ROHDE&SCHWARZ

Test and Measurement
Division

Release Notes

WIMAX, WIBRO

Application Firmware R&S FSQ-K92/K93

Release 4.20

for R&S FSQ, FSG Analyzer Firmware V4.2x

New Features:

- **Support for new instrument model R&S FSG**
- **Trace data via remote control available in binary format**
- **Results display pages selectable via SCPI command.**
- **Channel Estimation selection configurable by the user.**

Release Note Revision: 2

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Contents

History

Date	Rel Note Rev	Changes
25 July 2007	1	First revision for WIMAX Application Firmware 4.20.
16 August 2007	2	FSQ added.

General Topics

Compatibility of the R&S FSQ-K92/K93 WIMAX Application Firmware with other Firmware Releases

The following table shows the compatible versions of the basic analyzer firmware and the WIMAX Application Firmware.

Note: V3.90SP2 was the last release of the K92-only firmware. All releases from V3.91 onwards are of the combined K92/K93 firmware.

Table of compatible versions:

R&S FSQ-K92 Application Firmware	R&S FSQ-K92/K93 Application Firmware	R&S FSQ Basic Firmware	R&S FSG Basic Firmware
-	4.20	4.25	4.29
-	4.10	4.15	-
-	4.00	4.05	-
-	3.91	3.95SP2	-
3.90SP2	-	3.95SP2	-
3.90SP1	-	3.95SP1	-
3.90	-	3.95	-
3.80	-	3.85	-
3.72	-	3.75	-
3.70	-	3.75	-
3.61	-	3.65	-
3.60	-	3.65	-
3.55	-	3.55	-

Firmware Update of the R&S FSQ-K92/K93 WIMAX Application Firmware

The R&S FSQ-K92/K93 WIMAX Application Firmware package is available with its own version number. This application firmware package requires an appropriate basic instrument firmware version. Compatible revisions are shown in the table above.

Please make sure to have the correct basic firmware version installed prior to installing the R&S FSQ-K92/K93 WIMAX Application Firmware. Please refer to the basic firmware version release notes for firmware update information of the basic firmware.

Generation of the update disk set for R&S FSQ-K92/K93 WIMAX Application Firmware

The files needed for the R&S FSQ-K92/K93 WIMAX Application Firmware update are available in the FIRMWARE section of the Service Board on GLORIS (R&S FSQ-K92).

If you already have the update disk set you can skip this paragraph.

They are grouped according to the disk contents:

Disk 1:	disk1.bin	(self-extracting ZIP file)
Disk 2:	data3.cab	(packed contents of disk 2, will be automatically unpacked by FW update)
Disk 3:	data4.cab	(packed contents of disk 3, will be automatically unpacked by FW update)
Disk 4:	data5.cab	(packed contents of disk 4, will be automatically unpacked by FW update)
Disk 5:	data6.cab	(packed contents of disk 5, will be automatically unpacked by FW update)
Disk 6:	data7.cab	(packed contents of disk 6, will be automatically unpacked by FW update)

The contents of disk 1 are packed in a self-extracting ZIP file and need to be unzipped. For this purpose the following steps are necessary:

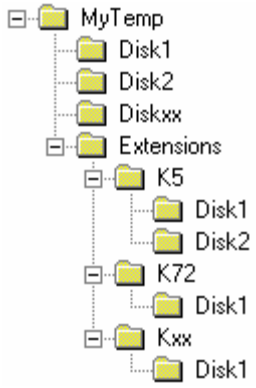
1. Create a temporary directory on your local PC (e.g. MyTemp\Extensions\K92 on drive C:)
2. Copy disk1.bin into that directory and rename it to disk1.exe
3. Execute disk1.exe. Under Windows XP this is done best using the following sequence:
   <CTRL><ESC> - RUN – C:\MyTemp\Extensions\K92\DISK1 - <ENTER> or
   <CTRL><ESC> - AUSFÜHREN – C:\MyTemp\Extensions\K92\DISK1 - <ENTER> for a German version.
   The files will be unzipped.
4. Delete disk1.exe from the temporary directory.
   The temporary directory will now contain the following files:

data1.cab	data1.hdr	data2.cab	DAX1_6.TXT	ExecCtrl.exe	id.txt
ikernel.ex_	ISSetup.exe	layout.bin	RestInst.exe	Setup.exe	Setup.ini
setup.inx					

   Please make sure that all the filenames are spelt correctly on your disks before you try to use them for the firmware update. Especially the trailing underscore ('_') as used in ikernel.ex_ is essential for correct operation of the update program.
5. Copy the contents of the temporary directory onto update disk #1.

The contents of the other disks are already packed in the format required by the firmware update program and need no further processing. The files only need to be copied onto disks #2, #3 … #6, the number in the filename (minus 1) indicating the corresponding disk number (data3.cab => disk #2, data4.cab => disk #3 and data5.cab => disk #4etc).

Preparing installation via LAN or USB stick:



If the installation shall be done via LAN or USB stick please set up the following directory structure:

Copy all files as mentioned in the previous section in the directories ..\MyTemp\Extensions\K92\Disk1 – Disk6

Other files (e.g. release rotes) shall not be stored in these directories. This files would be copied on harddisk and may cause a disk full problem on drive E:.

Since version 3.40 the directory path can contain more the 64 characters.

Performing the Application Firmware Update on the Instrument

The Application Firmware update process is performed in the following steps:

- Switch the instrument on and wait until the Analyzer has resumed operation.
- For updates from LAN or USB use the SETUP | NEXT | FIRMWARE UPDATE | UPDATE PATH softkey to specify any path for the location of the Disk1 directory (e.g. F:\MyTemp\Extensions\K92). For floppy usage the default A:\ must not be changed
- Press SETUP → NEXT → FIRMWARE UPDATE
- Confirm the query "Do you really want to update the firmware?" with OK
- Insert update disk #1 to #6as requested (for LAN or USB just confirm the copy process)
- The instrument will perform several automatic shutdowns, until the new firmware is installed properly. **Do not switch the instrument off until the update process has been finished completely.**

After switching on the instrument for the first time after a successful firmware update it is necessary to execute the instrument's self alignment process by pressing CAL and softkey CAL TOTAL.

Note: *A simplified update process is available if base system firmware 4.1x or newer is installed. More details are described in the release note of the base system firmware.*

Enabling the Application Firmware via License Key Code Entry

This section can be skipped if the option key was entered once.

After installing the application firmware package a license key for validation must be entered. The license key is printed either on a label on the rear panel of the instrument or delivered as a part of the R&S FSQ-K92/K93 WIMAX application firmware package.

The key sequence for entering the license key is:

SETUP - GENERAL SETUP – OPTIONS - INSTALL OPTION

Use the numeric keypad to input the license key number and press ENTER.

- On a successful validation the message 'option key valid‘ will appear. The instrument will perform an automatic reboot.
- If the validation failed, the application firmware is not installed.

  The most probable reason will be that the instrument is not equipped with the correct basic firmware version. Therefore a messagebox will appear asking for installation of the correct basic firmware version.

If the application firmware package was not installed prior to entering the license key code, a message will appear asking for installation of the application firmware package.

In any case please make sure that the correct basic firmware version and the application firmware package is installed prior to entering the license key code..

If upgrading to FSQ-K93 from FSQ-K92 then an upgrade key is supplied. This key needs to be entered (as described above) in addition to the existing FSQ-K92 key-code.

System Memory Requirements

For FSQ-K92/K93 WIMAX Application Firmware, an installed system memory of 512MByte is essential. The FSQ-K92/K93 firmware will generate an error message during activation, if available system memory does not meet the requirements. This may happen for FSQ-K92/K93, if FS-K30, FSQ-K70 or FSQ-K90/91 was active before starting WIMAX.

For instruments, shipped with 256MByte system memory, a memory extension FSQ-B512, order number 1157.1590.02, is available.

A reboot of the instrument after using NOISE (FS-K30), VSA (FSQ-K70) or WLAN (FSQ-K90/91) will allow FSQ-K92/K93 to be activated without memory extension.

The system memory size can be easily checked by pressing SETUP – SYSTEM INFO – STATISTICS, item "Memory size". This item is available since version 3.25 of the base system firmware.

Application Firmware WIMAX IEEE 802.16-2004 OFDM, IEEE 802.16e-2005 OFDMA, WiBro TX Measurements

Literature:

[1] IEEE Std 802.16-2004, 1 October 2004. Part 16: Air Interface for Fixed Broadband Wireless Access Systems.

[2] ETSI EN 301 021 V1.6.1 (2003-07)

Fixed Radio Systems; Point-to-multipoint equipment; Time Division Multiple Access (TDMA);

Point-to-multipoint digital radio systems in frequency bands in the range 3 GHz to 11 GHz

[3] IEEE P802.16-2004/Cor1/D5; 2005-09-12.

[4] IEEE Std 802.16e-2005 and IEEE Std 802.16-2004/Cor1-2005, IEEE Standard for Local and metropolitan area networks Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems Amendment 2: Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Bands

General issues of FSQ-K92/K93

Supported features of the IEEE802.16-2004 OFDM standard

Standard	IEEE 802.16-2004 OFDM
Duplexing Mode	TDD, FDD, H-FDD
Frame Structure	TDD mode according to [1] “Figure 207 Example of OFDM frame structure with TDD”. FDD mode according to [1] “Figure 208 Example of OFDM frame structure with FDD”.
Preambles	($P_{4\times64}$, P_{EVEN}) Long Preamble (LP), (P_{EVEN}) Short Preamble (SP), P_{SUB}
TTG, RTG	The power off periods TTG, RTG between the subframes must be $\geq$ 0s
*Modulation[1]	BPSK, QPSK, 16QAM, 64QAM
Miscellaneous	a. In DL Subframe the FCH BPSK 1/2 Symbol is taken into account.

The restrictions related to features marked with a * will be removed in a future version of the FSQ-K92/K93.

Currently NOT supported features of the IEEE802.16-2004 OFDM standard

Standard	IEEE 802.16a OFDM
Frame Structure	PMP-AAS Zones, Mesh frame structure
Preambles	P_{AAS} , P_{ODD} ,
Miscellaneous	a. Transmit diversity: Space-Time Coding (STC).

[1] At the moment the FSQ-K92 measurement application can’t distinguish between different coding rates for the same modulation format. I.e. in case auto demod functionality is used, the measurement application can detect the different modulation formats {BPSK, QPSK, 16QAM, 64QAM} but it can’t distinguish the different coding rates applied with a modulation format. As a consequence, the user is at the moment responsible,
1. that the signal to be analyzed uses only one profile (modulation format, coding rate) at all and
2. the Demodulator is set according to this value.
In example 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
[A==C $\Rightarrow$ B==D]
in order to produce correct measurement results.

Abbreviations and acronyms:

$P_{4\times64}$, P_{EVEN}, P_{ALL}, P_{AAS}, P_{ODD}, P_{SUB}	Different Preambles.
AAS	Adaptive Antenna System
CRS	Central Radio Station
DL	Down Link
FCH	Frame Control Header
FDD	Frequency Division Duplexing
H-FDD	Half-Duplex Frequency Division Duplex
LP	Long Preamble
RTG	Receive/Transmit Transition Gap
SP	Short Preamble
TDD	Time Division Duplexing
TS	Terminal Station
TTG	Transmit/Receive Transition Gap
UL	Up Link

New Functions in Version 4.20

1. Support for new instrument model R&S FSG.

2. Results display pages selectable via SCPI command.

3. Channel Estimation selection configurable by the user. Selections are either:

- user selected tracked signal
- fully tracked signal

Modified Functionality

The behaviour of the following functions changed compared to earlier versions [the number in brackets indicates the firmware version that introduced the individual change]:

1. [V3.70] Import and export of captured IQ data.

2. [V3.70] Number of analyzed bursts available via GPIB (FETCh:BURSt:COUNt?).

3. [V3.70] Number of symbols in each analyzed burst available via SCPI (FETCh:SYMBol:COUNt?).

4. [V3.70] Sweep time for auto-level can now be configured.

5. [V3.70] Format of parameters to INPut:IQ:IMPediance command changed to to LOW | HIGH.

6. [V3.72] Subchannelization extension

7. [V3.72] In the Downlink Bursts with optional Preambles are supported.

8. [V3.72] In the Uplink Bursts with optional Midambles are supported.

9. [V3.72] New statistical measurement, Burst Summary.

10. [V3.72] Import and export of IQ data via GPIB (MMEMory:LOAD:IQ:STATe, MMEMory:STORe:IQ:STATe)

11. [V3.72] Bitstream: Results display shows the demodulated data stream for all analysed modulation schemes with modulation detection mode ALL.

