ROHDE&SCHWARZ
Test and Measurement
Division

# Release Notes

# 3G FDD BTS/3GPP HSDPA BTS

## Application Firmware R&S FS-K72/FS-K74

## Release 4.20

## with Service Pack 1

for R&S FSP, FSU, FSQ, FSG, FSMR, FSUP, FMU
Analyzer Firmware 4.2x

**New Features:**

- Support for instrument R&S FSG.
- Softkey REF VALUE Y AXIS available now for CDP measurements, too.

**Release Note Revision: 6**

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# Contents

# History

| Date | Rel Note Rev | Changes |
|---|---|---|
| 19 July 2007 | 1 | First revision for R&S FS-K72/R&S FS-K74 version 4.20. |
| 16 August 2007 | 2 | FSP, FSU and FSQ added. |
| 12 October 2007 | 3 | Problem eliminated with Service Pack 1 added. |
| 08 November 2007 | 4 | Description of the update procedure adjusted to new update ZIP file. |
| 22 November 2007 | 5 | FMU added. |
| 09 October 2008 | 6 | FSUP added. |

# General Topics

## Hardware Requirements

Please note that R&S FS-K72/K74 requires options R&S FSP-B15 and R&S FSP-B70 in order to run on an R&S FSP. If either of the required hardware options is not installed the unit will not accept the license key for the corresponding firmware application.

## Compatibility of R&S FS-K72/K74

The following table shows the compatible versions of the basic analyzer firmware and the 3G FDD BTS Application Firmware R&S FS-K72 and 3GPP Application Firmware R&S FS-K74 (FS-K74 is supported since version 2.28/3.28):

**Table of compatible versions:**

| R&S FS-K72/K74 Application Firmware | R&S FSP Basic Firmware | R&S FSU Basic Firmware | R&S FSQ Basic Firmware | R&S FSMR Basic Firmware | R&S FSUP Basic Firmware | R&S FMU Basic Firmware | R&S FSG Basic Firmware |
|---|---|---|---|---|---|---|---|
| 4.20 SP1 | 4.20 | 4.21 | 4.25 | | 4.27 | 4.28 | 4.29 |
| 4.20 | 4.20 | 4.21 | 4.25 | | - | - | 4.29 |
| 4.17 | - | - | - | - | 4.17 | - | - |
| 4.10 | 4.10 | 4.11 | 4.15 | 4.16 | - | - | - |
| 4.01 | - | - | - | - | - | 4.08 | - |
| 4.00 | 4.00 | 4.01 | 4.05 | - | - | - | - |
| 3.90 SP1 | 3.90 | 3.91 | 3.95 | 3.96 | 3.99 | - | - |
| 3.90 | 3.90 | 3.91 | 3.95 | 3.96 | - | - | - |
| 3.80 | 3.80 | 3.81 | 3.85 | 3.86 | - | - | - |
| 3.70 | 3.70 | 3.71 | 3.75 | 3.76 SP1 | - | - | - |
| 3.60 | 3.60 | 3.61 | 3.65 | 3.66 SP1 | - | - | - |
| 3.50 | 3.50 | 3.51 | 3.55 | - | - | - | - |
| 3.40 | 3.40 | 3.41 | 3.45 | - | - | - | - |
| 3.35 | - | - | 3.35 | - | - | - | - |
| 3.30 | 3.30 | 3.31 | - | - | - | - | - |
| 3.28 | 3.20 | 3.21 | 3.25 | - | - | - | - |
| 3.24 | 3.10 | 3.11 | 3.15 | - | - | - | - |
| 3.20 | 3.00 | - | 3.05 | - | - | - | - |
| 2.60 | 2.60 | 2.61 | - | - | - | - | - |
| 2.40 | 2.40 | 2.41 | 2.45 | - | - | - | - |
| 2.35 | - | - | 2.35 | - | - | - | - |
| 2.30 | 2.30 | 2.31 | - | - | - | - | - |
| 2.28 | 2.20 | 2.21 | 2.25 | - | - | - | - |
| 2.24 | 2.10 | 2.11 | 2.15 | - | - | - | - |
| 1.21 | - | - | 2.05 | - | - | - | - |
| 1.20 | 1.80 | 1.81 | 1.85 | - | - | - | - |
| 1.12 | 1.70 | 1.71 | 1.75 | - | - | - | - |
| 1.11 | 1.60 | 1.61 | 1.65 | - | - | - | - |
| 1.10 | 1.50 | 1.51 | - | - | - | - | - |
| 1.00 | - | 1.41 | - | - | - | - | - |

Application firmware versions 3.xx are running on R&S FSPs with order # 1164.4391.xx or R&S FSU with order # 1166.1660.xx or R&S FSQ with operating system XP.

Application firmware version 2.xx are running on R&S FSPs with order # 1093.4495.xx or R&S FSU with order # 1129.9003.xx or R&S FSQ with operating system NT.

## Firmware Update of R&S FS-K72/K74

Since basic firmware version 4.2x a ZIP file with the update sets of the basic system firmware and all available applications is provided. This ZIP file is available in the instruments FIRMWARE section, e.g. R&S FSU of the Service Board on GLORIS.

Please follow the steps described in the instrument's basic firmware release note to perform a complete firmware update.

## 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 FS-K72 3G FDD BTS and R&S FS-K74 HSDPA BTS 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.

- Each application firmware R&S FS-K72 3G FDD BTS and R&S FS-K74 HSDPA BTS has its own option key. The K72 3G FDD BTS is a prerequisite for installing the K74 HSDPA BTS application firmware!
- Installing FS-K72: option key for FS-K72 must be entered
- Installing FS-K74: option key for FS-K72 **and** option key for FS-K74 must be entered
- On a successful validation the message 'option key valid‘ will appear.
- 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 message box 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.**

# Modified Functions

The version numbers in brackets indicate the version in which the function was modified.

