The current number of zones found during analysis is returned.

Usage: Query only

Mode: OFDMA/WiBro

4.3.11 FORMat Subsystem (WiMAX / WiBro, K93)

The FORMat subsystem specifies the data format of the data transmitted from and to the instrument.

FORMat[:DATA] <Format>

This command specifies the data format for the data transmitted from the instrument to the control PC. It is used for the transmission of trace data. The data format of trace data received by the instrument is automatically recognized, regardless of the format which is programmed.

(See also `TRACe[:DATA]` on page 221).

Parameters:

<Format> ASCii | REAL

ASCii
ASCII data are transmitted in plain text, separated by commas.

REAL
REAL data are transmitted as 32-bit IEEE 754 floating-point numbers in the "definite length block format".

*RST: ASCII

Example:
```
FORM REAL,32
FORM ASC
```

Mode: all

4.3.12 INITiate Subsystem (WiMAX / WiBro, K93)

The INITiate subsystem configures the instrument prior to a measurement being carried out. It is basically used to tell the instrument which measurement is to be performed and takes any necessary step to set up the instrument for the measurement.

INITiate<n>:CONTinuous <State>

This command determines whether the trigger system is continuously initiated (continuous) or performs single measurements (single).

In the **"Spectrum" mode**, this setting refers to the sweep sequence (switching between continuous/single sweep).

Suffix:

<n> irrelevant

Parameters:

<State> ON | OFF

*RST: ON

Example:
```
INIT:CONT OFF
```
Switches the sequence to single sweep.
```
INIT:CONT ON
```
Switches the sequence to continuous sweep.

Mode: all

INITiate<n>[:IMMediate]

The command initiates a new measurement sequence.

With sweep count > 0 or average count > 0, this means a restart of the indicated number of measurements. With trace functions MAXHold, MINHold and AVERage, the previous results are reset on restarting the measurement.

In single sweep mode, synchronization to the end of the indicated number of measurements can be achieved with the command *OPC, *OPC? or *WAI. In continuous-sweep mode, synchronization to the sweep end is not possible since the overall measurement never ends.

Suffix:

<n> irrelevant

Example:
```
INIT:CONT OFF
```
Switches to single sweep mode.
```
DISP:WIND:TRAC:MODE AVER
```
Switches on trace averaging.
```
SWE:COUN 20
```
Setting the sweep counter to 20 sweeps.
```
INIT;*WAI
```
Starts the measurement and waits for the end of the 20 sweeps.

Mode: all

INITiate:REFResh

This command updates the current IQ measurement results to reflect the current measurement settings. Note that no new IQ data is captured, i.e. the measurement settings apply to the IQ data being currently in the capture buffer. The command applies exclusively to IQ measurements. It requires available IQ data.

Example:
```
INIT:REFR
```
Updates the IQ measurement results according to the current settings.

Usage: SCPI conform

Mode: OFDM, OFDMA/WiBro

4.3.13 INPut subsystem

INPut:ATTenuation <Value>

This command programs the input attenuator. To protect the input mixer against damage from overloads, the setting 0 dB can be obtained by entering numerals, not by using the DOWN command.

The attenuation can be set in 5 dB steps (with option R&S FSV-B25: 1 dB steps). If the defined reference level cannot be set for the set RF attenuation, the reference level is adjusted accordingly.

In the default state with "Spectrum" mode, the attenuation set on the step attenuator is coupled to the reference level of the instrument. If the attenuation is programmed directly, the coupling to the reference level is switched off.

This function is not available if the Digital Baseband Interface (R&S FSV-B17) is active.

Parameters:

<Value> <numeric_value> in dB; range specified in data sheet

*RST: 10 dB (AUTO is set to ON)

Example: `INP:ATT 30dB`
Sets the attenuation on the attenuator to 30 dB and switches off the coupling to the reference level.

Mode: all

INPut:DIQ:RANGe[:UPPer] <Level>

Defines the level that should correspond to an I/Q sample with the magnitude "1".

It can be defined either in dBm or Volt (see "Full Scale Level" on page 90).

This command is only available if the optional Digital Baseband interface (option R&S FSV-B17) is installed.

For details see the Digital Baseband Interface (R&S FSV-B17) description of the base unit.

Parameters:

<Level> <numeric value>

Range: 70.711 nV to 7.071 V
*RST: 1 V

Example: `INP:DIQ:RANG 1V`

Mode: A, IQ, NF, TDS, VSA, CDMA, EVDO, WCDMA, ADEMOD, GSM, OFDM, OFDMA/WiBro, WLAN

INPut:DIQ:SRATe <SampleRate>

This command specifies the sample rate of the digital baseband IQ input signal (see "Input Sample Rate" on page 90).

This command is only available if the optional Digital Baseband interface (option R&S FSV-B17) is installed.

For details see the Digital Baseband Interface (R&S FSV-B17) description of the base unit.

Parameters:

<SampleRate>

Range: 1 Hz to 10 GHz
*RST: 32 MHz

Example: INP:DIQ:SRAT 200 MHz

Mode: A, IQ, NF, TDS, VSA, CDMA, EVDO, WCDMA, ADEMOD, GSM, OFDM, OFDMA/WiBro, WLAN

INPut:EATT <Attenuation>

Requires option R&S FSV-B25.

Switches the electronic attenuator on (if not already active) and allows the attenuation of the electronic attenuator to be set.

This command is only available with option R&S FSV-B25, but not if R&S FSV-B17 is active.

The attenuation can be varied in 1 dB steps from 0 to 25 dB. Other entries are rounded to the next lower integer value.

If the defined reference level cannot be set for the given RF attenuation, the reference level is adjusted accordingly and the warning "Limit reached" is output.

Parameters:

<Attenuation> 0...25

*RST: 0 dB (OFF)

Example:
```
INP1:EATT 10 dB
```

Mode: all

INPut:EATT:AUTO <State>

Switches the automatic behaviour of the electronic attenuator on or off. If activated, electronic attenuation is used to reduce the operation of the mechanical attenuation whenever possible.

This command is only available with option R&S FSV-B25, but not if R&S FSV-B17 is active.

Parameters:

<State> ON | OFF

*RST: ON

Example: INP1:EATT:AUTO OFF

Mode: all

INPut:EATT:STATe <State>

Switches the electronic attenuator on or off.

This command is only available with option R&S FSV-B25, but not if R&S FSV-B17 is active.

Parameters:

<State> ON | OFF

*RST: OFF

Example: INP:EATT:STAT ON
Switches the electronic attenuator into the signal path.

Mode: all

INPut:GAIN:STATe <State>

This command switches the preamplifier on or off (only for option RF Preamplifier, R&S FSV-B22/B24).

With option R&S FSV-B22, the preamplifier only has an effect below 7 GHz.

With option R&S FSV-B24, the amplifier applies to the entire frequency range.

This command is not available when using Digital Baseband Interface (R&S FSV-B17).

Parameters:

<State> ON | OFF

*RST: OFF

Example: INP:GAIN:STAT ON
Switches on 20 dB preamplification.

Mode: A, ADEMOD, BT, CDMA, EVDO, NF, PHN, WCDMA, GSM, VSA, TDS

INPut:SELect <Source>

This command selects the signal source for measurements.

Parameters:

<Source> RF | DIQ

RF
Radio Frequency ("RF INPUT" connector)

DIQ
Baseband Digital (IQ) (only available with Digital Baseband Interface, option R&S FSV-B17)

*RST: RF

Example: INP:SEL RF

Mode: A, IQ, NF, TDS, VSA, CDMA, EVDO, WCDMA, ADEMOD, GSM, OFDM, OFDMA/WiBro, WLAN

4.3.14 INSTrument Subsystem (WiMAX / WiBro, K93)

The INSTrument subsystem selects the operating mode of the unit either via text parameters or fixed numbers.