12. [V3.72] Constellation vs Symbol: ALL the Constellation display shows the Inphase and Quadrature phase results for all analysed modulation schemes over the full range of the measured input data with modulation detection mode ALL.

13. [V3.72] PVT: With the modulation detection mode ALL , a burst is an area with constant modulation format. PVT burst statistics are no longer available.

14. [V3.80] Digital Down Converter available for low carrier frequency with Baseband input.

15. [V3.80] External trigger level can now be specified.

16. [V3.80] SUPPORT softkey has been provided to allow detailed information about the FS-K92 option to be saved to file.

17. [V3.90] Transisions from WIMAX to Spectrum Analyzer has been optimised to ensure the Spectrum Analyzer has a defined state

18. [V3.90] Spectrum ACP mode now allows 5 adjacent channel offsets, and provides the option to enable Noise Correction. The command `[SENSe:]POWer:NCORrection ON|OFF` has been added.

19. [V3.90] Colouring of Burst Summary, Bitstream and Constellation displays according to the modulation type

20. [V3.90] The Modulation Detection Mode in the Demod Settings dialog now defaults to "All".

21. [V3.91] The YIG filter (where fitted) is no longer set ON when exiting to the Spectrum Analyzer.

22. [V3.91] OFDM WCS licensed bands: 3.5 MHz has been added as a prefined Channel Bandwidth.

23. [V3.91] The [SUPPORT] softkey has been disabled in RUN CONT mode.

24. [V3.91] GPIB: The remote command [SENSe]:DEMod:FORMat:BANalyze:BTYPE is obsolete and has no effect.

25. [V4.00] SMU Setting transfer for zone and burst configuration information option using a TCP-IP connection.

26. [V4.00] Frequency Error Vs Sample and Phase Error Vs Sample measurement graphs available.

27. [V4.00] Time to Capture Buffer start Measurement available.

28. [V4.00] Spectrum Emission Mask for WiBro available.

29. [V4.00] Preamble indices can be specified manually as well as according to the standard.

30. [V4.00] For a PUSC signal using up to 3 segemnts, each of the segments can be analysed.

31. [V4.00] For a DL-Subframe utilizing several zones, each zone may be analyzed.

32. [V4.00] The table of results is now fully supported with all measurement results.

33. [V4.00] Incorrect Pilot values highlighted in bitstream

34. [V4.00] Power results are now displayed in the burst summary display.

35. [V4.10] OFDMA/WiBro Analysis:

- Wrapping DL-MAP bursts are now supported in the burst configuration.
- "Pilots For Tracking" is now a combined setting for UL and DL.
- Support for UL Control regions, new entry for setting the UL Control region length.
- The zone map now highlights zones with a blue border.

36. [V4.10] New Result Summary value/limit

The OFDMA/WiBro Summary table now includes the Unmodified Subcarrier Error, along with corresponding changes to SCPI commands.

37. [V4.10] Maximum capture time

A maximum of 1 MSamples can be captured for an IQ measurement, allowing up to 500 ms capture time for a 2MHz Sample Rate (Fs). A previous fixed limit of 50 ms has been removed.

38. [V4.10] Sample Rate and Channel Bandwidth relation

The ratio between these two values can now be user-defined, or left as "Auto".

39. [V4.10] ACP measurement

A user configurable number of channels may be specified, up to a maximum of 12.

40. [V4.10] OFDMA/WiBro SYNC condition bits

Synchronisation (signal decoding) error messages reported to the user for OFDMA/WiBro measurements now set corresponding bits (bits 7-8) in the SCPI/IEC register.

41. [V4.10] Transfer of ".WIMAX" files between FSQ and signal generator

- It is now possible to load files from other generators related to the SMU (e.g. SMJ, AMU).
- Support for files produced by v2.0.x of the SMU firmware.
- Loading a .WIMAX file sets "Predefined MAP" mode (DEMOD SETTINGS / Frame Global)

- If a file is loaded while in WiBro standard, then it is possible that the FFT size, sample rate and channel bandwidth may be out of range. In this eventuality the invalid values are ignored and a warning message is displayed in the status bar while loading.

Note: Loading is not possible in OFDM mode

42. [V4.10] Transitions from WiMAX to SAN

Additional measurement settings are preserved when transitioning from OFDMA/WiBro to the Spectrum Analyzer, in particular the RBW/VBW settings for a SEM measurement.

43. [V4.10] Limit lines

Spectrum Flatness limits are now +/- 0.4 for all standards.

44. [V4.10] Graph/summary tables

- Reference Level / External Attenuation are now displayed as a combined cell at the top-right of the main page header.
- The Time to Capture Buffer Start label now has increased precision.

45. [V4.20]. Support for new instrument model R&S FSG.

46. [V4.20] Trace data now available via remote control in binary format for all traces.

47. [V4.20] Results display pages selectable via SCPI command.

48. [V4.20] Channel Estimation selection configurable by the user.

Selections are either:

- user selected tracked signal
- fully tracked signal

49. [V4.20] Added an alias SCPI command "SENSe:BURSt:COUNt" for SCPI command "SENSe:ZONE:COUNt".

50. [V4.20] Modified parsing of SCPI command ":CONF:WIM:ZONE1:BURS1:CONT" to ignore Symbol count for UL Zones.

Problems Eliminated with option R&S FSQ-K92/K93 WIMAX Application Firmware

None

Known problems with option R&S FSQ-K92/K93 WIMAX Application Firmware

The version numbers in brackets indicate the version in which the error was observed for the first time. A version specified as "K92" implies an issue affecting both FSQ-K92 and FSQ-K93. An error specified as "K93" affects FSQ-K93 only.

Manual Operation and IEC/IEEE Bus

1. (K93 V4.10) Simultaneous display of frame configuration and editing via SCPI

Changes to the frame configuration made via remote control while the Frame Configuration dialog is open are not reflected on screen. In addition, closing the Frame Configuration dialog will save the displayed configuration, losing any changes made via remote control while the dialog was open.

In normal remote operation (via GPIB or RSIB) the Frame Configuration dialog is automatically closed when SCPI commands are issued, preventing this situation from arising. However, using IECWIN via NT Pipe does not force the dialog to be closed.

Workaround: Close the Frame Configuration dialog prior to using the CONF:WIM:ZONE remote control commands.

2. (K93 V4.10) OFDMA/WiBro DEMOD settings

Subchannel Bitmap bits that are not available in FFT sizes 512/128 are disabled but may remain ticked. This has no effect on measurement behaviour.

Workaround: None.

3. (K93 V4.10) SEM Settings File Name

When switching from SEM According To: User to one of the build-in types (ETSI/IEEE/TTA), the File Name box does not correctly refresh.

Workaround: Close and reopen the dialog by using the SEM SETTINGS softkey.

4. (K92 V3.60) Result Summary RSSI results

The RSSI results in List Mode correspond to the preamble power. The ADC resolution is not taken into account.

Workaround: None.

5. (K92 V3.60) IF Power Trigger

IF Power Trigger does not work reliably, for signals with a 28MHz channel bandwidth.

Workaround: None.

6. (K92 V3.60) Spectrum ETSI Mask [2]

The ETSI Spectrum Mask settings in the UL [TS] – Table 6: Spectrum analyzer settings for RF power spectrum measurement – case leads to a non practicable measurements. Unless this situation is improved, the UL [TS] is treated in the same way as the DL [CRS].

Workaround: None.

7. (K92 V3.60) Possible overload condition when measuring below 200MHz

In certain circumstances an overload condition can occur when using autolevel below 200MHz

Workaround: Switch off autolevel and use manual settings to configure the individual measurement parameters prior to performing a measurement.

8. (K92 V3.90) HCOPY "PRINT SCREEN" in MSPaint

The WMF generated by "PRINT SCREEN" does not correctly display in Microsoft Paint. In particular, the screen shot is displayed with a partially black background.

Workaround: Use a more fully featured WMF viewer. For example, preview using the Microsoft Windows Picture and Fax Viewer, or insert into a Microsoft Word document.

9. (K92 V3.91) Split screen state after remote control

After using remote commands (e.g. via IECWin), the SPLIT / FULL SCREEN softkey state may not match that actually in use.

Workaround: Switch between full screen and split screen to correct the softkey states.

10.(K92 V3.90) Noise Correction enhancement label

The NOR label should be displayed when running a Spectrum ACPR measurement with Noise Correction enabled. Occasionally the label is not displayed.

Workaround: None.

11.(K92 V3.90) Auto demod does not work for already captured data

Auto Demod [Use Signal MAP for analysis] currently doesn't work with IMPORTed *.iqw files or when re-analyzing data using the REFRESH hot key.

Workaround: None.

IEC/IEEE Bus only

1. (K92 V3.60) Selecting screen A/B

For selecting screen A or B, DISPlay:<WINDow[1|2]>:SELect command does not work correctly.

Workaround: Instead of this command, an alias command is provided, which is:
DISPlay:<WINDow[1|2]>:SSELect.

2. (K93 V3.91) SENSe:DEMod:CESTimation arguments

For the OFDMA standard, remote command SENSe:DEMod:CESTimation has conflicting short forms for the parameters PREamonly/PREampayl. Using the argument "PRE" will select PREamonly. Long forms are returned. This behaviour is consistent with the External PC Software.

Workaround: Use long form of the arguments.

3. (K92 V3.90) [SENSe:]TRACking:LEVel

[SENSe] is not optional for this command when using the short form: "TRAC" as it conflicts with the "TRACe" command.

Workaround: Do not omit SENSe for this command.

Differences from the External PC Software

The FSQ-K93 firmware aims to provide the same functionality as the External PC Software. Any known differences are listed below.

IEC/IEEE Bus only

1. (K93 V3.91) CONFigure:WIMax:FBANd WIBRO

The External PC Software allows the parameter "WIBRO".

Workaround: In FSQ-K93, WiBro must be selected using the Standard on the General Settings menu.

2. (K93 V3.91) DISPlay:WINDow:SELect <1|2>

In FSQ-K93 this command is provided as DISPlay:WINDow<1|2>:SELect. Note, however, that this command does not currently work as expected.

Workaround: DISPlay:WINDow<1|2>:SSELect should be used instead. (See Known Problems: IEC/IEEE Bus only: Selecting screen A/B.)

3. (K93 V4.10) MMEMory:STORe:FRAMe:STATe 1,<filename>

This command is used in the External PC software to store the frame configuration settings to a file. This functionality is not provided in FSQ-K93. Instead, the command is used to download the named file to an attached SMU.

Workaround: Saving the current frame configuration is achived by using the existing save mechanism with the Current Settings check box being ticked.

Modifications to the Operating Manual

The R&S FSQ-K92/K93 analyzer functions are included in a separate manual set. Please refer to the following order numbers:

- 1300.7462.42-04- (English)

Regarding restrictions of OFDMA/WiBro signals that can be measured, see section “IEEE 802.16e-2005 OFDMA, WiBro Measurements”.

Modified Chapters for manual operation

IEEE802.16e-2005 OFDMA, WiBro Measurement Results

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

- BER Pilots
  Deviation of the measured pilots from the expected pilots according to the standard in percent.

EVM measurements

- EVM Data and Pilots
  EVM over Data and Pilot Symbols for the analyzed zone or the analyzed segment.
- EVM Data
  EVM over Data Symbols for the analyzed zone or the analyzed segment.
- EVM Pilots
  EVM over Pilot Symbols of the analyzed zone or the analyzed segment.
- Unmodified Subcarrier Error
  Power of the unmodulated subcarriers relative to the power of the modulated subcarriers

IQ constellation measurements

- IQ Offset
  Power at spectral line 0 normalized to the total transmitted power.
- Gain Imbalance
  Logarithm or percentage figure of the Q-Channel to I-Channel gain ratio.
- Quadrature Error
  Measure of the phase angle between Q-Channel and I-Channel deviating from the ideal 90 degree.

Power measurements

- Power DL Preamble
  Power of the Preamble corresponding to the Zones/Segments to be analyzed
- Power Data and Pilots
- Power Data
- Power Pilots

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

- Center Frequency Error
  Difference between measured and reference center frequency
- Symbol Clock Error
  Difference between measured and reference symbol clock relative to the system sampling rate.

Power measurements

- TD Power DL Preamble
- TD Power Subframe
- TD Power Zone
- Crest Factor
  Peak to average power ratio of the analyzed zone

RSSI and CINR measurements

- RSSI
  The Received Signal Strength Indicator is an estimate of the total received power of the DL preamble.
- RSSI Standard Deviation
  Standard deviation of the RSSI result.
- CINR
- CINR Standard Deviation
  Standard deviation of the CINR result.