**1. [V1.11] New functions: Antenna Diversity, Sync Type CPICH / SCH**

**2. [V1.12] Carrier Frequency Error now determined on per slot basis**

**3. [V1.12] New result display types: Composite Constellation, Power vs. Symbol**

**4. [V1.12] New: Support for Compressed Mode signals**

**5. [V1.20] Margin check of xdB margin below Spectrum Emission Mask Limit Lines**

6. [V3.20/V1.20] Output of frequency and response value if margin check failed
7. [V3.20/V1.21] Improved sensitivity for code channels with low SN ratio (6dB SNR of a code class 8 channel is sufficient to detect the channel in auto search mode)
8. [V3.20/V1.21] Pilot symbol check added.
9. [V3.20/V1.21] For signalling a detection of a pilot symbol that is different from that of the 3GPP standard the 5th Bit of the status register is used.
10. [V3.24/V2.24] Code Domain Error Power measurement is now available
11. [V3.24/V2.24] Improved Resolution of Trigger to Frame measurement
12. [V3.24/V2.24] Improved absolute accuracy of Trigger to Frame measurement
13. [V3.24/V2.24] Trace statistic available on result summary parameters (MIN Hold, MAX Hold, Averaging)
14. [V3.24/V2.24] Improved compressed mode handling
15. [V3.28/V2.28] Support of FS-K74 HSDPA BTS Test including automatic channel search
16. [V3.28/V2.28] Unit circle display in constellation diagrams
17. [V3.28] Option FS-K9 power sensor support for RF measurement
18. [V3.30/V2.30] New function: Multi-Frame Evaluation
19. [V3.30/V2.30] Detection of SCCPCH is now available
20. [V3.30/V2.30] Improved detection sensitivity for HSDPA channels
21. [V3.30/V2.30] Spectrum emission mask – IEC readout of worst fail position
22. [V3.30/V2.30] Auto channel detection of compressed mode channels
23. [V3.40/V2.40] IEC readout of frame bit-stream
24. [V3.40/V2.40] Slot power difference of power versus slot measurement
25. [V3.40/V2.40] Adjacent channel leakage power ratio (ACLR) for multi carrier signals
26. [V3.40/V2.40] Peak list evaluation of spectrum emission mask
27. [V3.40/V2.40] Advanced auto level adjust of multi carrier signals
28. [V3.40/V2.40] Autolevel Adjust for channel power measurement and statistic measurement
29. [V3.50/V2.60] Extended scrambling code range
30. [V3.50/V2. 60] Advanced channel type estimation for compressed mode
31. [V3.50/V2. 60] Display of slot format type A and type B
32. [V3.50/V2. 60] Display of TPC Symbols in the first slot of a compressed gap
33. [V3.50/V2. 60] Constellation re-arrangement for 16 QAM in dependence on constellation parameter B
34. [V3.50/V2. 60] Absolute and relative slot power display and differential slot power display added
35. [V3.50/V2. 60] Extended trigger range
36. [V3.50/V2. 60] RF combination measurement (RF Combi)
37. [V3.60/V2.60] Display of frequency error versus slot, phase discontinuity versus slot, symbol magnitude error and symbol phase error
38. [V3.60/V2.60] Result Summary: added value RHO
39. [V3.60/V2.60] Scrambling code input in hex and also in decimal
40. [V3.60/V2.60] HSDPA mode can be switched OFF / ON
41. [V3.60/V2.60] Measurement of timing offset in predefined channel mode
42. [V3.60/V2.60] Multi carrier ACP measurement with independent inter carrier spacing support
43. [V3.60/V2.60] SEM: Extended range definition for peak list and adjustable transition frequency
44. [V3.60/V2.60] External trigger level adjustable from 0.5 to 3.5 V
45. [V3.60/V2.60] Carrier frequency step size softkey available
46. [V3.70/V2.80] Scrambling code auto search

**47. [V3.70/V2.80] Channel table compare mode**

**48. [V3.70/V2.80] Remote command to read out total power versus slot**

**49. [V3.70/V2.80] ACLR/MCACLR: number of adjacent channels increased to 12, power mode to max hold the power results**

**50. [V3.70/V2.80] RF COMBI: noise correction mode**

**51. [V3.80/V2.80] Support for HSUPA within R&S FS-K74**

**52. [V3.80/V2.80] Trace view available within code domain analyzer**

**53. [V3.90] List result of scrambling code search**

**54. [V4.00] Vector error of Error Vector Magnitude (EVM) versus chip**

**55. [V4.00] Magnitude error of Error Vector Magnitude (EVM) versus chip**

**56. [V4.00] Phase error of Error Vector Magnitude (EVM) versus chip**

**57. [V4.00] Spectrum emission mask: List evaluation in lower screen now supported**

**58. [V4.00SP1] New remote command TRACe:DATA? ATRACE2**

**59. [V4.10] New remote command CALC:MARK:FUNC:WCDP:RES? PSYMbol | ACHannels**

**60. [V4.20] Support for instrument R&S FSG.**

**61. [V4.20] Soft key REF VALUE Y AXIS available for CDP measurements.**

# Problems Eliminated with 4.20

None.

# Problems eliminated with Service Pack 1

Service Pack 1 fixes the following problems.

The version numbers in brackets indicate the version in which the problem was observed for the first time.

**1. (V4.10) Application crashes in code domain power measurements (uplink direction only).**

This bug only affects the uplink direction (option R&S FS-K73). No update is necessary if only option R&S FS-K72 is used.

# Modifications to the Operating Manual

The R&S FS-K72/K74 3G FDD BTS analyzer functions are included in a separate manual set. Please refer to the following order numbers:

- 1154.7023.44-03 German and English

## Modified Chapters for manual operation

## Code Domain Power Menu – Overview

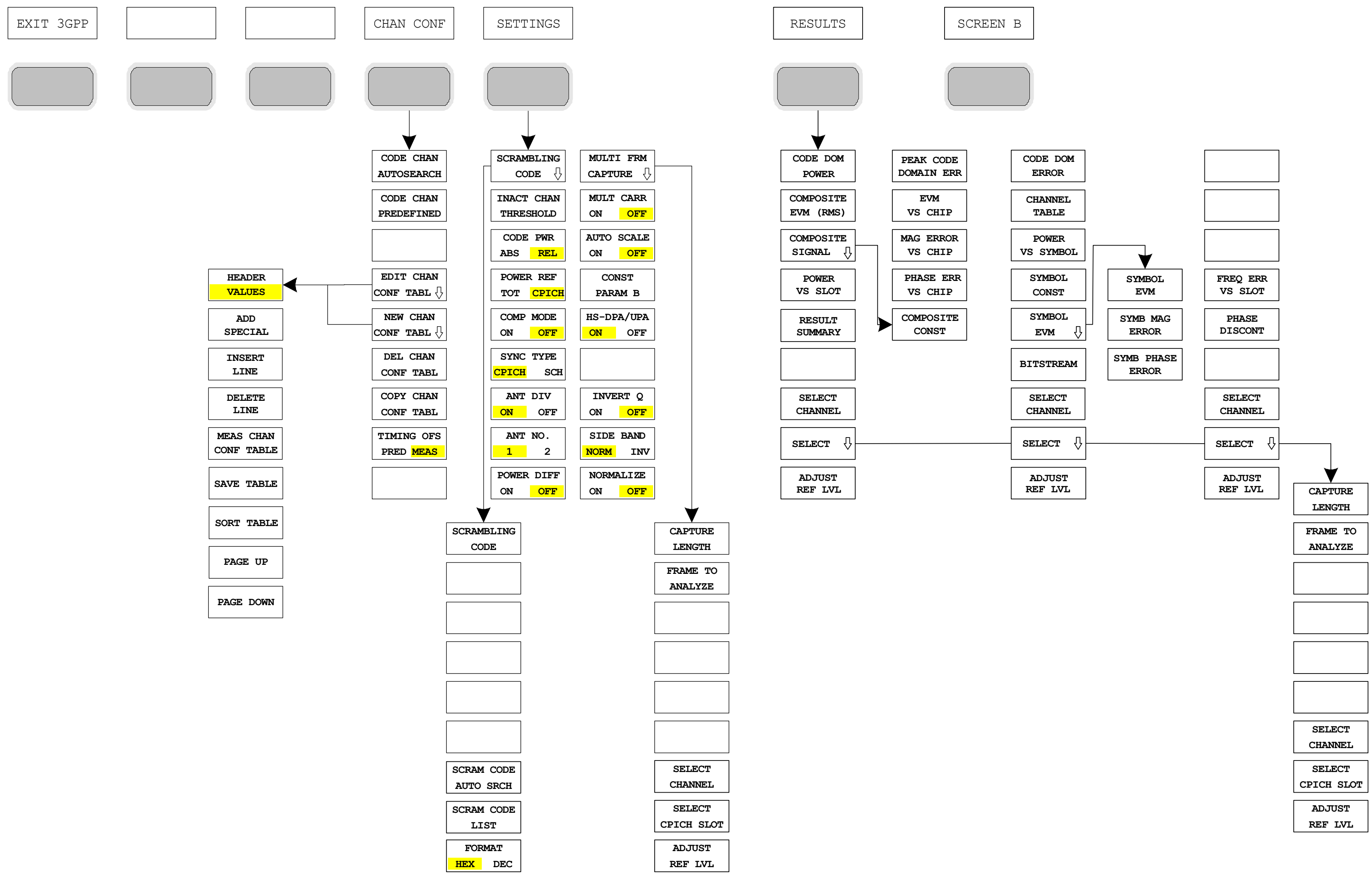



**Figure 1: Code Domain Power Menu – Overview**

## Measurement Menu – Overview

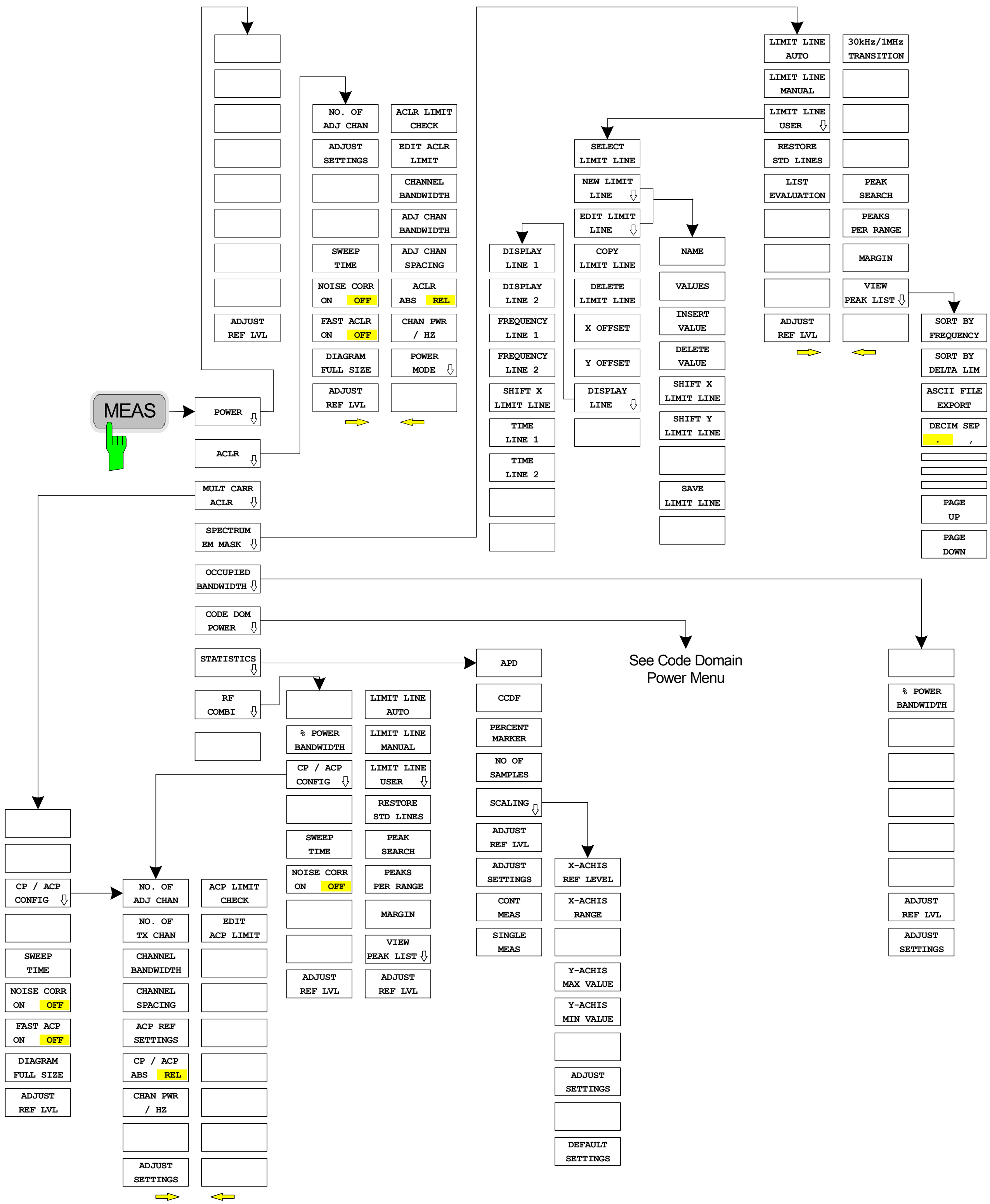



Figure 2: Overview of menus - measurements

## Signal Power Check – SPECTRUM EM MASK

MEAS key

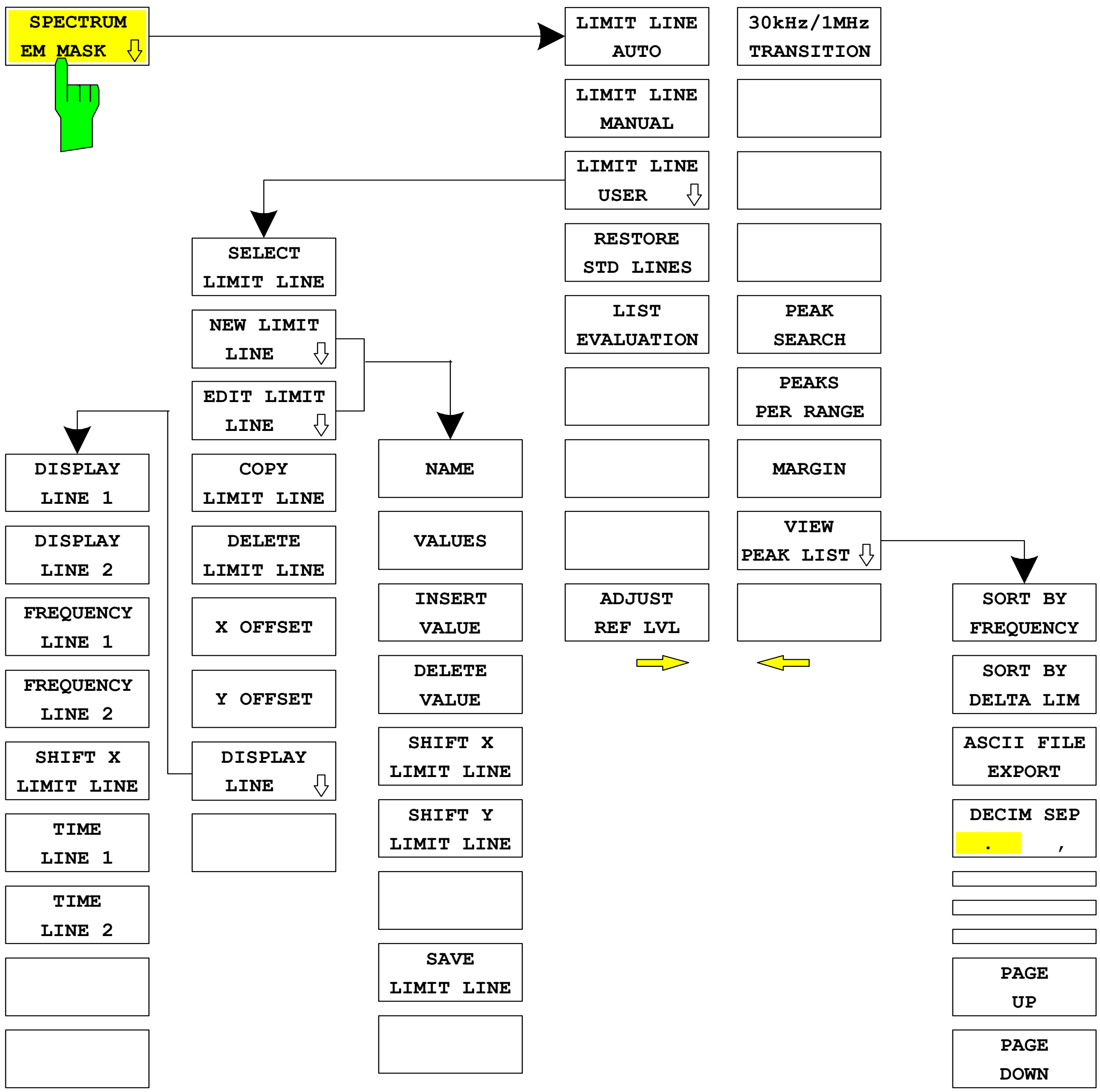


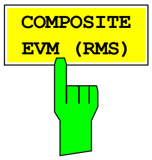

**Figure 3: Spectrum emission mask measurement menu**

The *SPECTRUM EM MASK* softkey starts the determination of the power of the 3GPP FDD signal in defined offsets from the carrier and compares the power values with a spectral mask specified by 3GPP.