Commands of the INSTrument Subsystem

INSTrument[:SELect] <Mode>

Parameters:

<Mode> WiMAX

Selects WiMax mode (WiMAX 802.16 OFDM Measurements option and WiMAX IEEE 802.16 OFDM, OFDMA Measurements option, R&S FSV-K93)

INSTrument:NSELect <Mode>

Parameters:

<Mode> **6**

Selects WiMax mode (WiMAX IEEE 802.16 OFDM, OFDMA Measurements option, R&S FSV-K93)

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Selects WiMax mode (WiMAX 802.16 OFDM Measurements option, R&S FSV-K93

4.3.15 MMEMory Subsystem (WiMAX / WiBro, K93)

The MMEMory (mass memory) subsystem provides commands to store and load IQ data.

Commands of the MMEMory Subsystem

MMEMory:LOAD:FRAMe:STATe 1, <FileName>

This command loads a zone frame setup from the specified *.xml file. This file is created by a R&S SMU signal generator in accordance to the IEEE 80216e-2005 standard.

Parameters:
<FileName> 1,<file_name>

Example: `MMEM:STOR:FRAM:STAT 1,'C:\R_S\Instr\user\data.xml'`
Loads the zone frame setup from the specified file.

Mode: OFDMA/WiBro

MMEMory:LOAD:IQ:STATe 1, <FileName>

This command loads the IQ data from the specified .iqw file.

Parameters:
<FileName> 1,<file_name>

Example: `MMEM:LOAD:IQ:STAT 1, 'C:\R_S\Instr\user\data.iqw'`
Loads IQ data from the specified file.

Mode: WLAN, OFDM, OFDMA/WiBro

MMEMory:LOAD:SEM:STATe 1, <FileName>

This command loads a spectrum emission mask setup from an xml file.

Parameters:
<FileName> 1,<file_name>

Example: `MMEM:LOAD:SEM:STAT 1,'D:\USER\ETSI_SEM.xml'`
Loads a spectrum emission mask setup from the specified file.

Mode: WLAN, OFDM, OFDMA/WiBro

MMEMory:STORe:IQ:STATe 1, <FileName>

This command stores the IQ data to the specified .iqw file.

Parameters:
<FileName> 1,<file_name>

Example: `MMEM:STOR:IQ:STAT 1, 'C:\R_S\Instr\user\data.iqw'`
Stores IQ data to the specified file.

Mode: WLAN, OFDM, OFDMA/WiBro

4.3.16 SENSe Subsystem (WiMAX / WiBro, K93)

The SENSe command is used to set and get the values of parameters in the remote instrument. The get variant of the SENSe command differs from set in that it takes no parameter values (unless otherwise stated) but is followed by the character '?' and will return the parameter's value in the same format as it is set.

4.3.16.1 Analysis Modulation Format

Parameter	Standard	Description
'BPSK'	Alias for BI-Phase shift keying at higher data rate for selected standard	
'BPSK3'	IEEE 802.11j (10 MHz)	BI-Phase shift keying at 3 Mbps
'BPSK6'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	BI-Phase shift keying at 6 Mbps
'BPSK9'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	BI-Phase shift keying at 9 Mbps
'BPSK45'	IEEE 802.11j (10 MHz)	BI-Phase shift keying at 4.5 Mbps
'BPSK65'	IEEE 802.11n	BI-Phase shift keying at 6.5 Mbps
'BPSK72'	IEEE 802.11n	BI-Phase shift keying at 7.2 Mbps
'CCK11'	IEEE 802.11b & g (Single Carrier)	Complementary Code Keying at 11 Mbps
'CCK55'	IEEE 802.11b & g (Single Carrier)	Complementary Code Keying at 5.5 Mbps
'DBPSK'	IEEE 802.11b & g (Single Carrier)	Differential BI-Phase shift keying
'DQPSK'	IEEE 802.11b & g (Single Carrier)	Differential Quadrature phase shift keying
'PBCC11'	IEEE 802.11b & g (Single Carrier)	PBCC at 11 Mbps
'PBCC22'	IEEE 802.11g (Single Carrier)	PBCC at 11 Mbps
'PBCC55'	IEEE 802.11b & g (Single Carrier)	PBCC at 5.5 Mbps
'QAM16'	Alias for Quadrature Amplitude Modulation at higher data rate for selected standard	
'QAM64'	Alias for Quadrature Amplitude Modulation at higher data rate for selected standard	
'QAM1612'	IEEE 802.11j (10 MHz)	Quadrature Amplitude Modulation at 12 Mbps
'QAM1618'	IEEE 802.11j (10 MHz)	Quadrature Amplitude Modulation at 18 Mbps
'QAM1624'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	Quadrature Amplitude Modulation at 24 Mbps
'QAM1626'	IEEE 802.11n	Quadrature Amplitude Modulation at 26 Mbps
'QAM1636'	IEEE802.11a,g(OFDM),j(20 MHz)&Turbo	Quadrature Amplitude Modulationat 36 Mbps
'QAM1639'	IEEE 802.11n	Quadrature Amplitude Modulation at 39 Mbps
'QAM6424'	EEE 802.11j (10 MHz)	Quadrature Amplitude Modulation at 24 Mbps
'QAM6427'	IEEE 802.11j (10 MHz)	Quadrature Amplitude Modulation at 27 Mbps
'QAM6448'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	Quadrature Amplitude Modulationat 48 Mbps
'QAM6452'	IEEE 802.11n	Quadrature Amplitude Modulation at 52 Mbps
'QAM6454'	IEEE802.11a,g(OFDM),j(20MHz)&Turbo	Quadrature Amplitude Modulationat 54 Mbps

Parameter	Standard	Description
'QAM6465'	IEEE 802.11n	Quadrature Amplitude Modulation at 65 Mbps
'QAM16289'	IEEE 802.11n	Quadrature Amplitude Modulation at 28.9 Mbps
'QAM16433'	IEEE 802.11n	Quadrature Amplitude Modulation at 43.3 Mbps
'QAM64578'	IEEE 802.11n	Quadrature Amplitude Modulation at 57.8 Mbps
'QAM64585'	IEEE 802.11n	Quadrature Amplitude Modulation at 58.5 Mbps
'QAM64722'	IEEE 802.11n	Quadrature Amplitude Modulation at 72.2 Mbps
'QPSK'	Alias for Quadrature phase shift keying at higher data rate for selected standard	
'QPSK6'	IEEE 802.11j (10 MHz)	Quadrature phase shift keying at 6 Mbps
'QPSK9'	IEEE 802.11j (10 MHz)	Quadrature phase shift keying at 9 Mbps
'QPSK12'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	Quadrature phase shift keying at 12 Mbps
'QPSK13'	IEEE 802.11n	Quadrature phase shift keying at 13 Mbps
'QPSK18'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	Quadrature phase shift keying at 18 Mbps
'QPSK144'	IEEE 802.11n	Quadrature phase shift keying at 14.4 Mbps
'QPSK195'	IEEE 802.11n	Quadrature phase shift keying at 19.5 Mbps
'QPSK217'	IEEE 802.11n	Quadrature phase shift keying at 21.7 Mbps

4.3.16.2 Commands of the SENSe Subsystem (K93)

[SENSe:]BANDwidth:CHANnel <Bandwidth>

This command specifies the channel bandwidth for the signal to be measured. The channel is selected via the `CONFigure:CHANnel` on page 162 command.