R&S FSQ-K93 Graphical OFDMA Measurement Results

Power vs Time measurements

Capture Buffer
Power profile of the capture buffer data being analyzed

Full Subframe
min mean max power profile of the subframe containing the zone to be analyzed.

Rising / Falling
min mean max profile of the rising respective falling edge of the subframe containing the zone to be analyzed.

EVM measurements

EVM vs Symbol ALL
EVM versus the symbols of the analyzed zone. In case the capture buffer contains more than one analyzed zones, the corresponding result graphs will be appended. The min mean max statistics is performed over carriers.

EVM vs Carrier ALL
EVM versus physical carriers. The min mean and max statistics is performed over the symbols of all analyzed zones in the capture buffer.

Error Freq / Phase
Relative Frequency Error vs Sample, and Phase Error vs Sample.

Spectrum Measurements

Spectrum Flatness
Average energy of the constellations for the physical carriers. The limit lines are displayed according to the requirements of the standard. The min mean and max statistic is performed over the analyzed zones in the capture buffer.

Spectrum Flatness Difference
Absolute difference of adjacent carriers. The limit lines are displayed according to the requirements of the standard. The min mean and max statistic is performed over the analyzed zones in the capture buffer.

Spectrum Emission Mask
Spectrum Emission Mask measurement according to the IEEE / ETSI standard, or user defined configuration..

Spectrum ACP ABS/REL

Spectrum FFT

Constellation Measurements

Constellation Diagram
: Complex Constellation Diagram of the modulation symbols. The modulation symbols belong to the Bursts of the analyzed zone. The different modulation formats are assigned unique colors. These colors are also used for the Bitstream measurement. With the [CONSTELL SELECTION] Softkey it is possible to suppress unwanted information.

Statistic Measurements

CCDF Cumulative Complementary Distribution Function
: Complementary Probability Distribution for the capture buffer sample exceeding the average power.

Bit Stream
: The modulation symbols define bit sequences. The mapping is defined in the standard. The modulation symbols of the bursts from the analyzed zone are displayed. The different modulation formats are assigned unique colors. These colors are also used for the Constellation Diagram Measurement. The selection panel allows select highlight the data the user is interested in.

Burst Summary
: 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.

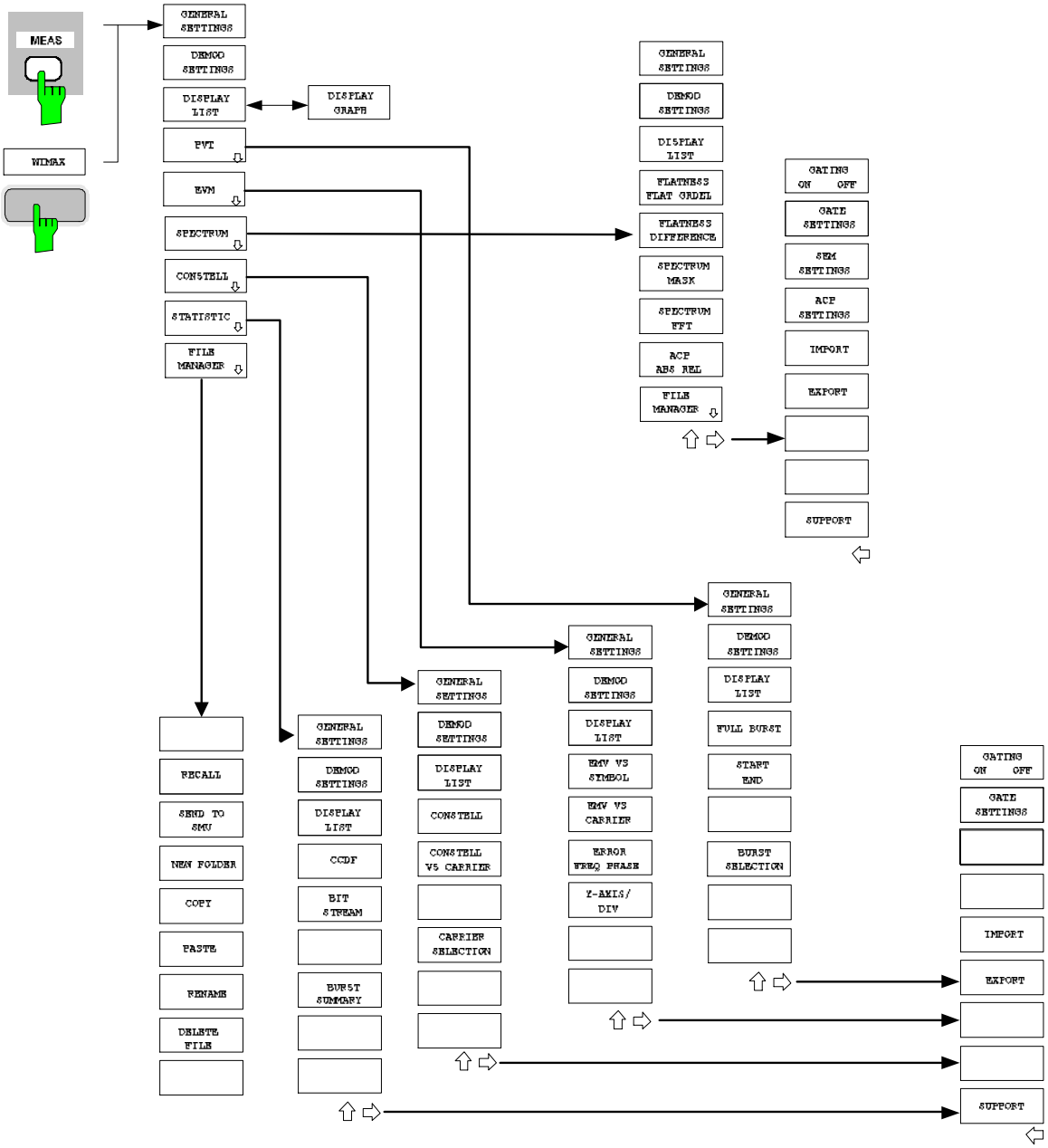


Fig. 1 IEEE 802.16-2004 OFDM menu

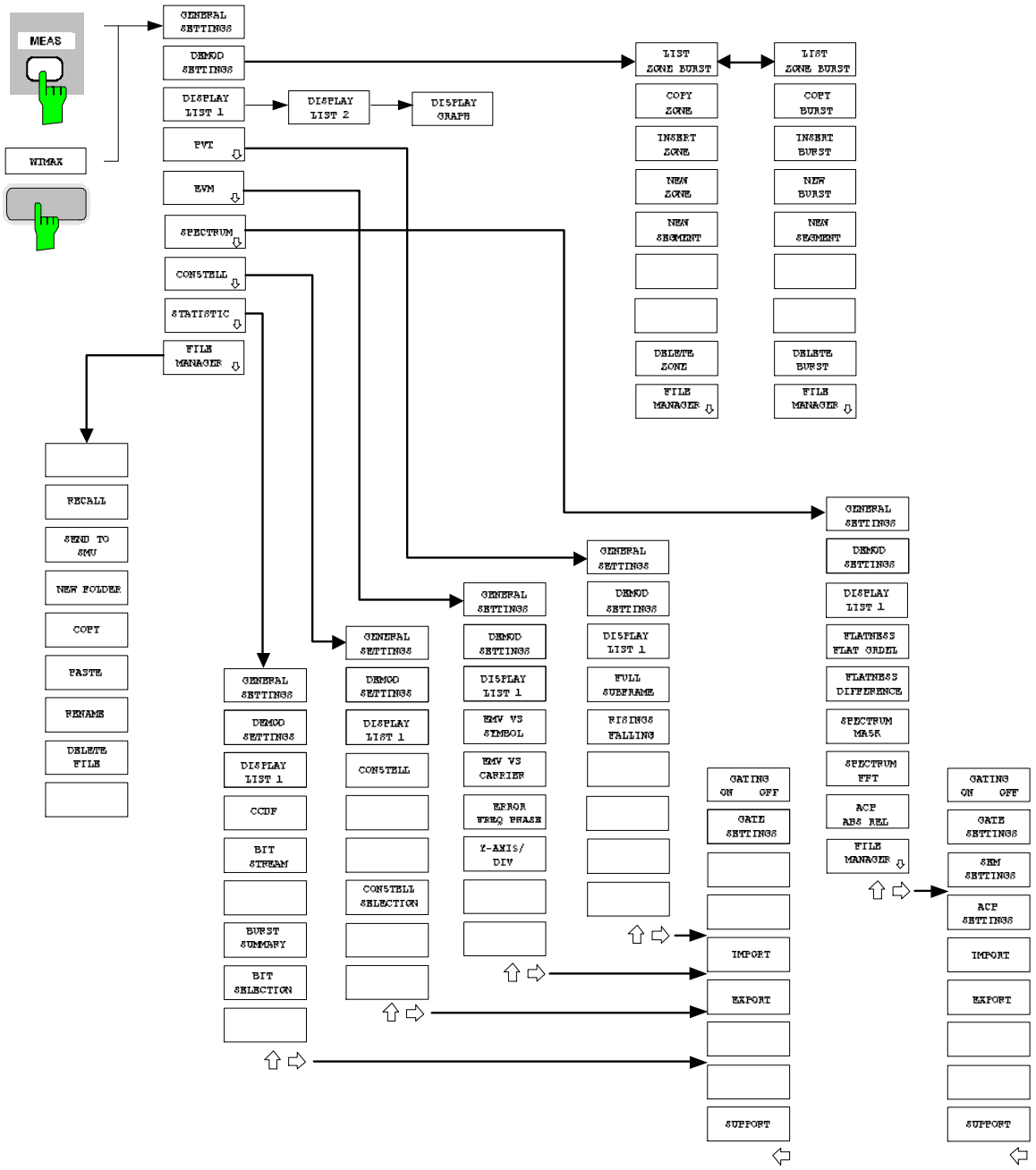
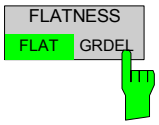


Fig. 2 IEEE 802.16e-2005 OFDMA / IEEE 802.16e-2005 WiBro menu

Spectrum Flatness/Spectrum Flatness Group Delay



The Spectrum Flatness measurement results are selected by pressing the *SPECTRUM* softkey in the main measurement softkey menu followed by the *FLATNESS FLAT/GRDEL* softkey. Subsequent presses of the *FLATNESS FLAT/GRDEL* softkey toggle the Flatness measurement between Spectrum Flatness and Spectrum Flatness Group Delay.

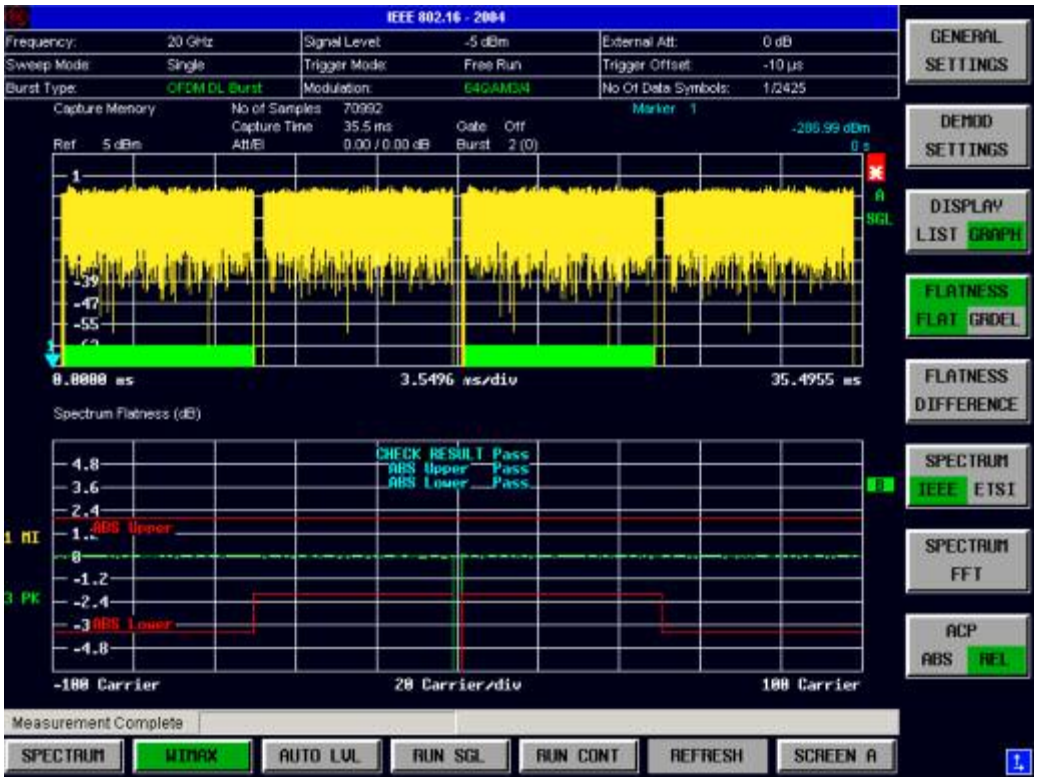


Fig. 3 Spectrum Flatness Results

The Spectrum Flatness results display shows either the Spectrum Flatness or the Group Delay values recorded on a per-carrier basis over the full set of measured data. A minimum, average and maximum trace are displayed for each of the result types. When Spectrum Flatness results are selected an upper and lower limit line representing the limits specified for the selected standard are displayed. An overall pass/fail status is displayed for the obtained (average) results against these limit lines.