IEC/IEEE bus command: `:CONF:WCDP:MEAS ESP`

Query of results: `:CALC:LIMit:FAIL? and visual evaluation`

## Root Mean Square Error Vector Magnitude ($EVM_{RMS}$)




The *COMPOSITE EVM* (RMS) softkey selects the root mean square composite EVM (modulation accuracy) display model according to the 3GPP specification. During the composite EVM measurement, the square root of the mean squared errors between the real and imaginary components of the received signal and an ideal reference signal (EVM refererenced to the total signal) is determined. Thus, composite EVM is a measurement of the composite signal.

$$EVM_{RMS} = \sqrt{\frac{\sum_{n=0}^{N} |s_n - x_n|^2}{\sum_{n=0}^{N-1} |x_n|^2}} \cdot 100\% \quad | \quad N = 2560$$

where:

| | | |
|---|---|---|
| $EVM_{RMS}$ | - | root mean square of the vector error of the composite signal |
| $s_n$ | - | complex chip value of received signal |
| $x_n$ | - | complex chip value of reference signal |
| n | - | index number for mean power calculation of received and reference signal. |
| N | - | number of chips at each CPICH slot |

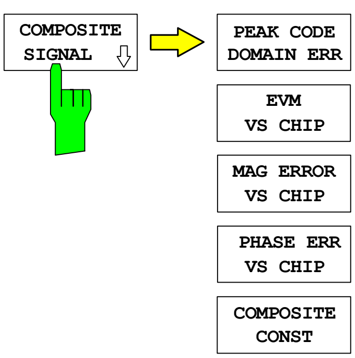
IEC/IEEE bus command: `:CALC2:FEED "XTIM:CDP:MACC"`

Query of result: `:TRAC2:DATA? TRAC2`

UNIT: [%]

Range: [0% … 100%]

## Error Vector Magnitude ($EVM_{chip}$) versus chip




The *COMPOSITE SIGNAL* softkey opens a submenu for evaluation dispays of the compsite WCDMA signal versus time. Different measurements are supported:

PEAK CODE DOMAIN ERR:

***Peak Code Domain Error***

Projection of the error between the received signal and the ideal reference signal onto the spreading factor of code class 8 and subsequent averaging using the symbols of each slot of the difference signal. The maximum value of all codes is displayed versus the CPICH slot number [screen B].

EVM VS CHIP:

***Error Vector Magnitude versus chip***

Square root of square difference between received signal and reference signal at chip level, displayed for each chip.

MAG ERROR VS CHIP:

***Magnitude Error versus chip***

Difference between the amplitude of the received signal and the reference signal at chip level, displayed for each chip.

PHASE ERROR VS CHIP:

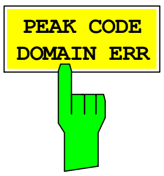
***Phase Error versus chip***

Phase difference between the received signal vector and the reference signal vector at chip level, displayed for each chip.

COMPOSITE CONST

***Composite Constellation diagram***

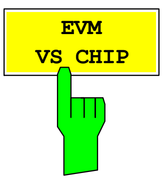
Constellation diagram of received signal (scrambled chips) [screen B].




The *PEAK CODE DOMAIN ERR* softkey selects the peak code domain error display mode. In line with the 3GPP specifications, the error between the measurement signal and the ideal reference signal is projected onto the various spreading factors. The result consists of one numerical value per slot for the peak code domain error value. The measurement interval is the slot spacing of the CPICH (timing offset of 0 chips referenced to the beginning of the frame).

IEC/IEEE bus command: `:CALC2:FEED "XTIM:CDP:ERR:PCD`

Query of result: `:TRAC2:DATA? TRAC2`




The EVM VS CHIP softkey activates the Error Vector Magnitude (EVM) versus chip display. The EVM is displayed for all chips of the slected slot. . The selected slot can be varied by the SELECT CPICH SLOT softkey. The EVM is calculated by the root of the square difference of received signal and reference signal. The reference signal is estimated from the channel configuration of .all active channels. The EVM is related to the square root of the mean power of reference signal and given in percent.

$$EVM_k = \sqrt{\frac{\left|s_k - x_k\right|^2}{\frac{1}{N}\sum_{n=0}^{N-1}\left|x_n\right|^2}} \cdot 100\% \quad | \quad N = 2560 \quad | \quad k \in \left[0 \ldots (N-1)\right]$$

| where: | | |
|---|---|---|
| | $EVM_k$ | - vector error of the chip EVM of chip number k |
| | $s_k$ | - complex chip value of received signal |
| | $x_k$ | - complex chip value of reference signal |
| | k | - index number of the evaluated chip |
| | n | - index number for mean power calculation of reference signal. |
| | N | - number of chips at each CPICH slot |

The value are displayed as trace in screen B (Figure 4) and can be read by IEC bus command.

IEC/IEEE bus command: `:CALCulate1:FEED 'XTIMe:CDPower:CHIP:EVM'`

Query of result: `:TRACe1:DATA? TRACe2`

UNIT: [%]

Range: [0% … 100%]

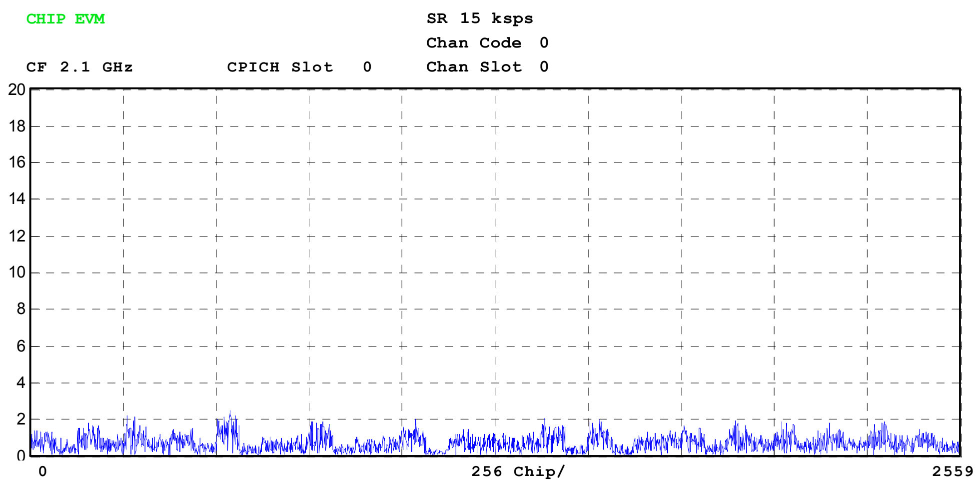
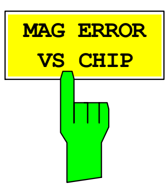



**Figure 4:** Display of vector error of the EVM versus chip measurement




The MAG ERROR VS CHIP softkey activates the Magnitude Error versus chip display. The magnitude error is displayed for all chips of the slected slot. The selected slot can be varied by the SELECT CPICH SLOT softkey. The magnitude error is calculated by the difference of the magnitude of received signal and magnitude of reference signal (Figure 6). The reference signal is estimated from the channel configuration of .all active channels. The magnitude error is related to the square root of the mean power of reference signal and given in percent.

$$MAG_k = \frac{|s_k| - |x_k|}{\sqrt{\frac{1}{N}\sum_{n=0}^{N-1}|x_n|^2}} \cdot 100\% \quad | \quad N = 2560 \quad | \quad k \in [0 \ldots (N-1)]$$

where:

| | | | |
|---|---|---|---|
| where: | $MAG_k$ | - | magnitude error of chip number k |
| | $s_k$ | - | complex chip value of received signal |
| | $x_k$ | - | complex chip value of reference signal |
| | k | - | index number of the evaluated chip |
| | n | - | index number for mean power calculation of reference signal |
| | N | - | number of chips at each CPICH slot |

The value are displayed as trace in screen B (Figure 5) and can be read by IEC bus command.