Parameters:
<Bandwidth>

Range: 1.25 MHz to 28 MHz
*RST: 1.75 MHz

Example:
```
CONF:CHAN 9
```
Defines the frequency of channel 9 as measurement range.
```
BAND:CHAN 7MHZ
```
Sets a channel bandwidth value of 7 MHz.

Usage: SCPI conform

Mode: OFDM

[SENSe:]BURSt:COUNt <NoBursts>

This command defines the number of bursts that will be analyzed by the measurement.

Parameters:
<NoBursts>
Range: 1 to 10922
*RST: 1
Example: `BURS:COUN 16`
Sets the number of bursts to 16.
Mode: OFDM, OFDMA/WiBro

[SENSe:]BURSt:COUNt:STATe <State>

When this command is set to on, the burst count parameter will be used by the measurement, otherwise the burst count parameter will be ignored.

Parameters:
<State> ON | OFF
*RST: OFF
Example: `BURS:COUN:STAT ON`
Sets the burst count state to ON
Mode: OFDM, OFDMA/WiBro

[SENSe:]DEMod:CESTimation <Standard>

This command defines how channel estimation is performed.

IEEE 802.16-2004 OFDM: The improved channel estimation is used for IQ measurements. The effect of this is most noticeable for the EVM measurement results, where the results will be improved if this feature is enabled. However, this functionality is not supported by the IEEE 802.16-2004 standard and must be disabled if the results are to be strictly measured against the standard.

IEEE 802.16e-2005 OFDMA/WiBro: The channel estimation is performed for downlink signals.

Parameters:

<Mode> ON | OFF | PAYLONLY | PREAMONLY | PREAMPAYL

ON
IEEE 802.16-2004 OFDM: Improved channel estimation is performed

OFF
IEEE 802.16-2004 OFDM: Improved channel estimation is not performed

PAYLONLY
IEEE 802.16e-2005 OFDMA: Channel estimation is performed in the payload only

PREAMONLY
IEEE 802.16e-2005 OFDMA: Channel estimation is performed in the preamble only

PREAMPAYL
IEEE 802.16e-2005 OFDMA: Channel estimation is performed in both the preamble and the payload

*RST: OFF (IEEE 802.16-2004 OFDM) , PREAMPAYL (IEEE 802.16e-2005 OFDMA)

Example: `DEM:CEST ON`
Specifies that the IQ measurement results use improved channel estimation.

Mode: OFDM, OFDMA/WiBro

[SENSe:]DEMod:FILTer:CATalog?

This command reads the names of all available filters. The file names are output without file extension. Syntax of output format: filter_1,filter_2, …, filter_n.

This command is a query only and thus has no *RST value.

Parameters:

*RST: 0

Example: `DEM:FILT:CAT?`
Reads all filter names

Usage: Query only

Mode: OFDM, OFDMA/WiBro

[SENSe:]DEMod:FILTer:MODulation <TXFilter>, <RXFilter>

This command selects the TX and RX filters. The names of the filters correspond to the file names; a query of all available filters is possible by means of the `[SENSe:]DEMod:FILTer:CATalog` on page 205 command.

Parameters:
<TXFilter>, <RXFilter><string>,<string>

*RST: AUTO,AUTO
DEF_TX: default transmit filter, DEF_RX: default receive filter

Example: `DEM:FILT:MOD 'DEF_TX','DEF_RX'`
DEF_TX is selected for the TX filter and DEF_RX for the RX filter

Mode: OFDM, OFDMA/WiBro

[SENSe:]DEMod:FORMat:BANalyze <Modulation>

The remote control command sets the analysis modulation format that will be assumed for the measurement.

If the standard is IEEE 802.16e-2005 OFDMA or WiBro, this command is query only and returns the highest detected modulation format from the last measurement sweep.

Parameters:

<Modulation> BPSK1/2 | QPSK1/2 | QPSK3/4 | 16QAM1/2 | 16QAM3/4 | 64QAM2/3 | 64QAM3/4

BPSK1/2
BI-Phase shift keying (OFDM only)

QPSK1/2
Quadrature phase shift keying

QPSK3/4
Quadrature phase shift keying

16QAM1/2
Quadrature Amplitude Modulation

16QAM3/4
Quadrature Amplitude Modulation

64QAM2/3
Quadrature Amplitude Modulation

64QAM3/4
Quadrature Amplitude Modulation

*RST: 16QAM1/2

Example: `DEM:FORM:BAN '16QAM1/2'`
Only bursts that are of the QAM16 modulation format are analyzed.

Mode: OFDM, OFDMA/WiBro

[SENSe:]DEMod:FORMat:BANalyze:SYMBols:EQUal <State>

If this command is activated only bursts of equal length will take part in the PVT analysis. The number of symbols that a burst must have in order to take part in the PVT analysis are specified by the `[SENSe:]DEMod:FORMat:BANalyze:SYMBols:MIN` on page 207 command.

Parameters:
<State> ON | OFF

*RST: OFF

Example: DEM:FORM:BAN:SYMB:EQU ON
Only bursts of equal length will take part in the PVT analysis.

Mode: OFDM

[SENSe:]DEMod:FORMat:BANalyze:SYMBols:MAX <NoDataSymbols>

This command specifies the maximum number of data symbols required for bursts to qualify for measurement analysis. Only bursts with the specified number of symbols will be used in the measurement analysis. The number of data symbols is defined as the uncoded bits including service and tail bits.

This value will not have any immediate effect if the [SENSe:]DEMod:FORMat:BANalyze:SYMBols:EQUal on page 206 command has been set to ON. In this case, no range of symbols is allowed and only bursts with exactly the number of symbols specified by the [SENSe:]DEMod:FORMat:BANalyze:SYMBols:MIN on page 207 command shall take place in measurement analysis.

Parameters:
<NoDataSymbols>

Range: 1 to 2425
*RST: 64

Example: DEM:FORM:BAN:SYMB:MAX 1300
Only bursts which contain a maximum symbol count of 1300 are analyzed.

Mode: OFDM

[SENSe:]DEMod:FORMat:BANalyze:SYMBols:MIN <NoDataSymbols>

This command specifies the number of data symbols required for bursts to qualify for measurement analysis. Only bursts with the specified number of symbols will be used in the measurement analysis. The number of data symbols is defined as the uncoded bits including service and tail bits.

If the [SENSe:]DEMod:FORMat:BANalyze:SYMBols:EQUal on page 206 command has been set to ON, this command specifies the exact number of symbols required for a burst to take part in measurement analysis. If the [SENSe:]DEMod:FORMat:BANalyze:SYMBols:EQUal on page 206 command is set to OFF, this command specifies the minimum number of symbols required for a burst to take part in measurement analysis.

Parameters:
<NoDataSymbols>

Range: 1 to 2425
*RST: 1

Example: DEM:FORM:BAN:SYMB:MIN 16
Only bursts which contain a symbol count of 16 are analyzed.

Mode: OFDM

[SENSe:]DEMod:FORMat[:BCONtent]:AUTo <Mode>

This command specifies how the signal should be demodulated (OFDM) and whether the DSP should perform a pre-analysis to determine the zone, burst and downlink sub–channel map for the current captured signal prior to calculating the results (OFDMA).

Parameters:

<Mode> NONE | FIRSt | USER | ALL | SIGNal | PREDefined | ULPHY | ULMAP | DLMAP

NONE
Demodulation off (Brute force mode), the specified modulation is used for all bursts.