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.

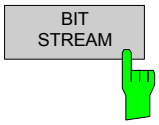
This requirement is affected by the **Channel Estimation Range** parameters in the Demod Settings:

- 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.

IEC/IEEE-bus command: `CONF:BURS:SPEC:FLAT:SEL FLAT`

CONF:BURS:SPEC:FLAT:IMM

Bit Stream



The Bit Stream measurement results are selected by pressing the *STATISTICS* softkey in the main measurement softkey menu followed by the *BIT STREAM* softkey.

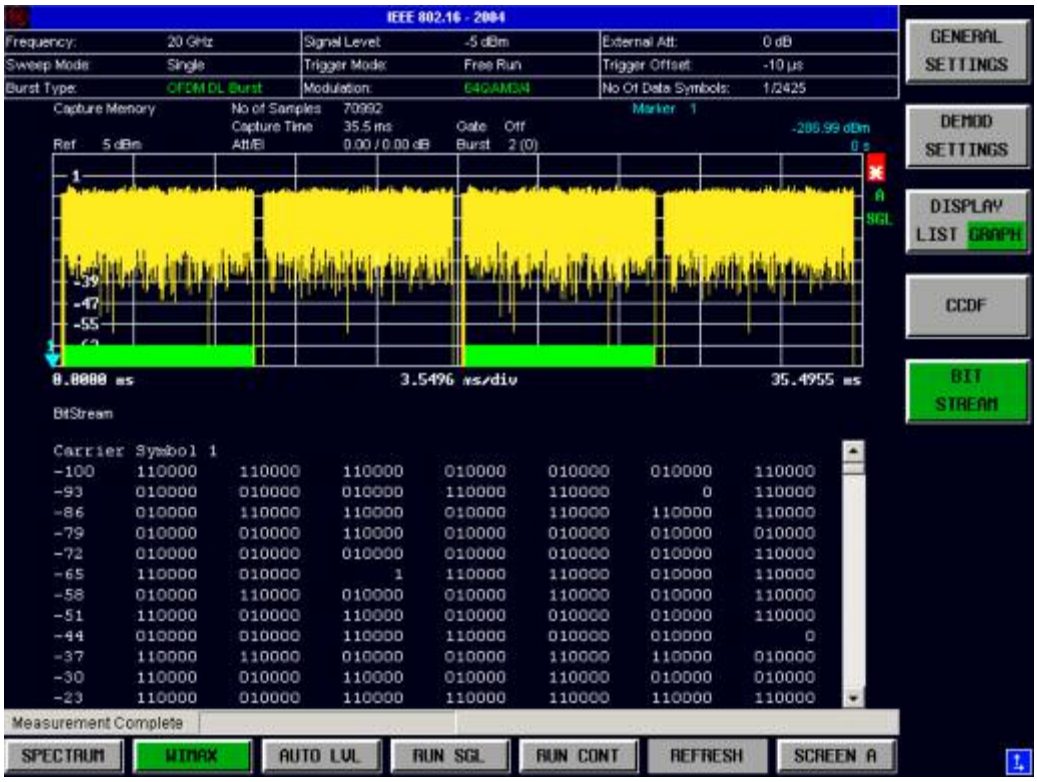


Fig. 4 Bit-Stream Results

The bit stream results display shows the demodulated data stream. These results are grouped by burst and symbol. When no other dialogs are on display the results can be scrolled through using the cursor keys or scroll wheel.

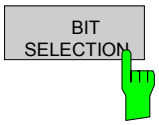
Pilot Errors (IEEE 802.16e-2005 OFDMA & WiBro)

If pilots errors are detected in the analysed signal, then they will be displayed with a red background in the Bit Stream (See Fig. 5).

Note that this behaviour is affected by the Pilots for Tracking setting in the DEMOD SETTINGS.

IEC/IEEE-bus command: CONF:BURS:STAT:BSTR:IMM

Bit Selection (IEEE 802.16e-2005 OFDMA & WiBro)

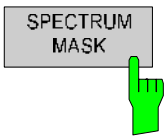


Pressing *BIT SELECTION* softkey displays a pop-up dialog which allows the displayed results to be filtered. The results may be filtered by any combination of modulation, symbol or burst. The results will be updated as soon as any change to the bit selection parameters are made.

Fig. 5 Bit-Stream for OFDMA, showing the Bit Selection dialog and highlighted pilot errors.

IEC/IEEE-bus command: – – –

Spectrum Emission Mask

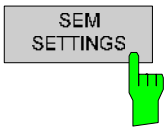


The Spectrum Emission Mask measurement results are selected by pressing the *SPECTRUM* softkey in the main measurement softkey menu followed by the *SPECTRUM MASK* softkey.

Fig. 6 Spectrum Emission Mask Results

The Spectrum Mask results display shows power against frequency. The span of the results is related to the specified sample rate. 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. If the *Sweep Count (Mask/ACP)* parameter in the General Settings view is set to any value other than 1 then the measurement is performed over the specified number of sweeps. When the measurement is performed over multiple sweeps a max hold trace is displayed as well as an average trace.

The Spectrum Emission Mask measurement can be configured from the SEM settings view:



The *SEM SETTINGS* softkey brings up the SEM Settings view.

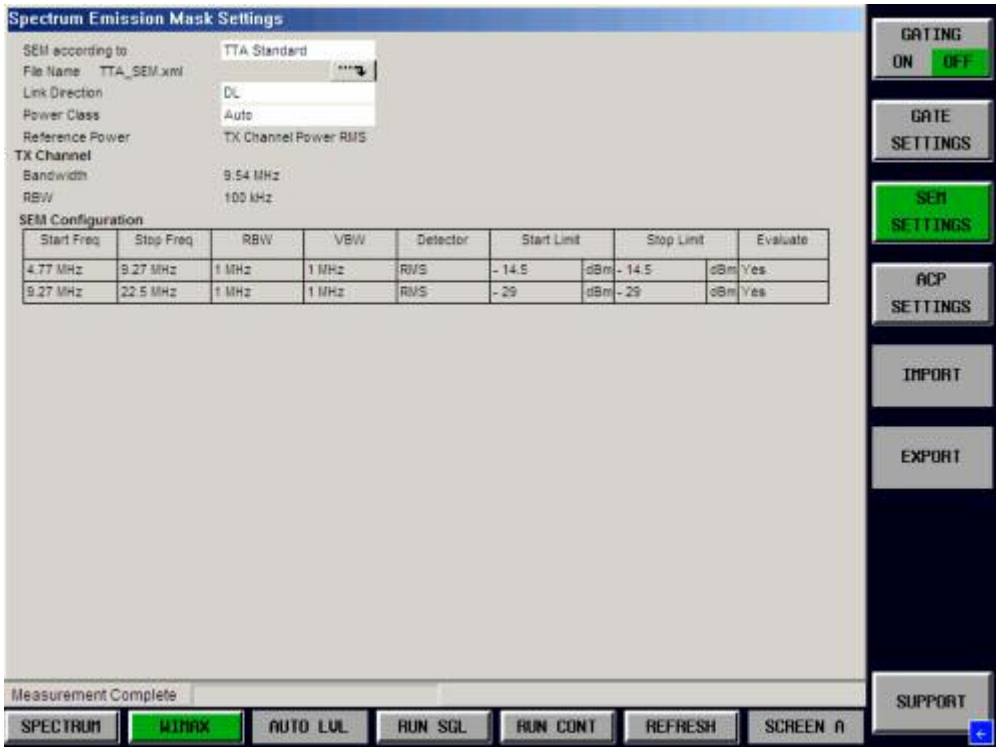


Fig. 7 ACP Settings view

IEC/IEEE-bus command: `SENS:POW:SEM:MODE UL|DL`
`SENS:POW:SEM USER|STANDARD|IEEE|ETSI`
`SENS:POW:SEM:CLASs`

SEM according to

SEM according to specifies how the Spectrum Emission Mask settings and limits are applied. This parameter provides the following settings:

TTA Standard – Settings and limits are as specified in the standard (WiBro only)

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

IEEE – Settings and limits are as specified in the standard (OFDM/OFDMA only)

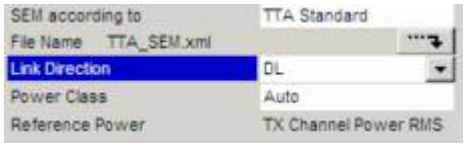
User – Settings and limits are configured via an XML file

File Name

When **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.**

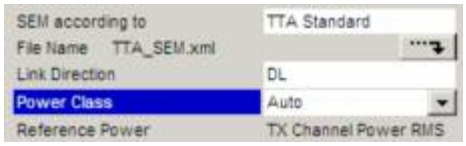
When using TTA/ETSI/IEEE standards, *File Name* reflects the name of the built-in configuration.

Link Direction



Link Direction allows the settings and limits for the relevant link direction (Uplink or Downlink) to be displayed.

Power Class



The SEM settings allow different set of limits depending on the signal level. By default the *Power Class* is set to Auto, which selects the limits automatically based on the measured signal level. If required, the Power Class can be set by hand, to force a set of limits to be used.

SEM Configuration

The SEM configuration shows the settings and limits applied over specified frequency ranges around the TX channel. The settings displayed are dependent on the selected *Link Direction* and *Power Class*

SEM Configuration

Start Freq	Stop Freq	RBW	VBW	Detector	Start Limit	Stop Limit	Evaluate
4.77 MHz	9.27 MHz	1 MHz	1 MHz	Peak	- 14.5	- 14.5	Yes
9.27 MHz	22.5 MHz	1 MHz	1 MHz	Peak	- 29	- 29	Yes
...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...

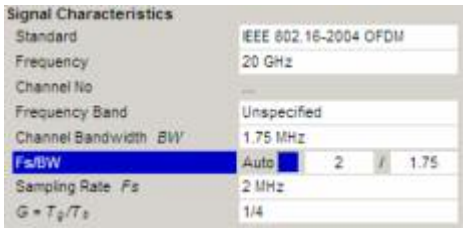
Fig. 8 SEM Configuration

General Settings

Fs/BW acc. to Standard

The *FS/BW* setting allows a user-defined Channel Bandwidth to Sampling Rate relationship. It is only available when the Frequency Band is "Unspecified".

When the setting is ticked, the relationship used is defined by the standard.



When the setting is unticked, the Fs and BW values can be modified with increased flexibility.

Initially the ratio takes the current Fs and BW values.

Changing the ratio updates Fs and vice versa. BW remains unchanged.

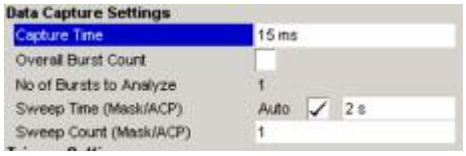
IEC/IEEE-bus command:

```
CONF:WIM:FSBW:AUTO ON
CONF:WIM:FSBW:FS 2.5
CONF:WIM:FSBW:BW 1.5
```

Data Capture Settings

The Data Capture settings specify how much data is to be captured and measured.

Capture Time

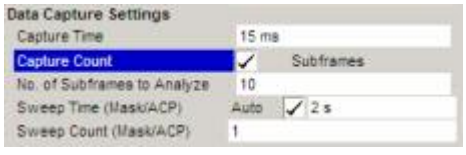


Capture Time specifies the time (and therefore the amount of data) to be captured in a single IQ measurement sweep.

A maximum of 1 MSamples can be captured for an IQ measurement, allowing up to 500 ms capture time for a 2MHz Sample Rate (Fs).