IEC/IEEE bus command: `:CALCulate1:FEED 'XTIMe:CDPower:CHIP:MAGNitude'`

Query of result: `:TRACe1:DATA? TRACe2`

UNIT: [%]

Range: [-100% … 100%]

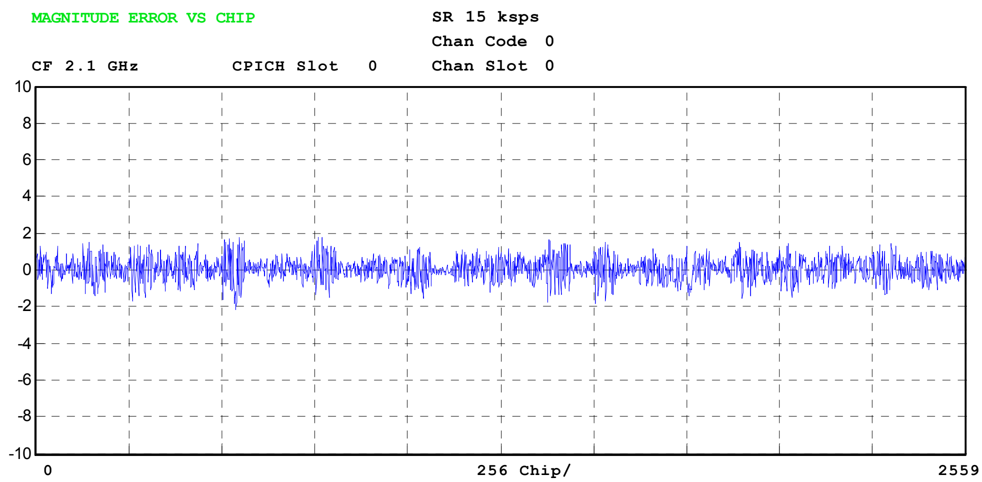
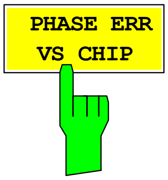



**Figure 5:** Display of magnitude error versus chip measurement




The PHASE ERROR VS CHIP softkey activates the Phase Error versus chip display. The phase error is displayed for all chips of the slected slot. The selected slot can be varied by the SELECT CPICH SLOT softkey. The phase error is calculated by the difference of the phase of received signal and phase of reference signal (Figure 6). The reference signal is estimated from the channel configuration of .all active channels. The phase error is given in grad in a range of +/- 180°.

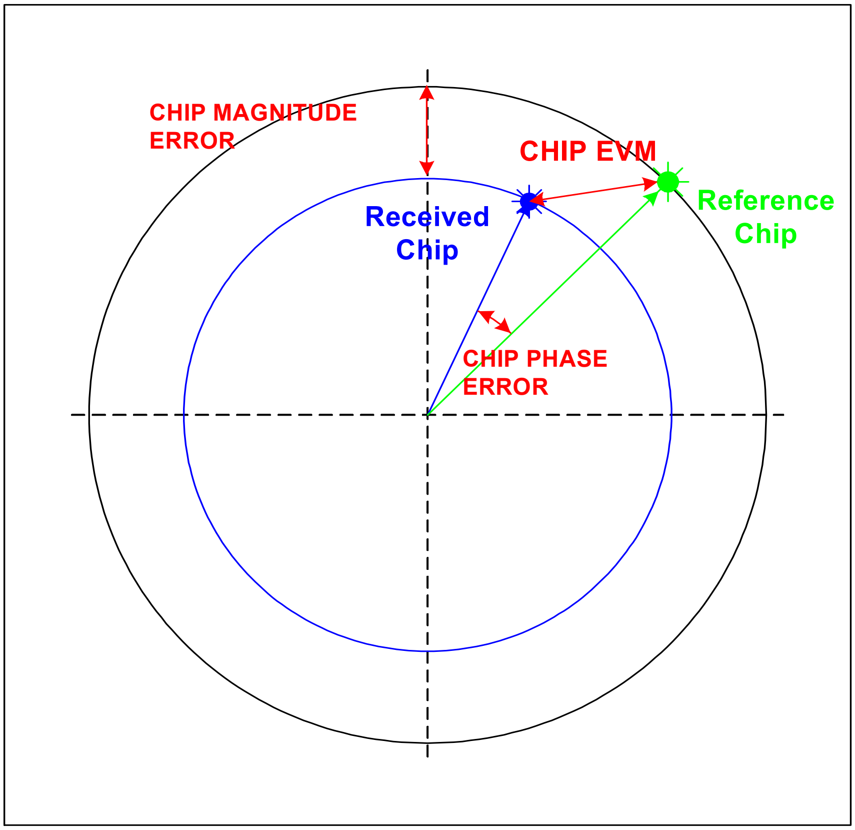



**Figure 6:** Schematic of reference signal chip and received signal chip to calculate the magnitude, phase and vector error.

$$PHI_k = \varphi(s_k) - \varphi(x_k) \quad | \quad N = 2560 \quad | \quad k \in [0 \ldots (N-1)]$$

where: $PHI_k$ - phase error of chip number k
$s_k$ - complex chip value of received signal
$x_k$ - complex chip value of reference signal
k - index number of the evaluated chip
N - number of chips at each CPICH slot
φ(x) - phase calculation of a complex value

The value are displayed in screen B (Figure 7) and can be read by IEC bus command.

IEC/IEEE bus command: `:CALCulate1:FEED :CALCulate1:FEED 'XTIMe:CDPower:CHIP:PHASe'`

Query of result: `:TRACe1:DATA? TRACe2`

UNIT: [°]

Range: [-180° … 180°]

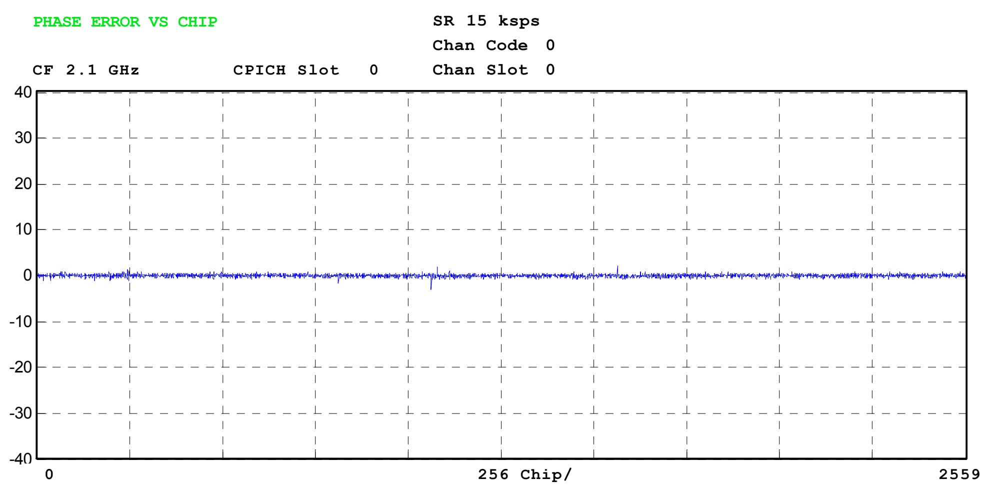
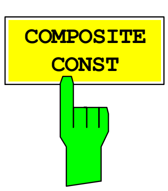



**Figure 7:** Display of phase error versus chip




Display of constellation diagram for the chips of all channels. The displayed constellation points are normalized with the square root of the total power (Figure 8).