FIRSt
Retrieves the first valid payload modulation and analyzes all bursts with same modulation.

USER
Analyzes all bursts carrying the modulation specified.

ALL
Retrieves all bursts individual payload modulation and analyzes accordingly.

SIGNal
"OFDMA": pre-analyzes to determine the zone, burst and downlink sub–channel map prior to analyzing the first zone results.
Note: this setting is now referred to as DLMAP

PREDefined
"OFDMA": analyzes using the predefined zone, burst and downlink sub–channel map for the current captured signal for the specified zone results

ULPHY
"OFDMA": the UL data burst in UL subframe is used

ULMAP
"OFDMA": analyzes using UL map, pre-analyzes to determine the zone, burst and uplink sub–channel map prior to analyzing for the zone specified, see `CONFigure:WIMax:FRAMe:ZONEtouse` on page 167

DLMAP
"OFDMA": analyzes using DL map, pre-analyzes to determine the zone, burst and downlink sub–channel map prior to analyzing for the zone specified, see `CONFigure:WIMax:FRAMe:ZONEtouse` on page 167

*RST: ALL

Example:
```
DEM:FORM:AUTO FIRS
```
Specifies that the first symbol field should be decoded.

Mode: OFDM

[SENSe:]FFT:OFFSet <Offset>

This command specifies the FFT start offset relative to the GP centre.

Parameters:

<Offset>

Range: -100 to 100
*RST: 0

Example: `FFT:OFF 0`
Sets the FFT start offset to 0.

Usage: SCPI conform

Mode: OFDMA/WiBro

[SENSe:]FREQuency:CENTer <Frequency>

This command defines the center frequency of the analyzer or the measuring frequency for IQ measurements.

Parameters:

<Frequency> <numeric_value>

Range: 0 to fmax
*RST: 5 GHz
Default unit: Hz
f_{max} is specified in the data sheet. To help analyze signals located at the end of the frequency range, the f_{max} value is extended by 0.05 GHz for direct entry. The preset and maximum values remain unchanged.

Example: `FREQ:CENT 100 MHz`

Mode: OFDMA/WiBro

[SENSe:]POWer:ACHannel:ACPairs <Value>

This command sets the number of adjacent channels (upper and lower channel in pairs).The figure 0 stands for pure channel power measurement.

Parameters:

<Value> 0 to 12 (WCDMA: 0 to 3)

*RST: 1

Example: `POW:ACH:ACP 3`
Sets the number of adjacent channels to 3, i.e. the adjacent channel and alternate adjacent channels 1 and 2 are switched on.

Mode: A-F, CDMA, EVDO, TDS, WCDMA

[SENSe:]POWer:ACHannel:BANDwidth|BWIDth[:CHANnel<channel>]
<Bandwidth>

This command sets the channel bandwidth of the specified TX channel in the radio communication system. The bandwidths of adjacent channels are not influenced by this modification.

With `[SENSe<source>:]POWer:HSPeed` set to ON, steep-edged channel filters are available. For further information on filters refer to the "List of Available RRC and Channel Filters" in the base unit description.

Parameters:

<Bandwidth> 100 Hz to 1000 MHz

*RST: 14 kHz

Example: `POW:ACH:BWID:CHAN2 30 kHz`
Sets the bandwidth of the TX channel 2 to 30 kHz.

Mode: A-F, CDMA, EVDO, OFDM, OFDMA/WiBro, TDS, WCDMA

[SENSe:]POWer:ACHannel:BANDwidth|BWIDth:ACHannel <Bandwidth>

This command defines the channel bandwidth of the adjacent channel of the radio transmission system. If the bandwidth of the adjacent channel is changed, the bandwidths of all alternate adjacent channels are automatically set to the same value.

With `[SENSe<source>:]POWer:HSPeed` set to ON, steep-edged channel filters are available. For further information on filters refer to the "List of Available RRC and Channel Filters" in the base unit description.

Parameters:

<Bandwidth> 100 Hz to 1000 MHz

*RST: 14 kHz

Example: `POW:ACH:BWID:ACH 30 kHz`
Sets the bandwidth of all adjacent channels to 30 kHz.

Mode: A-F, CDMA, EVDO, OFDM, OFDMA/WiBro, TDS, WCDMA

[SENSe:]POWer:ACHannel:BANDwidth|BWIDth:ALTernate<channel>
<Bandwidth>

This command defines the channel bandwidth of the first to fourth alternate adjacent channel of the system.

Suffix:

<Channel> 1...4

Parameters:

<Bandwidth>

Range: 0 Hz to 100 GHz

Example: `POW:ACH:BAND:ALT2 30kHz`
Sets the bandwidth of the second alternate adjacent channel to 30 kHz.

Mode: OFDM, OFDMA/WiBro

[SENSe:]POWer:ACHannel:MODE <Mode>

This command switches between absolute and relative adjacent channel measurement. The command is only available with span > 0 and if the number of adjacent channels is greater than 0.

Parameters:

<Mode> ABSolute | RELative

ABSolute
absolute adjacent channel measurement

RELative
relative adjacent channel measurement

*RST: RELative

Example: `POW:ACH:MODE REL`
Sets the adjacent channel measurement mode to relative.

Mode: A-F, CDMA, EVDO, OFDM, OFDMA/WiBro, WCDMA, TDS

[SENSe:]POWer:ACHannel:SPACing[:ACHannel] <Value>

This command defines the spacing between the carrier signal and the adjacent channel (ADJ). The modification of the adjacent-channel spacing (ADJ) causes a change in all higher adjacent-channel spacings (ALT1, ALT2, ...): they are all multiplied by the same factor (new spacing value/old spacing value).

Parameters:

<Value> 100 Hz to 2000 MHz

*RST: 14 kHz

Example: `POW:ACH:SPAC 33kHz`
Sets the spacing between the carrier signal and the adjacent channel to 33 kHz, the alternate adjacent channel 1 to 66 kHz, the alternate adjacent channel 2 to 99 kHz, and so on.

Mode: A-F, CDMA, EVDO, OFDM, OFDMA/WiBro, TDS, WCDMA

[SENSe:]POWer:ACHannel:SPACing:ALTernate<channel> <Spacing>

This command defines the channel spacing of the first to fourth alternate adjacent channel to the TX channel.

Suffix:

<channel> 1...4
the alternate adjacent channel

Parameters:

<Spacing>

Range: 0 Hz to 100 GHz

Example: `POW:ACH:SPAC:ALT1 100kHz`
Sets the spacing between TX channel and first alternate adjacent channel to 100 kHz.

Mode: OFDM, OFDMA/WiBro

[SENSe:]POWer:SEM <Mode>

This command sets the behaviour of the Spectrum Emission Mask (SEM) analysis to use a specific configuration:

Parameters:

<Mode> User | Standard | IEEE | ETSI

User
Analysis according to a user-defined configuration

Standard
Analysis according to the TTA standard (WiBro only)

IEEE
Analysis according to the ETSI standard (OFDM/OFDMA only)

ETSI
Analysis according to the IEEE standard (OFDM/OFDMA only)

*RST: 0

Example: `POW:SEM USER`
Sets the SEM configuration according to a user defined configuration.

Mode: OFDM, OFDMA/WiBro

[SENSe:]POWer:SEM:CLASs <Class>

This command sets the Spectrum Emission Mask (SEM) power class.

Parameters:

<Class> 0 | 1 | 2 | 3

0
automatic selection

1
(-INF, 23) dBm for uplink, (-INF, 29) dBm for downlink

2
(23, INF) dBm for uplink, (29, 40) dBm for downlink

3
(40, INF) dBm for downlink

*RST: 0

Example: `POW:SEM:CLAS 0`
Sets the SEM power class to automatic.