IEC/IEEE-bus command: `SENS:SWE:TIME`

Capture Count (OFDMA/WiBro only)



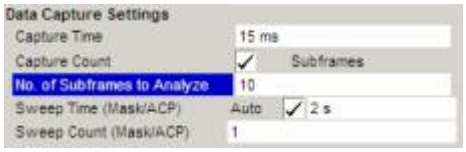
Capture Count specifies whether a specified number of subframes are to be captured and analyzed.

When *Capture Count* is set to OFF then data analysis shall be performed on a single measurement sweep. When *Capture Count* is set to ON then data analysis may be performed over a number of consecutive sweeps until the

required number of subframes has been captured and analyzed.

IEC/IEEE-bus command: `SENS:ZONE:COUN:STAT ON`

No of Subframes to Analyze (OFDMA/WiBro only)



No of Subframes to Analyze specifies the number of subframes to be measured.

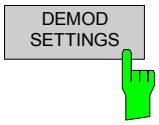
If the number of subframes specified are not contained in a single measurement sweep then measurement sweeps will continue to be performed until the requested number of subframes have been captured.

The *No of Subframes to Analyze* parameter is not editable when *Capture Count* is set to OFF.

IEC/IEEE-bus command: `SENS:ZONE:COUN?`

Demod Settings

This section of the user manual describes the Demod (Short for Demodulation) Settings view for the IEEE 802.16e-2005 OFDMA & WiBro standard where the settings associated with the signal modulation can be modified.



The *DEMOD SETTINGS* softkey brings up the Demod Settings view.

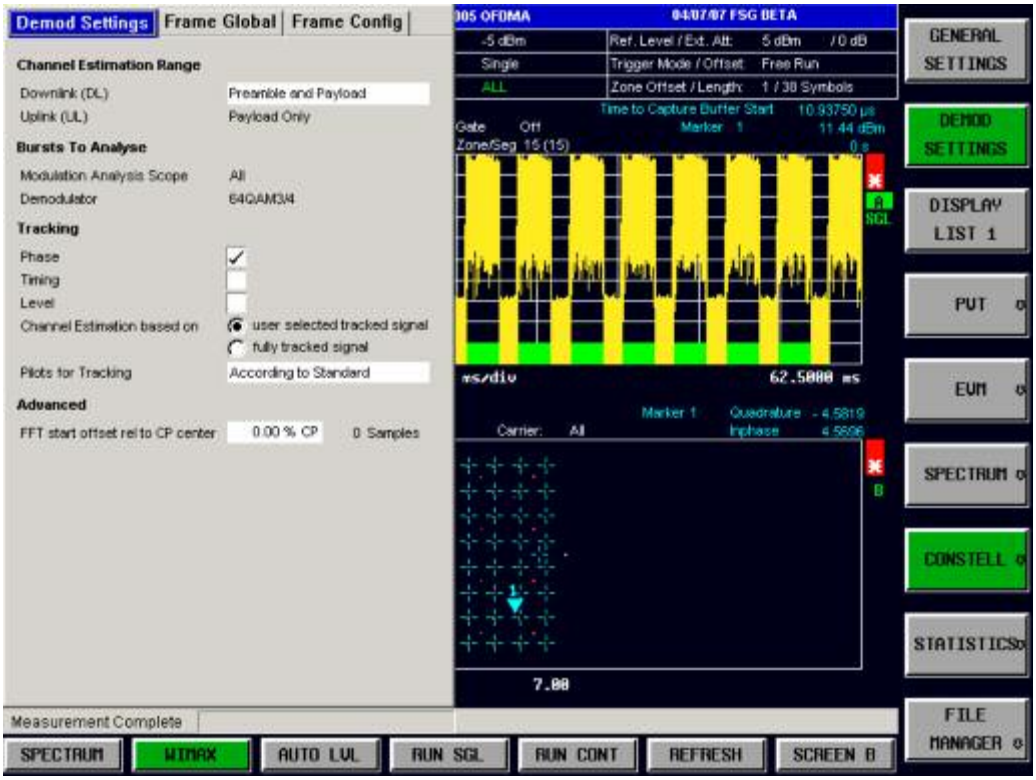


Fig. 9 Demod Settings view (IEEE 802.16e-2005 OFDMA & WiBro standard)

The Demod settings are logically grouped together into:

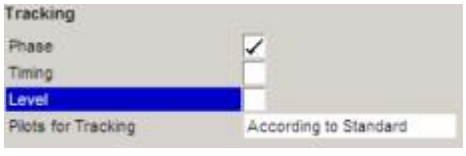
Demod Settings – contains the demodulation settings which are used to analyse the signal.

Frame Global – contains the general frame settings used in configuring and analysing the signal.

Frame Config – contains the Zone and Burst setting that specifies a Frame.

When a particular parameter is selected within the Demod Settings view the status bar changes to display information about the valid settings for the selected parameter. The parameters available in the Demod setting view are dependent on the currently selected standard

Level

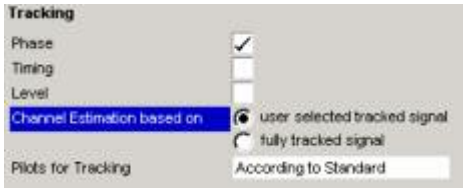


Level is used to specify whether or not the measurement results should be compensated for changes in DUT gain over time.

When Timing is set to ON then the measurement results will be compensated for gain on a per-symbol basis.

IEC/IEEE-bus command: `SENS:TRAC:LEV ON`

Channel Estimation based on.



Channel Estimation based on 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.

IEC/IEEE-bus command: `SENS:TRAC:CEST USER|FULL`

Pilots for Tracking

Pilots for Tracking is used to specify how the pilot sequence, for is determined for frame synchronisation. The following values are supported:

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

IEC/IEEE-bus command: `SENS:TRAC:PIL DET`

Frame Global (IEEE 802.16e-2005 OFDMA & WiBro only)

Use … for analysis

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.

Predefined MAP	Uses the current user-defined configuration
Signal MAP	Performs an additional initial sweep to determine the configuration from the signal.

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

Frequency, Sample Rate / Channel Bandwidth, FFT size, Guard Time, IDCell and Preamble Index (if not in the range

0 - 96).

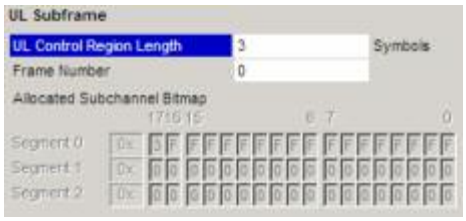
The current release supports Signal MAP determination for DL signals only.

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

IEC/IEEE-bus command: `DEM:FORM:AUT PRED`

UL Subframe

UL Control Region Length



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.

IEC/IEEE-bus command: `CONF:WIM:ULSF:CRL`

Frame Config (IEEE 802.16e-2005 OFDMA & WiBro only)

Burst Map

The burst editing changes slightly when a burst is specified as DL_MAP. Instead of specifying the number of subchannels and symbols for the burst, the number of slots is specified.

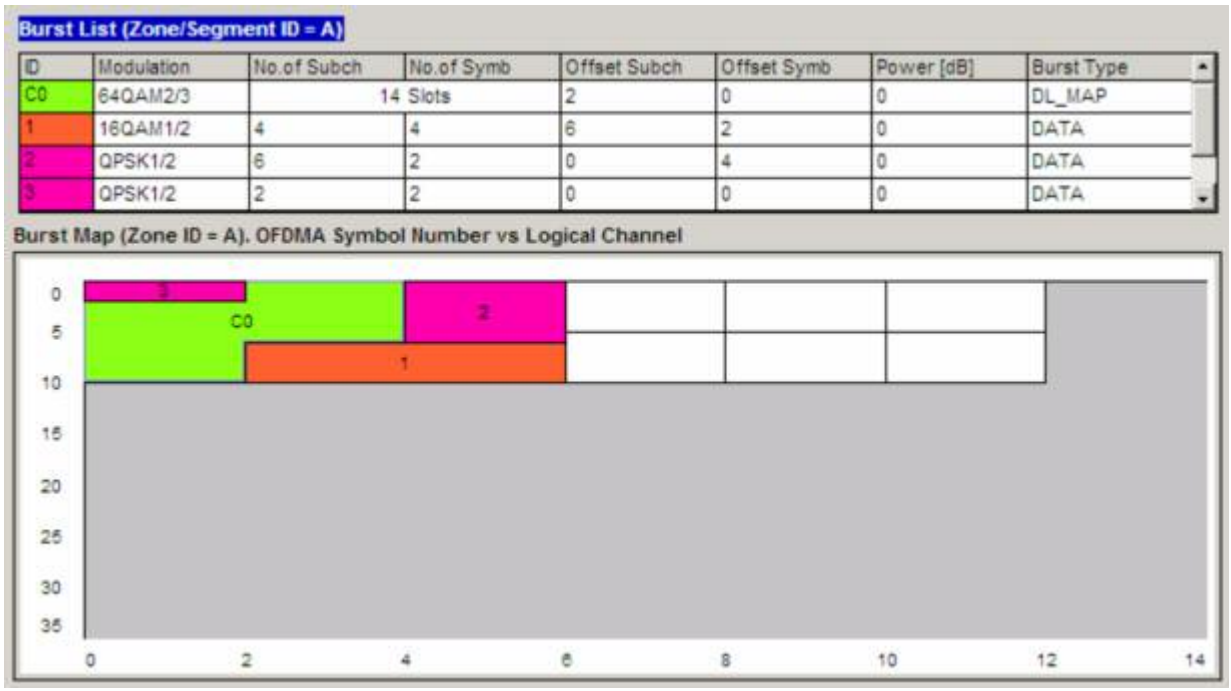


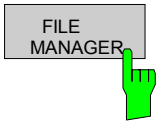
Fig. 10 Zone containing a wrapping DL_MAP burst (C0). Note the shape of the burst, which fills the available symbols in the first column (of two symbols), and then uses the second column.

File Manager

This section of the user manual describes the File Managerview, which provides the possibility to load WIMAX settings files saved from a R&S SMU signal generator, as well as providing some general file management support.

The File Manager is enabled for all standards, however .WIMAX files can only be loaded when in the IEEE 802.16e-2005 OFDMA and the WiBro standards.

Note: *The File Manager will write only*
a. to the directory D:\USER\WMAN and its subdirectories or
b. to a USB memory stick.



The *FILE MANAGER* softkey brings up the File Manager view.

Fig. 11 File Manager view

The roll-key is used to navigate between the different sections of the file manager dialog. Pressing the roll key (or pressing the ENTER key) enters the selected section. To return back to navigating through the different sections of the File Manager dialog press the ESC key.

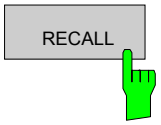
File Type

The *File Type* parameter applies filtering to the files view. The following selections are available:

All (*.*) – This selection allows all file types to be displayed. Use this selection when performing general file management tasks.

SMU WiMax – This selection allows only files with the extension .wimax to be displayed. Use this selection when using the file manager to locate and load SMU signal files.

Loading settings from a file on the local instrument



Select a .WIMAX file and clicking the RECALL softkey. WiMax files can only be loaded in OFDMA or WiBro modes.

IEC/IEEE-bus command: `MMEM:LOAD:FRAM:STAT 1,'D:\USER\DATA.WiMax'"`

Transfer settings between R&S FSQ and R&S SMU

If an R&S SMU signal generator is connected via LAN then settings can be transferred between the R&S SMU and R&S FSQ. In order for settings to be transferred the R&S SMU and R&S FSQ must be networked and the TCP-IP address of the SMU must be specified in the General Settings – Advanced Settings panel. See description *SMU Address* above.

In order to access the SMU via LAN the SMU Windows Firewall has to be switched Off. See figure below.