EC/IEEE bus command: `:CALC1:FEED "XTIM:CDP:COMP:CONS"`
Query of result: `:TRAC<1>:DATA? TRAC2`

Output: List of I/Q values of all chips per slot
Format: $Re_1, Im_1, Re_2, Im_2, \ldots, Re_{2560}, Im_{2560}$
Unit: [1]
Quantity: 2560

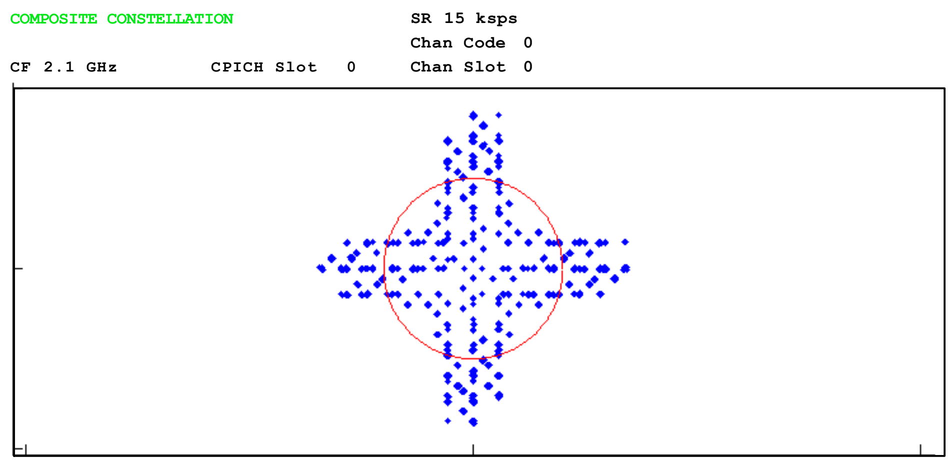



**Figure 8:** Composite Constellation diagram of received signal (scrambled chips)

## Explanation of displayed IQ impairments

*Explanation of IQ impairment model*

In RF devices including analog mixers such as up-converters, the analog complex baseband signal (r(t)=rI(t)+j*rQ(t)) is shifted to a real high frequency signal (sHF(t)). Each non-ideal complex mixer adds IQ impairments to the baseband signal. Two of them, the IQ offset and the IQ imbalance are estimated by the R&S FS-K72. Both values are given in the Result Summary display. The equations to explain these impairment parameters are described in the following paragraph. The estimation and display of IQ offset and IQ imbalance do NOT depend on the status of the NORMALIZE ON/OFF key. The key only controls an algorithm which compensates the IQ offset to normalize the constellation diagram to the origin.

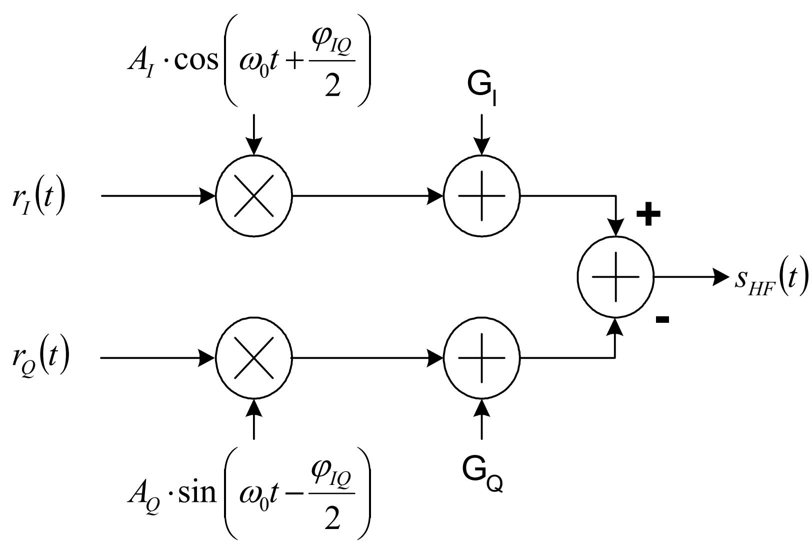



**Figure 9:** Basic model of possible IQ impairment parameters in complex up-converters.

*IQ-Offset*

The IQ offset is given in the Result Summary display. It represents a complex offset which leads to a shifted composite constellation diagram. The value is given relative to the mean power of the signal. It is calculated as follows:

$$offset_{IQ} = |g| \cdot 100\% = \sqrt{|g_I + j \cdot g_Q|^2} \cdot 100\% = \sqrt{\frac{G_I^2 + G_Q^2}{\frac{1}{T}\int_0^T |r(t)|^2 dt}} \cdot 100\%$$

| | | |
|---|---|---|
| where: | \|g\| | - magnitude of the relative IQ offset |
| | gI | - relative IQ offset of the real part |
| | gQ | - relative IQ offset of the imaginary part |
| | GI | - absolute IQ offset of the real part |
| | GQ | - absolute IQ offset of the imaginary part |
| | r(t) | - complex baseband signal (reference signal matching with optimum EVM assuming that AWGN is given) |
| | T | - evaluation time (T=666µs → 1 slot) |
| | offsetIQ | - IQ offset parameter |

*IQ-Imbalance*

The IQ imbalance is given in the Result Summary display. It represents a complex gain error between the mixer gain in the I path and the mixer gain in the Q path. We assume that a baseband signal r(t) is multiplied by a complex analog oscillator with radian frequency $\omega_0=2\pi * f_0$. The complex signal r(t) can be split into a real part $\{r_I(t)\}$ and an imaginary part $\{r_Q(t)\}$. Using this assumption, an ideal complex local oscillator ($LO_{ideal}$) can also be described by two real sinusoidal signals with a phase offset of 90°. These signals are described as $\cos(\omega_0 t)$ and $\sin(\omega_0 t)$.

$$LO_{ideal} = A \cdot \exp(j\omega_0 t) = A \cdot \cos(\omega_0 t) + j \cdot A \cdot \sin(\omega_0 t)$$

The local oscillator is not ideal in an analog mixer. Normally, there are two different amplitude values ($A_I$ and $A_Q$) in each path. Moreover, an unwanted phase shift ($\varphi_{IQ}$) between the real part and the imaginary part of the local oscillator ($LO_{impairment}$) may occur. Considering these impairments, a non-ideal LO can be described as follows:

$$LO_{impairment} = A_I \cdot \cos\left(\omega_0 t + \frac{\varphi_{IQ}}{2}\right) + j \cdot A_Q \cdot \sin\left(\omega_0 t - \frac{\varphi_{IQ}}{2}\right)$$

The IQ imbalance expresses the relative gain error of the mixer. It is calculated as follows:

$$imbalance_{IQ} = \sqrt{\frac{\left|A_I \cdot \exp\left(j\frac{\varphi_{IQ}}{2}\right) - A_Q \cdot \exp\left(-j\frac{\varphi_{IQ}}{2}\right)\right|^2}{\left|A_I \cdot \exp\left(j\frac{\varphi_{IQ}}{2}\right) + A_Q \cdot \exp\left(-j\frac{\varphi_{IQ}}{2}\right)\right|^2}} \cdot 100\%$$

where: $A_I$ - amplitude mixer gain of the real part

$A_Q$ - amplitude mixer gain of the imaginary part

$\varphi_{IQ}$ - additional phase shift between real part and imaginary part

$imbalance_{IQ}$ - IQ imbalance parameter

## Menu MEAS – SPECTRUM EM MASK


The softkey *LIST EVALUATION* reconfigures the SEM output to a split screen. In the upper half the trace with the limit line is shown. In the lower half the peak value list is shown. For every range of the spectrum emisison defined by the standard the peak value is listed. For every peak value the frequency, the absolut power, the relative power to the channel power and the delta limit to the limit line is shown. As long as the delta limit is negative, the peak value is below the limit line. A positive delta indicates a failed value. The results are then colored in red, and a star is indicated at the end of the row, for indicating the fail on a black and white printout.
If the list evaluation is active, the peak list function is not available.