Mode: OFDM, OFDMA/WiBro

[SENSe:]POWer:SEM:MODe <Mode>

This command sets the Spectrum Emission Mask (SEM) analysis to be UL or DL (uplink or downlink).This command only available for WiBro standard.

Parameters:

<Mode> DL | UL

Example: `POW:SEM:MOD UL`
Sets the Spectrum Emission Mask analysis to be UL.

Mode: OFDM, OFDMA/WiBro

[SENSe:]POWer:SEM:TTA <Type>

This command sets the Spectrum Emission Mask (SEM) analysis according to TTA standard or a user defined mask.

Parameters:
<Type> USER | STANDARD

*RST: STANDARD

Example: `POW:SEM:TTA STANDARD`
Sets the SEM analysis according to TTA standard.

Mode: WiBro

[SENSe:]SUBChannel <Subchannel>

This command sets the subchannel to be used in the measurement. It is only available in Up Link mode.

Parameters:
<Subchannel>

Range: 1 to 31

Example: `SUBC 12`
Sets the subchannel to 12.

Mode: OFDMA/WiBro

[SENSe:]SUBChannel:STATe <State>

This command enables or disables the use of subchannels in the measurement analysis. It is only available in Up Link mode.

Parameters:
<State> ON | OFF

*RST: OFF

Example: `SUBC:STAT ON`
Specifies that the measurement will be analyzed using the specified SUBChannel.

Usage: SCPI conform

Mode: OFDMA/WiBro

[SENSe:]SUBChannel:ULPHysmod <Modifier>

This command sets the Up Link Physical Modifier to be used in the measurement. It is only available in Up Link mode.

Parameters:
<Modifier>
Range: 0 to 255
Example: `SUBC:ULPH 1`
Sets the UL Physical Modifier to 1.
Mode: OFDMA/WiBro

[SENSe:]SWAPiq <State>

This command defines whether or not the recorded IQ pairs should be swapped (I<->Q) before being processed. Swapping I and Q inverts the sideband.

Parameters:
<State> ON | OFF

ON
I and Q are exchanged, inverted sideband, Q+j*I

OFF
Normal sideband, I+j*Q,

*RST: OFF
Example: `SWAP ON`
Specifies that IQ values should be swapped.
Mode: WLAN, GSM, OFDM, OFDMA/WiBro

[SENSe:]SWEep:ACPR:TIME <Time>

This command specifies the sweep time for the Spectrum Mask and Spectrum ACP/ ACPR measurements.

Parameters:
<Time>
Range: 10 ms to 16000 s
*RST: 2s
Example: `SWE:ACPR:TIME:AUTO OFF`
Deactivates the automatic calculation of the sweep time.
`SWE:ACPR:TIME 100S`
Sets the sweep time to 100 s.
Usage: SCPI conform
Mode: OFDM, OFDMA/WiBro

[SENSe:]SWEep:ACPR:TIME:AUTO <State>

This command activates or deactivates the automatic calculation of the sweep time for the Spectrum Mask and Spectrum ACP/ACPR measurements.

Parameters:
<State> ON | OFF

*RST: ON

Example: `SWE:ACPR:TIME:AUTO OFF`
Deactivates the automatic calculation of the sweep time.

Usage: SCPI conform

Mode: OFDM, OFDMA/WiBro

[SENSe:]SWEep:COUNt <NoSweeps>

This command specifies the number of sweeps for Spectrum Mask and Spectrum ACPR measurements.

Parameters:
<NoSweeps>
Range: 1 to 32767
*RST: 1

Example: `SWE:COUNt 64`
Sets the number of sweeps to 64.

Usage: SCPI conform

Mode: OFDM, OFDMA/WiBro

[SENSe:]SWEep:EGATe <State>

This command switches on/off the sweep control by an external gate signal. If the external gate is selected the trigger source is automatically switched to EXTernal as well.

In case of measurement with external gate, the measured values are recorded as long as the gate is opened. During a sweep the gate can be opened and closed several times. The synchronization mechanisms with *OPC, *OPC? and *WAI remain completely unaffected.

The sweep end is detected when the required number of measurement points (691 in "Spectrum" mode) has been recorded.

Parameters:
<State> ON | OFF

*RST: OFF

Example: `SWE:EGAT ON`
Switches on the external gate mode.
`SWE:EGAT:TYPE EDGE`
Switches on the edge-triggered mode.
`SWE:EGAT:HOLD 100US`
Sets the gate delay to 100 µs.
`SWE:EGAT:LEN 500US`
Sets the gate opening time to 500 µs.
`INIT;*WAI`
Starts a sweep and waits for its end.

Mode: A, BT, EVDO, TDS, WLAN, OFDM, OFDMA/WiBro

[SENSe:]SWEep:EGATe:HOLDoff[:TIME] <DelayTime>

This command defines the gate delay in the capture buffer in time units.

Parameters:
<DelayTime>
Range: 0 to 262.14
*RST: 0 s
Default unit: ms

Example: `SWE:EGAT:HOLD 125us`
Sets a delay of 125 µs in the capture buffer.

Mode: OFDM, OFDMA/WiBro

[SENSe:]SWEep:EGATe:HOLDoff:SAMPle <NoSamples>

This command defines the gate delay in the capture buffer as a number of samples.

Parameters:
<NoSamples>
Range: 0 to 50E6
*RST: 0

Example: `SWE:EGAT:HOLD:SAMP 2500`
Sets a delay of 2500 samples in the capture buffer.

Mode: OFDM, OFDMA/WiBro

[SENSe:]SWEep:EGATe:LENGth[:TIME] <Time>

This command defines the gate time in the capture buffer in time units.

Parameters:
<Time>
Range: 0 to 262.14
*RST: 0
Default unit: ms

Example: `SWE:EGAT:LENG 100ms`
Sets a gate length of 100 milliseconds between sweeps.

Mode: OFDM, OFDMA/WiBro

[SENSe:]SWEep:EGATe:LENGth:SAMPle <NoSamples>

This command defines the gate time in the capture buffer as a number of samples.

Parameters:
<NoSamples>
Range: 0 to 50E6
*RST: 0

Example: `SWE:EGAT:LENG:SAMP 2000000`
Enforces a gate length of 2000000 samples in the capture buffer.

Mode: OFDM, OFDMA/WiBro

[SENSe:]SWEep:EGATe:LINK <State>

This command links together the movement of the gating lines and the capture buffer marker.

Parameters:

<State> ON | OFF

*RST: 0

Example: `SWE:EGAT:LINK ON`
Keeps the capture buffer marker on the centre of the gating lines if the gating line delay and length are changed.

Mode: OFDM, OFDMA/WiBro

[SENSe:]SWEep:TIME <Time>

This command defines the sweep time. The available time values vary depending on the span setting.

If the sweep time is programmed directly using this command, automatic coupling to resolution bandwidth and video bandwidth is switched off.

Parameters:

<Time>

Range: 24 µs to 15.5 ms
*RST: 24 µs (AUTO is set to ON)

Example: `SWE:TIME 10s`

Mode: OFDM, OFDMA/WiBro

[SENSe:]TRACking:CESTimation[:BASE] <Mode>

This command defines whether or not the reference signal is compensated with the user set tracking options (USERtracked) or with all tracking options being set (FULLytracked). In case USERtracked is specified then the tracking options according to the user selection (Phase, Timing, Level) are applied to generate the reference signal. In case FULLytracked is specified then all tracking options are applied (Phase, Timing, Level) to generate the reference signal. This option is not available if the Channel Estimation Range for downlink is set to "Preamble Only". In this case the user defined tracking options are used.