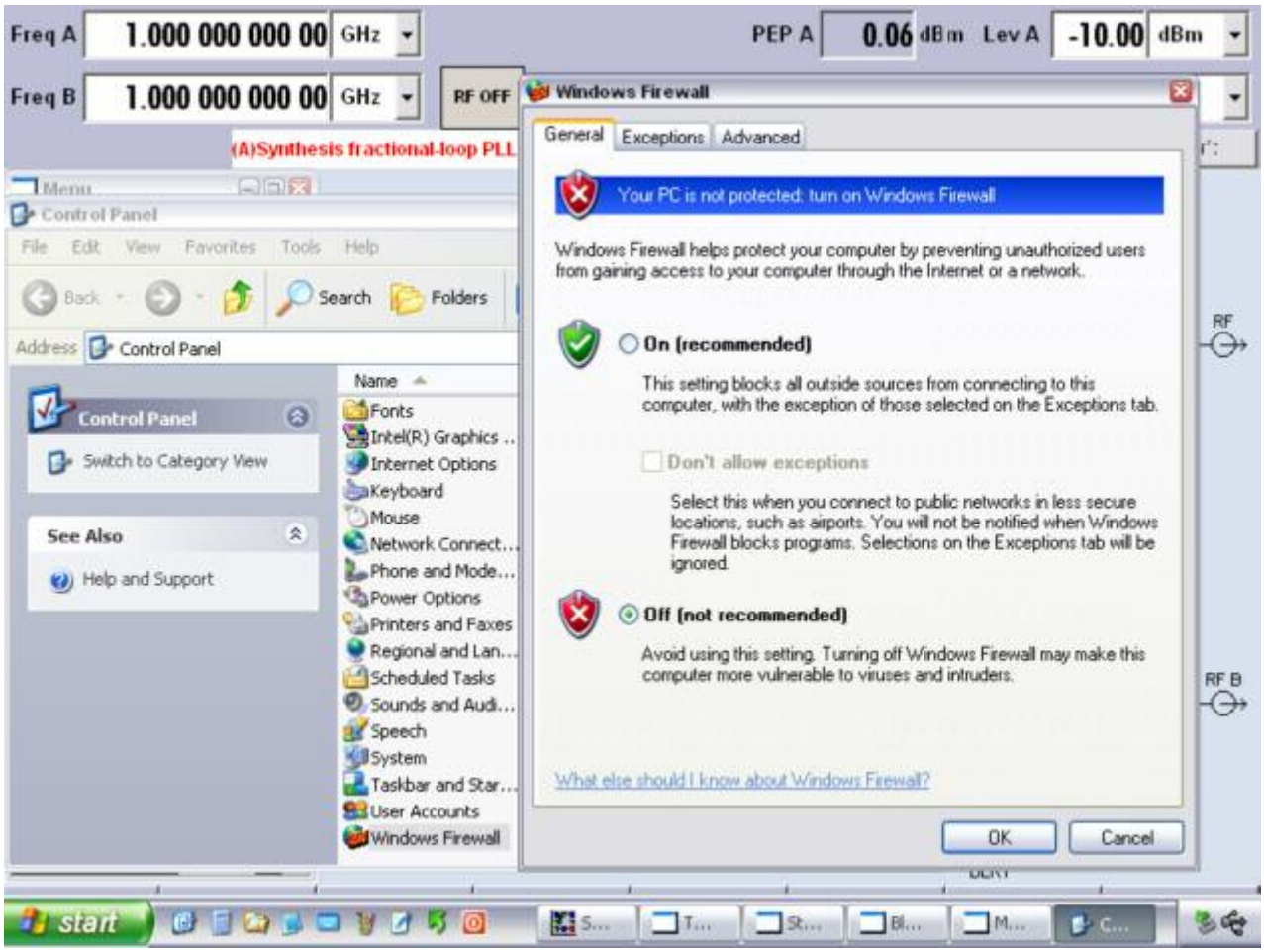
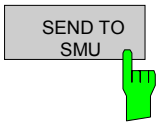


Fig. 12 SMU Windows Firewall setting, in order to access the SMU via LAN from the R&S FSQ.

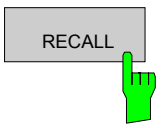
Download from R&S FSQ to R&S SMU



An SMU WIMAX settings file (.WIMAX) file can be downloaded from the FSQ to the SMU using the filemanager. Download is achieved by selecting the file to be downloaded then pressing the SEND TO SMU soft-key.

IEC/IEEE-bus command: `MMEM:STORE:FRAM:STAT 1,'D:\USER\DATA.WiMax'"`

Upload from R&S SMU to R&S FSQ



The WIMAX settings active on the SMU can be uploaded to the FSQ using the filemanager. Upload is achieved by selecting the SMU entry in the *Folders* list then selecting *Current SMU WiMax Settings* in the *Files* list and the pressing the *RECALL* soft-key.

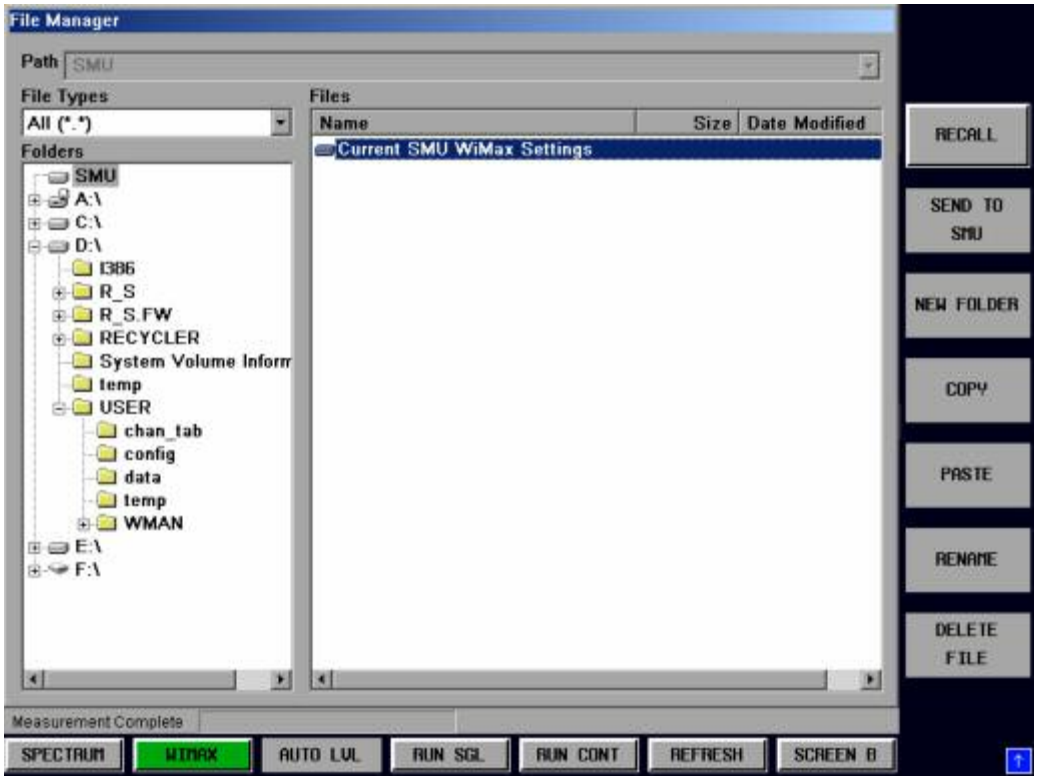


Fig. 13 File Manager view

IEC/IEEE-bus command: `MMEM:LOAD:FRAM:STAT 1,'SMU'"`

Modified Chapters for remote operation

CALCulate<1|2>:LIMit<1>:BURSt:ALL <numeric value>, …

This command sets or returns all the limit values. The limits are set or returned as a list of values separated by ',' in the following (ASCII) format:

Query/Set OFDM:

<average EVM All Carriers>, <max EVM All Carriers>,
<average EVM Data>, <max EVM Data>, -- Not used [1]
<average Frequency Error>, <max Frequency Error>,
<average Symbol Error>, <max Symbol Error>,
<average SS Timing>, <max SS Timing>, -- Not used, uplink only [2]
<average IQ Offset>, <max IQ Offset>

[1] EVM Data values are no longer used for OFDM, but are kept to maintain positions for backward compatibility.

[2] SS Timing values are no longer used for OFDM, but are kept to maintain positions for backward compatibility. The SS Timing values are only used in UL (i.e. they are not returned, and should not be set, in DL).

Query/Set OFDMA:

<average EVM Data and Pilots >, <max EVM Data and Pilots >,
<average EVM Data>, <max EVM Data>,
<average Frequency Error>, <max Frequency Error>,
<average Symbol Error>, <max Symbol Error>,
<average IQ Offset>, <max IQ Offset>,
<average BER Pilots>, <max BER Pilots> -- Optional when setting [3]
<average Unmod Subcarrier Error>, <max Unmod Subcarrier Error> -- Optional when setting, Returned in Uplink only

[3] BER Pilots values do not have to be provided when setting OFDMA limits, unless the Unmod. Subcarrier Error values are following (in which case they are required to maintain the correct positions).

[4] Unmod Subcarrier Error values do not have to be provided when setting OFDMA limits. If provided, the values will be ignored unless an uplink zone is marked for analysis. When querying OFDMA limits, the Unmod. Subcarrier Error values are only returned when an uplink zone is marked for analysis.

Note: *Additional limits may be returned in future releases. However, the order and position of limits will be maintained for backward compatibility (e.g. SS Timing) and setting additional limits will be optional (e.g. BER Pilots). Remote command scripts that expect a fixed number of limits to be returned will fail. It may be preferable for scripts to expect the current number of limits, or more, to be returned.*

Value	Description
EVM All Carriers / EVM Data and Pilots / EVM Data	Returned in either dB or % depending on selected table display units (UNIT:TABLe).
Frequency Error	Returned in Hz.
Symbol Error	Returned in ppm.
IQ Offset	Returned in either dB or % depending on selected table display units (UNIT:TABLe).
BER Pilots	Returned in %.
Unmod Subcarrier Error	Returned in dB.

Example: "CALC:LIM:BURS:ALL?" All limit values are returned
Characteristics: *RST value: mode-specific
SCPI: device-specific
Mode: OFDM, OFDMA

CALCulate<1|2>:LIMit<1>:BURSt:ALL:RESult?

This command returns all the limit results (PASSED | FAILED). The results are output as a list of result strings separated by ',' in the following (ASCII) format:

OFDM:
<average EVM All Carriers>, <max EVM All Carriers>,
<average EVM Data>, <max EVM data>,
<average Frequency Error>, <max Frequency Error>,
<average Symbol Error>, <max Symbol Error>,
<average SS Timing>, <max SS Timing>,
<average IQ Offset>, <max IQ Offset>,

Note: *SS Timing and EVM Data are maintained for backward compatibility.*

OFDMA:
<average EVM Data and Pilots>, <max EVM Data and Pilots>,
<average EVM Data>, <max EVM Data>,
<average Frequency Error>, <max Frequency Error>,
<average Symbol Error>, <max Symbol Error>,
<average IQ Offset>, <max IQ Offset>,
<average BER Pilots>, <max BER Pilots>
<average Unmod Subcarrier Error>,<max Unmod Subcarrier Error> -- returned for UL zones

Note: *Unmodulated Subcarrier Error values are only returned for an analyzed Uplink zone.*

Example: "CALC:LIM:BURS:ALL:RES?" All limit values are returned.
Characteristics: *RST value: -
SCPI: device-specific
Mode: OFDM, OFDMA

CALCulate<1|2>:LIMit<1>:BURSt:USERror[:AVERage]

This command gets/sets the average Unmodulated Subcarrier Error limit in dB. This limit value is only valid for an Up Link zone.
Note: An Up Link zone must be selected as the zone to be analysed before the limit can be set.

Example: `"CALC:LIM:BURS:USER?"` Unmodulated Subcarrier Error limit is returned
Characteristics: *RST value: –
SCPI: device-specific
Mode: OFDMA

CALCulate<1|2>:LIMit<1>:BURSt:USERror[:AVERage]:RESult

This command returns the average Unmodulated Subcarrier Error limit result (PASSED | FAILED) for an analysed Up Link zone.

Example: `"CALC:LIM:BURS:SYMB:USER:RES?"` Unmodulated Subcarrier Error limit result is returned
Characteristics: *RST value: –
SCPI: device-specific
Mode: OFDMA

CALCulate<1|2>:LIMit<1>:BURSt:USERror:MAXimum

This command gets/sets the maximum Unmodulated Subcarrier Error limit in dB. This limit value is only valid for an Up Link zone.
Note: An Up Link zone must be selected as the zone to be analysed before the limit can be set.

Example: `"CALC:LIM:BURS:USER:MAX?"` Unmodulated Subcarrier Error limit is returned
Characteristics: *RST value: –
SCPI: device-specific
Mode: OFDMA

CALCulate<1|2>:LIMit<1>:BURSt:USERror:MAXimum:RESult

This command returns the Unmodulated Subcarrier Error limit result (PASSED | FAILED) for an analysed Up Link zone.

Example: `"CALC:LIM:BURS:SYMB:USER:MAX:RES?"` Unmodulated Subcarrier Error limit result is returned
Characteristics: *RST value: –
SCPI: device-specific
Mode: OFDMA

CALCulate<1|2>:MARKer<1>:FUNCtion:TTCapture:FRAMe <numeric value>
This command sets or returns the frame that the Time to Capture Buffer marker is to be set to.