**IEC/IEEE-bus command:**

```
:CALCulate1:PEAKsearch:AUTO ON | OFF
```

With this command the list evaluation which is by default for backwards compatibility reasons off can be turned on.

```
TRACe1:DATA? LIST
```

With this command the list evaluation results are queried in the following order:
<no>, <start>, <stop>, <rbw>, <freq>, <power abs>, <power rel>, <delta>, <limit check>, <unused1>, <unused2>
All results are float values.

| | |
|---|---|
| no | : range number |
| start | : start frequency |
| stop | : stop frequency |
| rbw | : resolution bandwidth of range |
| freq | : frequency of peak |
| power abs | : absolut power in dBm of peak |
| power rel | : relative power in dBc (related to the channel power) of peak |
| delta | : distance to the limit line in dB (positive indicates value above the limit, fail) |
| limit check | : limit fail (pass = 0, fail =1) |
| unused1 | : reserved (0.0) |
| unused2 | : reserved (0.0) |

# Modified Chapters for remote operation

## Advanced channel type estimation (SCPICH)

**:TRACe[:DATA]?** CWCDp

*CWCDp* For each channel, 10 values are transmitted. The range of channel type has been extended to 13.

<code class>,<channel number>,<absolute level>,<relative level>, <timing offset>, <pilot length>, <active flag>, **<channel type>**, <modulation type>, <reserved>...

| No. | Parameter | Range | Unit | Explanation |
|---|---|---|---|---|
| 1) | <code class> | {2 ... 9} | [1] | Code class of the channel. |
| 2) | <channel number> | {0 ... 511} | [1] | Code number of the channel. |
| 3) | <absolute level> | {-∞ ... ∞} | [dBm] | Absolute level of the code channel at the selected channel slot. (The channel slot can be marked by the SELECTED CPICH slot.) |
| 4) | < relative level > | {-∞ ... ∞} | [dB] | Relative level of the code channel at the selected channel slot referenced to CPICH or total power. (The channel slot can be marked by the SELECTED CPICH slot.) |
| 5) | <timing offset> | {0 ... 38400} | [chips] | Timing offset of the code channel to the frame start. The value is measured in chips. The step width is 256 chips in the case of code class 2 to 8, and 512 chips in the case of code class 9. |
| 6) | <pilot length> | {0,2,4,8,16} | [symbols] | Pilot length of the code channel. According to the 3GPP standard, the pilot length range depends on the code class. |
| 7) | <active flag> | {0,1} | [1] | Flag to indicate whether a channel is active<br>0 - channel not active<br>1 - channel active |
| 8) | <channel type> | {0 ... 13} | [1] | Channel type indication |
| | | 0 - DPCH | **D**edicated **P**hysical **Ch**annel of a standard frame | |
| | | 1 - PICH | **P**aging **I**ndication **Ch**annel | |
| | | 2 - CPICH | **C**ommon **Pi**lot **Ch**annel | |
| | | 3 - PSCH | **P**rimary **S**ynchronization **Ch**annel | |
| | | 4 - SSCH | **S**econdary **S**ynchronization **Ch**annel | |
| | | 5 - PCCPCH | **P**rimary **C**ommon **C**ontrol **P**hysical **Ch**annel | |
| | | 6 - SCCPCH | **S**econdary **C**ommon **C**ontrol **P**hysical **Ch**annel | |
| | | 7 - HS_SCCH | HSDPA: **H**igh **S**peed **S**hared **C**ontrol **Ch**annel | |

| | | | | |
|---|---|---|---|---|
| | | 8 - HS_PDSCH | HSDPA: **H**igh **S**peed **P**hysical **D**ownlink **S**hared **C**hannel | |
| | | 9 - CHAN | Channel without any pilot symbols (QPSK modulated) | |
| | | 10 - CPRSD | Dedicated Physical Channel in **c**om**pr**e**s**se**d** mode | |
| | | 11 - CPR-TPC | Dedicated Physical Channel in **c**om**pr**essed mode<br>**TPC** symbols are sent in the first slot of the gap. | |
| | | 12 - CPR-SF/2 | Dedicated Physical Channel in **c**om**pr**essed mode using half spreading factor (**SF/2**). | |
| | | 13 - CPR-SF/2-TPC | Dedicated Physical Channel in **c**om**pr**essed mode using half spreading factor (**SF/2**).<br>**TPC** symbols are sent in the first slot of the gap. | |
| | | 14 – EHICH-ERGCH | ***E-HICH***: ***E****nhanced* ***H****ARQ* ***H****ybrid* ***A****cknowledgement* ***I****ndicator* ***Ch****annel*<br>**E-RGCH: E**nhanced **R**elative **G**rant **Ch**annel | |
| | | 15 - EAGCH | ***E-AGCH***: ***E****nhanced* ***A****bsolute* ***G****rant* ***Ch****annel* | |
| | | 16 – SCPICH | **SCPICH: S**econdary **C**ommon **Pi**lot **Ch**annel | |
| 9) | <modulation type> | {2,4,15} | [1] | Modulation type of the code channel at the selected channel slot. (The channel slot can be marked by adjusting SELECT CPICH slot.) |
| | | 2 - QPSK | Modulation type QPSK. | |
| | | 4 - 16QAM | Modulation type 16QAM. | |
| | | 15 - NONE | There is no power in the selected channel slot [slot is switched OFF]. (According to 3GPP, the power of an HSDPA channel can be switched every 2 ms, i.e. 3 slots.) | |
| 10) | <reserved> | {0} | [1] | Reserved for future functionality. |

## Define channel table using advanced channel types (SCPICH)

**:CONFigure:WCDPower[:BTS]:CTABle:DATA**
<code class>,<code number>,<use TFCI>,<timing offset >,
<pilot length>,**<pich>**,<status>,<CDP relative [dB]>....

| | | | |
|---|---|---|---|
| Code class: | 2 to 9 | | |
| Code number: | 0 to 511 | | |
| Use TFCI: | 0: not used, 1: used | | |
| Timing offset: | 0 to 38400, for code class 9, the step width is 512; otherwise, 256 | | |
| Pilot length: | code class 9: | | 4 |
| | code class 8: | | 2, 4, 8 |
| | code class 7: | | 4, 8 |
| | code class 5/6: | | 8 |
| | code class 2/3/4 | | 16 |
| *Channel Type:* | *0:* | *DPCH* | ***D**edicated **P**hysical **Ch**annel of a standard WCDMA Frame* |
| | *1:* | *PICH* | ***P**aging **I**ndication **Ch**annel* |
| | *2:* | *SCCPCH* | ***S**econdary **C**ommon **C**ontrol **P**hysical **Ch**annel* |
| | *3:* | *HS_SCCH* | *HSDPA: **H**igh **S**peed **S**hared **C**ontrol **Ch**annel* |
| | *4:* | *HS_PDSCH* | *HSDPA: **H**igh **S**peed **P**hysical **D**ownlink **S**hared **Ch**annel* |
| | *5:* | *CHAN* | *any other QPSK modulated channel without pilot symbols* |
| | *10:* | *CPRSD* | *Dedicated Physical Channel (DPCH) in **com**pr**e**s**s**e**d** mode* |
| | *11:* | *CPR-TPC* | *DPCH* in **com**pr**essed mode **TPC** symbols are sent in the first slot of the gap. |
| | *12:* | *CPR-SF/2* | *DPCH* in **com**pr**essed mode using half spreading factor (**SF/2**). |
| | *13:* | *CPR-SF/2-TPC* | *DPCH* in **com**pr**essed mode using half spreading factor (**SF/2**).**TPC** symbols are sent in the first slot of the gap. |
| | 14: | *E-HICH*: | *HSUPA: Enhanced HARQ Hybrid Acknowledgement Indicator Channel* |
| | | *E-RGCH*: | *HSUPA: Enhanced Relative Grant Channel* |
| | 15 | *EAGCH* | *E-AGCH: Enhanced Absolute Grant Channel* |
| | 16 | *SCPICH* | ***S**econdary **C**ommon **P**ilot **C**hannel* |
| Status: | 0: not active, 1: active | | |
| CDP relative: | for setting commands any value, for query CDP relative value | | |