Parameters:

<Mode> USERtracked|FULLytracked

*RST: USER

Example: TRAC:CEST USER
Specifies that the measurement results should be compensated for level.

Usage: SCPI conform

Mode: OFDMA

[SENSe:]TRACking:LEVel <State>

This command defines whether or not the measurement results should be compensated for level.

Parameters:

<State> ON | OFF

*RST: OFF

Example: `TRAC:LEV ON`
Specifies that the measurement results should be compensated for level.

Usage: SCPI conform

Mode: OFDM

[SENSe:]TRACking:PHASe <State>

This command defines whether or not the measurement results should be compensated for phase.

Parameters:

<State> ON | OFF

*RST: ON

Example: `TRAC:PHAS ON`
Specifies that the measurement results should be compensated for phase.

Usage: SCPI conform

Mode: OFDM, OFDMA/WiBro

[SENSe:]TRACking:PILot <Mode>

This command defines whether the measurement results should have predefined pilot tracking or whether the tracking should be determined when the measurement is run.

Parameters:

<Mode> PRED | DET

PRED
Predefined pilot tracking is used.

DET
Pilot tracking is determined when the measurement is run.

*RST: PRED

Example: `TRAC:PIL DET`
Pilot tracking is determined when the measurement is run.

Usage: SCPI conform

Mode: OFDMA/WiBro

[SENSe:]TRACking:TIME <State>

This command defines whether or not the measurement results should be compensated for time.

Parameters:

<State> ON | OFF

*RST: OFF

Example: `TRAC:TIME ON`
Specifies that the measurement results should be compensated for time.

Usage: SCPI conform

Mode: OFDM, OFDMA/WiBro

[SENSe:]ZONE:COUNt <Number>

Defines or queries the number of zones that are to be analyzed by the measurement.

Parameters:

<Number> 0 | 1

*RST: 1

Example: `ZONE:COUN 16`
Sets the number of zones to 16.

Mode: OFDMA/WiBro

[SENSe:]ZONE:COUNt:STATe <State>

When activated, the zone count parameter is used by the measurement, otherwise the zone count parameter is ignored..

Parameters:

<State> 0 | 1

*RST: 0

Example: `ZONE:COUN:STAT 1`
Activates the zone count.

Mode: OFDMA/WiBro

4.3.17 STATus Subsystem (WiMAX, K93)

The STATus subsystem contains the commands for the status reporting system.

For the `STATus:QUEStionable:LIMit` register, the measurement window is selected by LIMit 1 (screen A) or 2 (screen B). *RST does not influence the status registers.

For details see the description of the STATus subsystem in the base unit.

4.3.18 SYSTEM Subsystem (WiMAX, K93)

This subsystem contains a series of commands for general functions.

Commands of the SYSTEM Subsystem

SYSTem:COMMunicate:TCPip:ADDRess <Address>

This command sets the lookup TCP/IP address of an external R&S SMU signal generator connected via TCP/IP. This enables the instrument to download the frame zone setup directly.

Parameters:

<Address> <string>

Example: `SYST:COMM:TCP:ADDR 192.168.1.1`
Sets the lookup TCP/IP address of the SMU to 192.168.1.1.

Mode: OFDMA/WiBro

4.3.19 TRACe Subsystem (WiMAX, K93)

The TRACe subsystem controls access to the instrument's internal trace memory. The format of the returned data depends on the measurement type performed and is described in the subsequent chapters.

4.3.19.1 TRACe commands

TRACe[:DATA]? <ResultType>

This command returns all the measured data that relates to the currently selected measurement type. All results are returned in ASCII format. The returned data depends on the currently selected measurement type. `DISPlay:FORMat` is not supported with this command.

The following measurement types are available:

- chapter 4.3.19.2, "Constellation vs Symbol", on page 222
- chapter 4.3.19.3, "Constellation vs Carrier", on page 223
- chapter 4.3.19.4, "Power vs Time – Full Burst and Start / End Data", on page 223
- chapter 4.3.19.5, "Power vs Time – Full Subframe and Rising/Falling Subframe", on page 223
- chapter 4.3.19.6, "Spectrum Flatness/Group Delay/Flatness Difference", on page 224
- chapter 4.3.19.7, "Spectrum FFT", on page 225
- chapter 4.3.19.8, "Statistics Bitstream Data", on page 225
- chapter 4.3.19.9, "Statistics Burst Summary Data", on page 225
- chapter 4.3.19.10, "Statistics CCDF – Complementary Cumulative Distribution Function", on page 227
- chapter 4.3.19.11, "EVM vs Carrier", on page 227
- chapter 4.3.19.12, "EVM vs Symbol", on page 228
- chapter 4.3.19.13, "Frequency Sweep Measurements", on page 228
- chapter 4.3.19.14, "Spectrum Mask", on page 228
- chapter 4.3.19.15, "Spectrum ACPR", on page 229

Query parameters:

<ResultType> TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | LIST

For details on the parameters refer to the corresponding measurement type (see list above).

Example: `TRAC? TRACE2`
The measurement data for the selected graph is returned.

Usage: Query only
SCPI conform

Mode: OFDM, OFDMA/WiBro

TRACe:IQ:SRATe <SampleRate>

This command allows the sample rate for IQ measurements to be specified.

Parameters:
<SampleRate>
Range: 1440000 to 32.248E6 Hz
Example: `TRAC:IQ:SRAT 2000000`
Specifies a sample rate of 20 MHz.
Mode: OFDM, OFDMA/WiBro

TRACe:IQ:DATA:MEMory ? <OffsetSa>, <NoSamples>

Returns all the I/Q data associated with the measurement acquisition time. The result values are scaled linearly in Volts and correspond to the voltage at the RF input of the instrument. The command returns a comma-separated list of the measured voltage values in floating point format (Comma Separated Values = CSV). The number of values returned is 2 * the number of samples, the first half being the I values, the second half the Q values.

Query parameters:
<OffsetSa> Offset of the values to be read related to the start of the acquired data.
Range: 0 to <NoSamples>
*RST: RST value
<NoSamples> Number of measurement values to be read.
Range: 1 to (<NoSamples>-<OffsetSa>)
*RST: RST value
Example: `TRAC:IQ:DATA:MEM? 0,2000`
Requests first 2000 samples.
Usage: Query only
Mode: WLAN, OFDM, OFDMA/WiBro

4.3.19.2 Constellation vs Symbol

This measurement represents I and Q data. Data will be returned as a repeating array of interleaved I and Q data in groups of selected carriers, until all the data is exhausted.

Each I and Q point will be returned in floating point format. TRACE1 is used for this measurement results.

For the IEEE 802.16e-2005 OFDMA standard, the following rule applies: For all symbols, the results are returned in repeating groups of the FFT size. For example, if the FFT size was 1024 and 12 symbols were found, then 12288 I/Q pairs worth of data would be returned. Carriers that do not exist or are filtered out by the current filter settings are denoted by the keyword **NAN**.

4.3.19.3 Constellation vs Carrier

This measurement represents I and Q data. Data will be returned as a repeating array of interleaved I and Q data in groups of 53 channels including the channel 0, until all the data is exhausted.

Each I and Q point will be returned in floating point format. TRACE1 is used for this measurement results.

4.3.19.4 Power vs Time – Full Burst and Start / End Data

This description applies to measurement results from the IEEE 802.16-2004 OFDM standard.

Both measurement results are once again simply slightly different views of the same results data.