Example: "CALC:MARK:FUNC:TTC:FRAM 2"

Characteristics: *RST value: 1
SCPI: device-specific
Mode: OFDM, OFDMA

CALCulate<1|2>:MARKer<1>:FUNCtion:TTCapture[:TIMe]?
This command returns the time to the start of the frame of the capture buffer. The frame that is returned is set by CALC<1|2>:MARK<1>:FUNC:TTC:FRAM

Example: "CALC:MARK:FUNC:TTC?"

Characteristics: *RST value: 1
SCPI: device-specific
Mode: OFDM, OFDMA

CONFigure: ADDRess:SMU
This remote control command is used to specify the IP address of the SMU to which WiMax settings can be uploaded or downloaded.

Example: "CONF:ADDR:SMU '192.168.1.68'"
Characteristics: *RST value: –
SCPI: device-specific
Mode: OFDMA

CONFigure:BURSt:SPECtrum:MASK:SELect IEEE | ETSI
This remote control configures how R&S FSQ-K92/K93 will interpret the Spectrum MASK measurement results. This is either performed using the IEEE or ETSI standard.
Note: This command is maintained for backward compatibility only. It has been replaced by [SENSe:]POWer:SEM.

Example: "CONF:BURS:SPECT:MASK:SEL ETSI"
R&S FSQ-K92/93 option is will interpret the measurement results using the ETSI standard
Characteristics: *RST value: –
SCPI: device-specific
Mode: OFDM, OFDMA

CONFigure:BURSt: STATistics:BSTReam:SYMBol:SELect <numeric value>
This remote control command is only available when Bit Stream measurement is selected. When the Bit Stream measurement is initiated, it will calculate the results of the selected symbol.

Example: "CONF:BURS:STAT:BST:SYMB:SEL 1" Symbol 1 is selected.
Characteristics: *RST value: 1
SCPI: device-specific
Mode: OFDMA

CONFigure:BURSt: STATistics:BSTReam:FORMat:SELec ALL | BPSK | QPSK | QAM16 | QAM64t

This remote control command is only available when Bit Stream measurement is selected. When the Bit Stream measurement is initiated, it will calculate the results of the selected modulation format.

Example: `"CONF:BURS:STAT:BST:FORM:SEL QPSK"` QPSK modulation formats.
`"CONF:BURS:STAT:BST:FORM:SEL ALL"` All modulation formats.

Characteristics: *RST value: ALL
SCPI: device-specific
Mode: OFDMA

CONFigure:BURSt: STATistics:BSTReam:BURSt:SELect ALL | <numeric_value>

This remote control command is only available when Bit Stream measurement is selected. When the Bit Stream measurement is initiated, it will calculate the results of the selected burst.

Example: `"CONF:BURS:STAT:BST:BURS:SEL 1"` Burst 1 is selected.
`"CONF:BURS:STAT:BST:BURS:SEL ALL"` All bursts are selected.

Characteristics: *RST value: ALL
SCPI: device-specific
Mode: OFDMA

CONFigure:WIMax:FSBWratio:AUTo <boolean>

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.

Example: `"CONF:WIM:FSBW:AUTO ON"` Set to auto
Characteristics: *RST value:
SCPI: device-specific
Mode: OFDM, OFDMA

CONFigure:WIMax: FSBWratio:FS <numeric_value>

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.

Example: `"CONF:WIM:FSBW:FS 2.5"`
Characteristics: *RST value:
SCPI: device-specific
Mode: OFDM, OFDMA

CONFigure:WIMax: FSBWratio:BW <numeric_value>

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.

Example: `"CONF:WIM:FSBW:BW 1.5"`
Characteristics: *RST value:
SCPI: device-specific
Mode: OFDM, OFDMA

CONFigure:WIMax:DLSFrame:IDCell <numeric value>

This remote control command can be used to specify the downlink IDCell number, which in turn is used as DL_PermBase parameter for the permutation equations to partly set the sub carrier randomizer initialisation vector.

Example: `"CONF:WIM:DLSF:IDC 0"`
Characteristics: *RST value: 0
SCPI: device-specific
Mode: OFDMA

CONFigure:WIMax:DLSFrame:PREamble:INDex <numeric_value>

This remote control command can be used to specify the Preamble Index, which is used in finding the subframe.

Example: `"CONF:WIM:DLSF:PRE:IND 0"`
Characteristics: *RST value: 0
SCPI: device-specific
Mode: OFDMA

CONFigure:WIMax:DLSFrame:PREamble:MODe AUTO | USER

This remote control command can be used to specify whether the Preamble Index will be automatically calculated 'AUTO' or the 'USER' specified value will be used. The Preamble Index value is used in finding the subframe.

Example: `"CONF:WIM:DLSF:PRE:MOD AUTO"`
Characteristics: *RST value: AUTO
SCPI: device-specific
Mode: OFDMA

CONFigure:WIMax:ULSFrame:CRLength <numeric_value>

This remote control command is used to specify the Control Region length for the uplink frame.

Example: `"CONF:WIM:ULSF:CRL 0"`
Characteristics: *RST value: 0
SCPI: device-specific
Mode: OFDMA

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:RES"`
Characteristics: *RST value: 0
SCPI: device-specific
Mode: OFDMA

CONFigure:WIMax:ZONE<1…26>:BURSt<1...32>:CONTrol[:DATA]

This remote control command can be used to enter a burst definition that is to be associated with a specific zone. It accepts eight arguments which make up all the input settings to create a new burst. 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.

The argument list must be defined as follows:

Modulation	Modulation scheme - QPSK_1_2 | QPSK_3_4 | QAM16_1_2 | QAM16_3_4 | QAM64_1_2 | QAM64_2_3 | QAM64_3_4
Subchannels	Number of sub channels used by the burst (does not apply to downlink DL_MAP burst and uplink bursts)
Symbols	Number of symbols used by the burst (does not apply to downlink DL_MAP burst and uplink bursts)
Slot Duration	Slot duration (only applies to downlink DL_MAP burst and uplink bursts)
SubChannel Offset	Sub channel offset of the burst
Symbol Offset	Symbol offset of the burst
Burst Power	Defines the boosting power of the burst
Burst Type	Burst type - FCH | DLMAP | ULMAP | DATA.

Example: `"CONF:WIM:ZONE1:BURS1:CONT QAM16_1_2,5,10,20,0,0,0,DATA”`
To define a 16 QAM 1/2 burst using 5 sub channels 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.

Characteristics: *RST value:
SCPI: device-specific
Mode: OFDMA

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:RES"`
Characteristics: *RST value: 0
SCPI: device-specific
Mode: OFDMA

DISPlay[:WINDow<1|2>]:TABLe:LIST <numeric_value>

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).
Example: `"DISP:TABL:LIST 2"` Displays the second page of the results table

Characteristics: *RST value: 0
SCPI: device-specific
Mode: K92,K93

FETCh:BURSt:ALL?

This command returns all the results. The results are output as a list of result strings separated by ',' in the following (ASCII) format:

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>,
<average RSSI SD>,
<min CINR>, <average CINR>, <max CINR>,
<average CINR SD>

OFDMA 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>,
<min unmod. subcarrier error>, <average unmod. subcarrier error >, <max unmod. subcarrier error >,

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 SD>,
<min CINR>, <average CINR>, <max CINR>,
<CINR SD>
<min unmod. subcarrier error>, <average unmod. subcarrier error >, <max unmod. subcarrier error >,

Note that the units for the EVM results are specified with the UNITS:EVM command.

Example:	"FETC:BURS:ALL?"	All calculated results are returned.
Characteristics:	*RST value: -	
	SCPI:	device-specific
Mode:	OFDM, OFDMA	

FETCh:BURSt:USERror:MINimum?
This command returns the minimum Unmodulate Subcarrier Error for the analysed zone.

Example:	"FETC:BURS:USER:MIN?"	The minimum unmodulated subcarrier error.
Characteristics:	*RST value: –	
	SCPI:	device-specific
Mode:	OFDMA	

FETCh:BURSt:USERror:AVERage?
This command returns the average Unmodulate Subcarrier Error for the analysed zone.

Example:	"FETC:BURS:USER:AVER?"	The average unmodulated subcarrier error.
Characteristics:	*RST value: –	
	SCPI:	device-specific
Mode:	OFDMA	

FETCh:BURSt:USERror:MAXimum?

This command returns the maximum Unmodulate Subcarrier Error for the analysed zone.

Example: `"FETC:BURS:USER:MAX?"` The maximum unmodulated subcarrier error.
Characteristics: *RST value: –
SCPI: device-specific
Mode: OFDMA

FETCh:ZONE:STATistic:COUNt?

This remote control command returns the number of zones captured so far for the current statistical measurement analysis.

Example: `"FETC:ZONE:STAT:COUN?"` Returns the number of zone captured so far for the current statistical analysis.
Characteristics: *RST value: –
SCPI: device-specific
Mode: OFDMA

MMEMory:LOAD:FRAMe:STATe 1,<file_name>

The remote control command is used to load a K93 zone frame setup from an xml file created from a SMU signal generator, with support for the IEEE 80216e-2005 OFDMA/WiBro standard.

Using the special filename "SMU" will attempt to receive the current settings from a networked SMU. The IP address used is configured by `CONF:ADDR:SMU`.

Example: `"MMEM:LOAD:FRAM:STAT 1,'D:\USER\DATA.xml'"`
Characteristics: *RST value: –
SCPI: device-specific
Mode: OFDMA

MMEMory:LOAD:SEM:STATe 1,<file_name>

The remote control command is used to load a K93 spectrum emission mask setup from an xml file

Example: `"MMEM:LOAD:SEM:STAT 1,'D:\USER\TTA_SEM.xml'"`

Characteristics: *RST value: –
SCPI: device-specific
Mode: OFDM, OFDMA

MMEMory:STORe:FRAMe:STATe 1,<file_name>

The remote control command is used to send a locally created and stored K93 zone frame file name, with support for the IEEE 80216e/D11 standard, to the SMU signal generator. If the command succeeds, the SMU will generate the waveform associated with the file sent.

Example: `"MMEM:STOR:FRAM:STAT 1,'D:\USER\WMAN\DATA.wimax'"`

Characteristics: *RST value: –
SCPI: device-specific
Mode: OFDMA

[SENSe:]DEMod:FORMat[:BCONtent]:AUTO NONE | FIRST | USER | ALL

The remote command is used to specify for OFDM how the DSP should use its demodulation and for OFDMA 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.
NONE, 'OFDM' demodulation off (Brute force mode) the specified modulation is used for all bursts.
FIRSt, 'OFDM' retrieve the first valid payload modulation and analyze all bursts with same modulation.
USER, 'OFDM' analyze all bursts carrying the modulation specified.
ALL, 'OFDM' analyze each burst with the first valid payload modulation found for that burst.
SIGNal, 'OFDMA' pre-analyze to determine the Zone, Burst and Downlink sub–Channel Map, prior to analyze for the first Zone results.
PREDefined, 'OFDMA' analyze using the predefined Zone, Burst and Downlink sub–Channel Map for the current captured signal for the specified Zone results

Example: "SENS:DEM:FORM:AUTO FIRST" Specifies that the first symbol field should be decoded.

Characteristics: *RST value: ALL
SCPI: device-specific:

Mode: OFDM

[SENSe:]POWer:SEM USER|STANDARD|IEEE|ETSI

This command sets the behaviour of the Spectrum Emission Mask (SEM) analysis.

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)

Example: "POW:SEM USER" set SEM analysis according to a user defined configuration.

Characteristics: *RST value: IEEE (OFDM/OFDMA), STANDARD (WiBro)
SCPI: device-specific

Mode: OFDM, OFDMA

[SENSe:]POWer:SEM:TTA USER|STANDARD

This command sets the Spectrum Emission Mask (SEM) analysis for WiBro mode according to TTA standard or a user defined mask.

Note: This command is maintained for backward compatibility only. It has been replaced by [SENSe:]POWer:SEM.

Example: "POW:SEM:TTA STANDARD" set SEM analysis according to TTA

Characteristics: *RST value: STANDARD
SCPI: device-specific

Mode: OFDMA

[SENSe:]TRACking:CESTimation[:BASE] USERtracked|FULLytracked

This command defines whether or not the measurement is analyzed with all tracking options used. If USERtracked is specified then the tracking options specified by the user are used to analyze the signal (Level, Phase and Time). If FULLytracked is specified then the signal is automatically analyzed using all tracking options. 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.