## Activating Error Vector Magnitude versus chip measurements

**:CALCulate<1|2>:FEED 'XTIMe:CDPower:CHIP:EVM'**
This command selects the vector error data to be displayed

**:CALCulate<1|2>:FEED 'XTIMe:CDPower:CHIP :MAGNitude'**
This command selects the magnitude error data to be displayed

**:CALCulate<1|2>:FEED 'XTIMe:CDPower:CHIP:PHASe'**
This command selects the phase error data to be displayed

**:CALCulate<1|2>:FEED 'XTIMe:CDPower:COMPosite:CONSt'**
This command selects the composite constellation data to be displayed

## Query result of Error Vector Magnitude versus chip

**:TRACe[:DATA]? TRACE2**

EVM VS CHIP (TRACe2)

The square root of square difference between received signal and reference signal for each chip are transferred. The values are normalized to the square root of the average power at the selected slot:

| | |
|---|---|
| Output: | List of vector error values of all chips at the selected slot |
| Format: | $VectError_0$, $VectError_1$, ...., $VectError_{2559}$ |
| Unit: | [%] |
| Quantity: | 2560 |

**:TRACe[:DATA]? TRACE2**

MAGNITUDE ERROR VS CHIP (TRACe2)

The magnitude difference between received signal and reference signal for each chip are transferred. The values are normalized to the square root of the average power at the selected slot:

| | |
|---|---|
| Output: | List of magnitude error values of all chips at the selected slot |
| Format: | $MagError_0$, $MagError_1$, ...., $MagError_{2559}$ |
| Unit: | [%] |
| Quantity: | 2560 |

**:TRACe[:DATA]? TRACE2**

PHASE ERROR VS CHIP (TRACe2)

The phase differences between received signal and reference signal for each chip are transferred. The values are normalized to the square root of the average power at the selected slot:

| | |
|---|---|
| Output: | List of magnitude error values of all chips at the selected slot |
| Format: | $PhaseError_0$, $PhaseError_1$, ...., $PhaseError_{2559}$ |
| Unit: | [°] |
| Quantity: | 2560 |

## Query result of scrambled chip data for composite constellation display

**:TRACe[:DATA]? TRACE2**

COMPOSITE CONSTELLATION (TRACe2)

The real and the imaginary components of the received chip constellation at the selected slot are transferred. The values are normalized to the square root of the average power at the selected slot:

| | |
|---|---|
| Output: | List of I/Q values of all chips per slot |
| Format: | $Re_1$, $Im_1$, $Re_2$, $Im_2$, ...., $Re_{2560}$, $Im_{2560}$ |
| Unit: | [1] |
| Quantity: | 2560 |

## Query result of Frequency Error vs Slot

**:TRACe[:DATA]? ATRACE2**

FREQUENCY ERROR VS SLOT (ATRACe2)

This command returns a list of slot number / absolute frequency error vs slot for all slots.

| | |
|---|---|
| Output: | List of slot number and absolute frequency error values of all slots |
| Format: | `SlotNumber 0`, $FreqError_0$, ...., `SlotNumber 14`, $FreqError_{14}$ |
| Unit: | [Hz] |
| Quantity: | `15` |

## Enabling of automatic peak search in spectrum emission mask measurement

**CALCulate<1|2>:PEAKsearch:AUTO ON | OFF**

PEAK LIST OF SPECTRUM EMISSION MASK MEASUREMENT (SEM)

This command calculates a peak list of the spectrum emission mask measurement at each sweep. One peak value is determined for each range of the limit line. The command corresponds to the softkey 'LIST EVALUATION'

ON: Enables automatic peak search

OFF: Disables automatic peak search

**Range:** [ON | OFF**]**

**Example:** "CALC:PEAK:AUTO ON"

**Default:** OFF

## Query result of peak search list in spectrum emission mask measurement

**TRACe<1|2>:DATA? LIST**

READ OUT RESULTS OF PEAK LIST EVALUATION

This command reads the peak list of the spectrum emission mask measurement list evaluation (refer to CALC:PEAK:AUTO ON | OFF). An array of values is returned for each range of the limit line. The arrays for each limit line range are following sequentially.

<value array of range 1>, <value array of range 2>, ….., <value array of range n>

The array of each range contains the following value list:

<No>, <Start>, <Stop>, <Rbw>, <Freq>, <Levelabs>, <Levelrel>, <Delta>, <Limitcheck>, <unused1>, <unused2>

*where:*

| | | |
|---|---|---|
| No | [] | : number of the limit line range |
| Start | [Hz] | : start frequency of the limit line range |
| Stop | [Hz] | : stop frequency of the limit line range |
| Rbw | [Hz] | : resolution band width of the limit line range |
| Freq | [Hz] | : frequency of the power peak with in the range |
| Levelabs | [dBm] | : absolute power of the peak with in the range |
| Levelrel | [dB] | : relative power of the peak with in the range related to channel power. |
| Delta | [dB] | : power difference to margin power |
| Limitcheck | [0 \| 1] | : decision whether the power is below [0] or above [1] the limit line |
| Unused1 | [] | : reserved (0.0) |
| Unused2 | [] | : reserved (0.0) |

**Example:** " TRAC:DATA? LIST" Reads the value list of automatic peaks search

## Query result of Result Summary Parameters

**:CALCulate<1>:MARKer<1>:FUNCtion:WCDPower[:BTS]:RESult?** PTOTal | FERRor | TFRame | TOFFset | MACCuracy | PCDerror | EVMRms | EVMPeak | CERRor | CSLot | SRATe | CHANnel | CDPabsolute | CDPRelative | IQOFfset | IQIMbalance | MTYPe | RHO | **PSYMbol | ACHannels**

This command queries the measured and calculated results of the 3GPP FDD code domain power measurement.

| | | | |
|---|---|---|---|
| PTOTal | total power | FERRor | frequency error in Hz |
| TFRame | trigger to frame | TOFFset | timing offset |
| MACCuracy | composite EVM | PCDerror | peak code domain error |
| EVMRms | error vector magnitude RMS | EVMPeak | error vector magnitude peak |
| CERRor | chip rate error | CSLot | channel slot number |
| SRATe | symbol rate | CHANnel | channel number |
| CDPabsolute | channel power absolute | CDPRelative | channel power relative |
| IQOFfset | I/Q offset | IQIMbalance | I/Q imbalance |
| MTYPe | modulation type | **PSYMbol** | **Number of pilot bits** |
| RHO | rho value for every slot | **ACHannels** | **Number of active channels** |

**Example:** `":CALC:MARK:FUNC:WCDP:RES? PTOT"`

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

# Appendix: Contact to our hotline

Any questions or ideas concerning the instrument are welcome 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 |