All fully complete bursts within the capture time are analyzed. This data is returned in dBm values on a per sample basis. Each sample will in some way relate to an analysis of each corresponding sample within each processed burst.

The type of PVT data returned will be determined by the TRACE number passed as an argument to the SCPI command, in addition to the graphic type that is selected.

If the graphic type selected is full burst, then the return data is as follows.

TRACE1	full burst, burst data values

If the graphic type selected is rising/falling, then the return data is as follows.

TRACE1	start, burst data values
TRACE2	end, burst data values

The number of samples returned during full burst analysis will depend on the modulation type and will typically be 5000.

The number of samples returned when the rising and falling graphic type is selected will be less than what is returned for full burst and will be approximately 400 samples. The samples will be returned in floating point format as a single sequence of comma delimited values.

4.3.19.5 Power vs Time – Full Subframe and Rising/Falling Subframe

This description applies to measurement results from the IEEE 802.16e-2005 standard.

Both measurement results are once again simply slightly different views of the same results data.

All fully complete frames within the capture time are analyzed into three master frames. The three master frames relate to the minimum, maximum and average values across all complete frames. This data is returned in dBm values on a per sample basis. Each

sample will in some way relate to an analysis of each corresponding sample within each processed frame.

The type of PVT data returned will be determined by the TRACE number passed as an argument to the SCPI command, in addition to the graphic type that is selected.

If the graphic type selected is full burst, then the return data is as follows.

TRACE1	full subframe, minimum frame data values
TRACE2	full subframe, mean frame data values
TRACE3	full subframe, maximum frame data values

If the graphic type selected is rising/falling, then the return data is as follows.

TRACE1	rising edge, minimum frame data values
TRACE2	rising edge, mean frame data values
TRACE3	rising edge, maximum frame data values
TRACE4	falling edge, minimum frame data values
TRACE5	falling edge, mean frame data values
TRACE6	falling edge, maximum frame data values

The number of samples returned during full frame analysis will depend on the modulation type and will typically be 5000.

The number of samples returned when the start/end graphic type is selected will be less than what is returned for full burst and will be approximately 400 samples. The samples will be returned in floating point format as a single sequence of comma delimited values.

4.3.19.6 Spectrum Flatness/Group Delay/Flatness Difference

There are three separate traces that are available with this measurements. Trace data for a particular trace will only be returnable by querying the appropriate trace.

All traces are all plotted on a per carrier basis. All carriers are drawn in addition to the unused 0 carrier.

Carriers that are not used are denoted by the keyword **NAN**.

For example, the return data will be a repeating group of 201 carriers for the IEEE 802.16-2004 ODFM standard.

TRACE1	Minimum absolute power value (ABS) or Minimum group delay values
TRACE2	Mean absolute power value (ABS) or Mean group delay values or
TRACE3	Maximum absolute power value (ABS) or Maximum group delay values or

Absolute power results are returned in dB or dB difference and group delay results are returned in ns.

4.3.19.7 Spectrum FFT

All FFT points will be returned if the data for this measurement is requested. This will be an exhaustive call, due to the fact that there are nearly always more FFT points than IQ samples. The number of FFT points is the number presented by a power of 2 that is higher than the total number of samples.

E.g. if there were 20000 samples, then 32768 FFT points would be returned.

Data will be returned in floating point format in dBm. TRACE1 is used for this measurement results.

4.3.19.8 Statistics Bitstream Data

Data will be returned depending on the selected standard from which the measurement was executed:

- For the IEEE 802.16-2004 OFDM standard, data is returned in repeating groups of 200 data channels where each symbol value will be represented by an integer value within one byte. Channel 0 is unused and will therefore not have any data associated with it, with no return data being provided.
- For the IEEE 802.16e-2005 OFDMA standard, the data is returned in groups of the selected FFT size, where each symbol value will be represented by an integer value within one byte. The FFT size is either 128, 512, 1024, or 2048 sub carriers. Unused carriers, including the zero carrier, are also returned. They are denoted by the string value **NAN**.

The number of repeating groups that are returned will be equal to the number of measured symbols.

64QAM has the highest data rate and it contains symbol values up to 63, making one byte sufficient in size to represent all symbol data values, regardless of the modulation type in use.

Data will be returned in ASCII printable hexadecimal character format. TRACE1 is used for this measurement results.

4.3.19.9 Statistics Burst Summary Data

The return data depends on the current standard and measurement results.

For the IEEE 802.16-2004 OFDM standard, the data will be returned in repeating groups of 6 comma separated values as follows:

- 1st value – burst number
  If this value is 0 then it is an FCH burst.
- 2nd value – area with:
  0 = preamble

1 = data

- 3rd value – modulation with:
  0 = BPSK
  1 = QPSK
  2 = 16QAM
  3 = 64QAM
- 4th value – symbol length
  This is an integer value giving the number of symbols in the current area.
- 5th value – power in dBm for the current area
  This is returned as a float
- 6th value – EVM in dB for the current area
  This is returned as a float.

Example:

Burst	Area	Modulation	Length	Power	EVM
FCH	Preamble	QPSK	1	-1.96	-43.75
	Data	BPSK	1	-2.96	-33.75
Burst 2	Preamble	QPSK	1	-3.96	-23.75
	Data	64QAM	26	-4.96	-13.75

SCPI would return the following:

B|A|M|L |P |E

u|r|o|e |o |V

r|e|d|n |w |M

s|a| | |e |

t| | | |r |

0,0,1, 1,-1.96,-43.75,

0,1,0, 1,-2.96,-33.75,

2,0,1, 1,-3.96,-23.75,

2,1,3,26,-4.96,-13.75

The number of repeating groups that are returned will be equal to the number of rows in the Burst Summary results.

For the IEEE 802.16e-2005 OFDMA standard, the data will be returned in repeating groups of 7 comma separated values as follows:

- 1st value – subframe number
- 2nd value – burst number
- 3rd value – burst type:
  1 = FCH
  2 = DL map
  3 = UL map

4 = data

- 4th value – modulation where:
  1 = QPSK
  2 = 16QAM
  3 = 64QAM
- 5th value – number of slots
  This is an integer value giving the number of slots associated with the burst.
- 6th value – power in dBm for the current area
  This is returned as a float.
- 7th value – EVM in dB for the current area
  This is returned as a float.

The number of repeating groups that are returned will be equal to the number of rows in the Burst Summary results.

Data will be returned in ASCII printable hexadecimal character format. TRACE1 is used for this measurement results.

4.3.19.10 Statistics CCDF – Complementary Cumulative Distribution Function

Up to a maximum of 201 data points will be returned in addition to a data count value. The first value in the return data will represent the quantity of probability values that follow. Each of the potential 201 data points will be returned as probability value and will represent the total number of samples that are equal to or exceed the corresponding power level. Probability data will be returned up to the power level that contains at least one sample. It is highly unlikely that the full 201 data values will ever be returned.

Each probability value will be returned as a floating point number, with a value less than 1.

4.3.19.11 EVM vs Carrier

Two trace types are provided with this measurement. There is an average EVM value for each of the 53 channels or a repeating group of EVM values for each channel. The number of repeating groups will correspond to the number of fully analyzed trains.

Each EVM value will be returned as a floating point number, expressed in units of dBm.

TRACE1	Average EVM values per channel
TRACE2	All EVM values per channel for each full train of the capture period

For the IEEE 802.16e-2005 standard, the number of sub carriers returned varies according to the FFT size.

Each EVM value will be returned as a floating point number, expressed in units of dBm or percentage.