Example: "TRAC:CEST USER"

Characteristics: *RST value: USER
SCPI: conforming
Mode: K93

[SENSe:]ZONE:COUNt <numeric_value>
This command defines the number of zones that will be analyzed by the measurement.

Example: "ZONE:COUN 16" Sets the number of zones to 16.
Characteristics: *RST value: 1
SCPI: device-specific
Mode: OFDMA

[SENSe:]ZONE:COUNt:STATe <Boolean>
When this command is set to on, the zone count parameter will be used by the measurement, otherwise the zone count parameter will be ignored.

Example: "ZONE:COUN:STAT 1" Sets the zone count state to ON
Characteristics: *RST value: 0
SCPI: device-specific
Mode: OFDMA

Status Reporting Registers

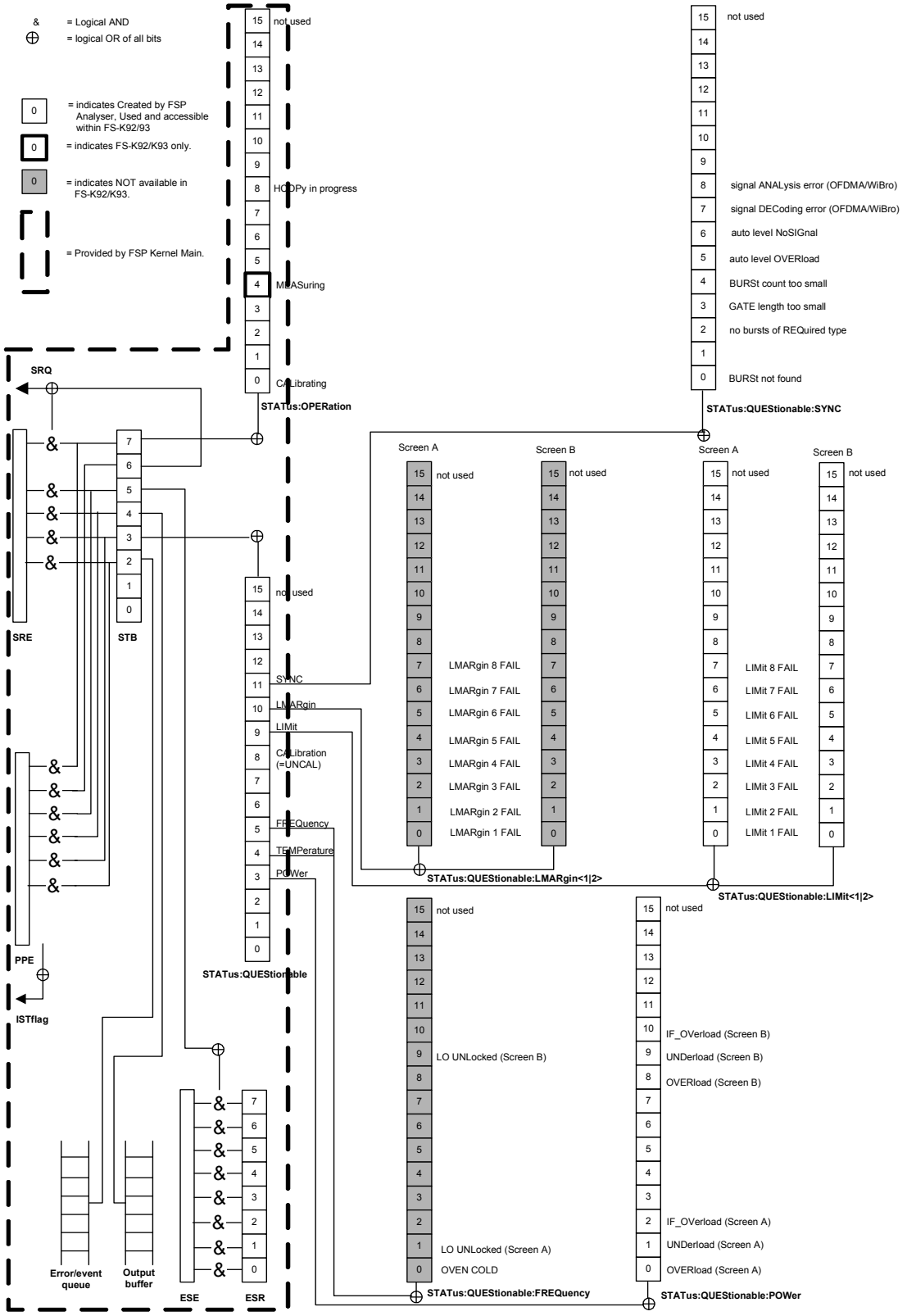


Fig. 14 Overview of the status registers

STATus:QUEStionable:SYNC Register

This contains information about sync and bursts not found, and about pre-measurement results exceeding or falling short of expected values.

The bits can be queried with commands `"STATus:QUEStionable:SYNC:CONDition?"` and `"STATus:QUEStionable:SYNC[:EVENt]?"`.

Bit No	Meaning
0	**BURSt not found** This bit is set if an IQ measurement is performed and no bursts are detected
1	This bit is not used
2	**No bursts of REQuired type** This bit is set if an IQ measurement is performed and no bursts of the specified type are detected
3	**GATE length too small** This bit is set if gating is used in a measurement and the gate length is not set sufficiently large enough
4	**BURSt count too small** This bit is set if a PVT measurement is performed with gating active and there is not at least 1 burst within the gate lines
5	**Auto level OVERload** This bit is set if a signal overload is detected when an auto-level measurement is performed
6	**Auto level NoSIGnal** This bit is set if no signal is detected by the auto-level measurement
7	**Signal DECoding error (OFDMA/WiBro)** This bit is set if the signal cannot be decoded. This corresponds to incorrect configuration of primary measurement settings, an incorrect zone/burst configuration, or a failed auto-demodulation.
8	**Signal ANALysis error (OFDMA/WiBro)** This bit is set if the signal cannot be decoded due to an unexpected error within the DSP component.
9 to 14	These bits are not used
15	This bit is always 0

TRACe Subsystem

The TRACe subsystem controls access to the instrument's internal trace memory.

COMMAND	PARAMETERS	UNIT	COMMENT
TRACe			
[:DATA]	TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | LIST		Query only
:IQ			
:DATA			
:MEMory?			Query only
:SRATe	<numeric_value>,<numeric_value>	Hz	
:FILTer	<numeric_value>		
:FLATness	NORMal | WIDE		

TRACE[:DATA]

This command returns all the measured data that relates to the currently selected measurement type. The data format returned is particular to the currently selected measurement type and is specified below.

IQ Measurements

There are a number of measurements that can be performed in IQ mode. No data will be returned for any of the following measurements, should it be requested, until such time as a measurement belonging to the IQ group has been previously run.
Running a frequency sweep measurement, for example Spectrum Mask, will not generate results for this measurement group.

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.
The results are dependant on whether an 802.16e/D11 ODFMA or 802.16 2004 OFDM measurement has been run.
For 802.16 2004 OFDM the following rules apply:
If "All Carriers" is selected, it will return 200 IQ values per symbol.
If "Pilots Only" is selected, it will return 8 pilot IQ values per symbol in the following carrier order:
-88, -63, -38, -13, 13, 38, 63, 88.
If a single carrier is selected, it will return 1 IQ value per symbol.
For 802.16e/D11 OFDMA the following rules apply:
The results are retuned in repeating groups of the FFT size, for all symbols.
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 text "NAN".
Filtering can be performed by burst, symbol, sub carrier and modulation.
Note: All sub carriers for each symbol are always returned regardless of the user filter settings.

Supported data formats (FORMat:DATA): ASCii|REAL

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 200 channels excluding 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.

Supported data formats (FORMat:DATA): ASCii|REAL

Power vs Time – Full Burst and Start / End data
This description applies to measurement results from the 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 into three master bursts. The three master bursts relate to the minimum, maximum and average values across all complete bursts. This data is returned in dBm values to the user 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 start/end, 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 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.

Supported data formats (FORMat:DATA): ASCii|REAL

Power vs Time – Full Sub Frame and Rising/Falling Sub Frame
This description applies to measurement results from the 802.16e/D11 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 to the user 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 sub frame, minimum frame data values.
TRACE2 – full sub frame, mean frame data values.
TRACE3 – full sub frame, 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.

Supported data formats (FORMat:DATA): ASCii|REAL

Spectrum Flatness
There are six separate traces that are available with this measurement. Trace data for a particular trace will only be returnable by querying the appropriate trace
Spectrum flatness provides three basic graph types. These are an absolute power value graph (ABS), an adjacent carrier power difference graph and a relative group delay graph, which are all plotted on a per carrier basis. All carriers are drawn, in addition to the unused 0 carrier.
The number of carriers depends on the measured standard. For 802.16 2004 ODFM, the number of carriers is 200 but for the 802.16e/D11 ODFMA standard the number of carriers is dependent on the FFT size. 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 802.16 2004 ODFM standard.
TRACE1 – ABS/adjacent carrier power difference/Group delay (minimum trace)
TRACE2 – ABS/adjacent carrier power difference/Group delay (average trace)
TRACE3 – ABS/adjacent carrier power difference/Group delay (maximum trace)
Absolute power results are returned in dB or dB difference and group delay results are returned in ns.

Supported data formats (FORMat:DATA): ASCii|REAL

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.
For example, 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.

Supported data formats (FORMat:DATA): ASCii|REAL

Statistics Bitstream data
Data will be returned depends on the selected standard from which the measurement was executed.
For the 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 802e16e/D11 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, 2048 sub carriers. Unused carriers, including the zero carrier, are also retuned and these 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.

Supported data formats (FORMat:DATA): ASCii|UINT

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 where:
0 = Preamble
1 = Data.
3rd value – Modulation where:
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/D11 OFDMA standard, the data will be returned in repeating groups of 7 comma separated values as follows:
1st value – Sub Frame 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.

Data will be returned in ASCII printable hexadecimal character format. TRACE1 is used for this measurement results.

Supported data formats (FORMat:DATA): ASCii|UINT

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.

Supported data formats (FORMat:DATA): ASCii|REAL

EVM vs Carrier
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 points returned will be equal to the number of used sub carriers. This varies according to the measured standard and is 201 carriers for the 802.16 OFDM 2004, which includes the zero sub carrier.
For the 802.16e/D11 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

Supported data formats (FORMat:DATA): ASCii|REAL

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

Supported data formats (FORMat:DATA): ASCii|REAL

Error vs Preamble
Three traces types are available with this measurement. The basic trace types show either the minimum, mean or maximum frequency or phase value as measured over the preamble part of the burst.
Frequency Sweep Measurements
No data will be returned for these measurements, should it be requested, until such time as a measurement has been previously run.
Running an IQ measurement will not generate results for these measurements.

Supported data formats (FORMat:DATA): ASCii|REAL

Spectrum Mask
Result data will be returned as a fixed number of 625 trace points in floating point format. Only an array of Y data will be returned.
TRACE1 – Clear write values
TRACE2 – Max hold values
LIST – Spectrum Emission Mask (SEM) summary results.
SEM summary results format:
1st Value -Index into table of results
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)
The returned values repeat for each row of the results table.

Supported data formats (FORMat:DATA): ASCii|REAL

Spectrum ACPR
Result data will be returned as a fixed number of 625 trace points in floating point format. Only an array of Y data will be returned.
TRACE1 – Clear write values
TRACE2 – Max hold values

Supported data formats (FORMat:DATA): ASCii|REAL

Example: `"TRAC? TRACE2"` The measurement data for the selected graph is returned.
Characteristics: *RST value: –
SCPI: conforming
Mode: K92

Appendix: Contacting our hotline

Any questions or ideas concerning the instrument are welcomed by our hotline:

USA & Canada

Monday to Friday (except US public holidays)
8:00 AM – 8:00 PM Eastern Standard Time (EST)

Tel. from USA	888-test-rsa (888-837-8772) (opt 2)
From outside USA	+1 410 910 7800 (opt 2)
Fax	+1 410 910 7801
E-mail	Customer.Support@rsa.rohde-schwarz.com

East Asia

Monday to Friday (except Singaporean public holidays)
8:30 AM – 6:00 PM Singapore Time (SGT)

Tel.	+65 6 513 0488
Fax +	65 6 846 1090
E-mail	Customersupport.asia@rohde-schwarz.com

Rest of the World

Monday to Friday (except German public holidays)
08:00 – 17:00 Central European Time (CET)

Tel. from Europe	+49 (0) 180 512 42 42
From outside Europe	+49 89 4129 13776
Fax	+49 (0) 89 41 29 637 78
E-mail	CustomerSupport@rohde-schwarz.com