TRACE1	Minimum EVM values
TRACE2	Mean EVM values
TRACE3	Maximum EVM values

4.3.19.12 EVM vs Symbol

Three traces types are available with this measurement. The basic trace types show either the minimum, mean or maximum EVM value, as measured over the complete capture period.

The number of repeating groups that are returned will be equal to the number of measured symbols.

Each EVM value will be returned as a floating point number, expressed in units of dBm.

TRACE1	Minimum EVM values
TRACE2	Mean EVM values
TRACE3	Maximum EVM values

4.3.19.13 Frequency Sweep Measurements

Currently, there is only one measurement that is performed in frequency sweep mode. This is the Spectrum Mask measurement. No data will be returned for this measurement, should it be requested, until such time as a measurement has been previously run.

Running an IQ measurement will not generate results for this type of measurement.

4.3.19.14 Spectrum Mask

Result data will be returned as 501 trace points in floating point format. These trace points are obtained directly from the base system via the measurement API and the quantity is therefore a fixed value. Only an array of Y data will be returned.

TRACE1	Clear write values
TRACE2	Max hold values
LIST	Spectrum Emission Mask (SEM) summary results (in WiBro standard only):

SEM summary results formats:

1st value	index into table of results (1 – 9)
2nd value	start frequency band (Hz)
3rd value	stop frequency band (Hz)
4th value	RBW (Hz)
5th value	limit fail frequency (Hz)

6th value	power absolute (dBm)
7th value	power relative (dBc)
8th value	limit distance (dB)
9th value	failure flag (1 = fail, 0 = pass)

There are 5 rows of results for downlink, and 9 rows for uplink.

4.3.19.15 Spectrum ACPR

Result data will be returned as 501 trace points in floating point format. These trace points are obtained directly from the base system via the measurement API and the quantity is therefore a fixed value. Only an array of Y data will be returned.

TRACE1	Clear write values
TRACE2	Max hold values

4.3.20 TRIGger Subsystem (WiMAX, K93)

The trigger subsystem is used to synchronize device action(s) with events.

Commands of the TRIGger Subsystem

TRIGger[:SEQuence]:HOLDoff <DelayTime>

This command defines the length of the trigger delay. A negative delay time (pretrigger) can be set in zero span only.

Parameters:
<DelayTime>

Range: -3.25 to 837.33
*RST: 0 s
Default unit: ms

Example: `TRIG:HOLD 500us`
A holdoff period of 500 µs is used after the trigger condition has been met.

Usage: SCPI conform

Mode: OFDM, OFDMA/WiBro

TRIGger<n>[:SEQuence]:IFPower:HOLDoff <Value>

This command sets the holding time before the next IF power trigger event.

Suffix:
<n> irrelevant

Parameters:
<Value> <numeric_value> in s: 150 ns to 1000 s

*RST: 150 ns

Example: `TRIG:SOUR IFP`
Sets the IF power trigger source.
`TRIG:IFP:HOLD 200 ns`
Sets the holding time to 200 ns.

Mode: A-F, ADEMOD, CDMA, EVDO, GSM, VSA, OFDM, OFDMA/ WiBro, TDS, WCDMA

TRIGger<n>[:SEQuence]:IFPower:HYSTeresis <Value>

This command sets the limit that the hysteresis value for the IF power trigger has to fall below in order to trigger the next measurement.

Suffix:
<n> irrelevant

Parameters:
<Value> <numeric_value> in dB: 3 dB to 50 dB

*RST: 3 dB

Example: `TRIG:SOUR IFP`
Sets the IF power trigger source.
`TRIG:IFP:HYST 10DB`
Sets the hysteresis limit value.

Mode: ALL

TRIGger<n>[:SEQuence]:LEVel[:EXTernal] <TriggerLevel>

This command sets the level of the external trigger source in Volt.

Suffix:
<n> irrelevant

Parameters:
<TriggerLevel>

Range: 0.5 V to 3.5 V
*RST: 1.4 V

Example: `TRIG:LEV 2V`

Mode: All

TRIGger[:SEQuence]:LEVel:POWer <Level>

This command sets the level of the input signal for which triggering will occur.

Parameters:
<Level>
Range: -50 to 20
*RST: -20 DBM
Default unit: dBm

Example: `TRIG:MODE POW`
Sets the external trigger mode.
`TRIG:LEV:POW 10 DBM`
Sets the level to 10 dBm for RF measurement.

Mode: OFDM, OFDMA/WiBro

TRIGger[:SEQuence]:LEVel:POWer:AUTO <State>

This command specifies whether or not an automatic power trigger level calculation is performed before each main measurement. The setting of this command is ignored if the setting for the `TRIGger<n>[:SEQuence]:LEVel[:EXTernal]` command is not "POWer".

Parameters:
<State> ON | OFF

*RST: OFF

Example: `TRIG:LEV:POW:AUTO ON`
Specifies that an automatic power trigger level calculation should be performed before the start of each main measurement.

Mode: OFDM, OFDMA/WiBro

TRIGger[:SEQuence]:MODE <Mode>

This command configures how triggering is to be performed.

Parameters:
<Mode> IMMediate | EXTernal | POWer

IMMediate
No triggering is performed. This corresponds to the Free Run trigger mode.

EXTernal
The next measurement is triggered by the signal at the external trigger input e.g. a gated trigger.

POWer
The next measurement is triggered by signals outside the measurement channel.

*RST: IMMediate

Example: `TRIG:MODE IMM`
No triggering is performed.

Mode: OFDM, OFDMA/WiBro

TRIGger<n>[:SEQuence]:SOURce <Source>

This command selects the trigger source for the start of a sweep.

Suffix:

<n> irrelevant

Parameters:

<Source> IMMediate | EXTern | IFPower | TIME | VIDeo | BBPower

IMMediate
Free Run

EXTern
External trigger

RFPower
First intermediate frequency
For Spectrum mode and options R&S FSV-K7, -K7s, -K91, -K93, -K100 only

IFPower
Second intermediate frequency

VIDeo
Video mode is only available in the time domain and only in Spectrum mode.

BBPower
Baseband power (for digital input via the Digital Baseband Interface, R&S FSV-B17)

*RST: IMMediate

Example: `TRIG:SOUR EXT`
Selects the external trigger input as source of the trigger signal

Mode: ALL

4.3.21 UNIT Subsystem (WiMAX, K93)

The unit subsystem specifies the units for the specific result types.

Commands of the UNIT Subsystem:

- `UNIT:EVM` on page 232
- `UNIT:PREamble` on page 233
- `UNIT:TABLe` on page 233

UNIT:EVM <Unit>

This command specifies the units for EVM results.

Parameters:

<Unit> DB | PCT

DB
EVM results returned in dB

PCT
EVM results returned in %

*RST: DB

Example: `UNIT:EVM PCT`
EVM results to be returned in %.

Mode: OFDM, OFDMA/WiBro

UNIT:PREamble <Unit>

This command specifies the units for Preamble error results.

Parameters:

<Unit> HZ | DEG

HZ
Preamble error results returned in Hz

DEG
Preamble error results returned in degrees

*RST: Hz

Example: `UNIT:PRE HZ`
Preamble error results to be returned in Hz.

Mode: OFDM, OFDMA/WiBro

UNIT:TABLe <Unit>

This command specifies the parameters of the result summary that can be displayed as dB or degrees.

Parameters:

<Unit> DB | PCT

DB
results returned in dB

PCT
results returned in %

*RST: DB

Example: `UNIT:TABL DB`
Results to be returned in dB.

Mode: OFDM, OFDMA/WiBro

List of Commands

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