ROHDE&SCHWARZ

Test and Measurement
Division

# Release Notes

# Firmware Release 4.13 SP1

## for R&S ESU EMI Test Receiver

with order number: **1302.6005.xx**

**Release Note Revision: 10**

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# Contents

# History

| Date | Rel Note Rev | Changes |
|---|---|---|
| 16. Jan 2007 | 5 | First revision for V3.93 |
| 30. Mar 2007 | 6 | Release for service pack 1 |
| 18. Jun 2007 | 7 | Release for service pack 2 |
| 31. Jul 2007 | 8 | Release for service pack 3 |
| 08. Oct 2007 | 9 | First revision for 4.13 |
| 29. Nov 2007 | 10 | Release for service pack 1 |

# General Topics

## Firmware Update

### Generation of the update disk set

The files needed for the firmware update are grouped according to the disk contents:

| | | |
|---|---|---|
| Disk 1: | disk1.bin | (self-extracting ZIP file; needs to be renamed to disk1.exe before unpacking) |
| 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 13: | data12.cab | (packed contents of disk 13, will be automatically unpacked by FW update) |
| Disk 14: | data13.cab | (packed contents of disk 14, will be automatically unpacked by FW update) |
| Disk 15: | data14.cab | (packed contents of disk 15, will be automatically unpacked by FW update) |

**Please note that the difference in disk number and filename of the corresponding archive file is by intention, not by chance!**
**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 on drive C:)
2. Copy disk1.bin into that directory and rename it to disk1.exe
3. Execute disk1.exe. Under Windows 95/98/NT/2000 this is done best using the following sequence:
   <CTRL><ESC> - RUN – C:\MyTemp\DISK1 - <ENTER>
   or
   <CTRL><ESC> - AUSFÜHREN – C:\MyTemp\DISK1 - <ENTER> for a German Windows 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 | ExecCtrl.exe | 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.

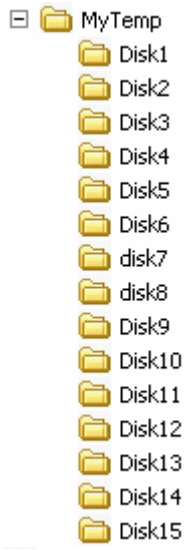
**The contents of the other disks are already packed in the format required by the firmware update program and need no further processing.** The files only need to be copied onto disks #2 to #12, the number in the filename (minus 1) indicating the corresponding disk number (data3.cab => disk #2, data4.cab => disk#3, etc.).

## 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 Disk1 – Diskxx.

*Please do not copy any further files like documentation, release notes or pictures in those directories, because this may cause malfunction due to limited hard disc space on the instrument.*




## Performing the firmware update on the instrument

The 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 disk directory (e.g. F:\MyTemp). 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 #12 as 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.**

## Known problems during firmware update

After switching on the instrument for the first time after a successful firmware update, the following system message might occur once: System Message
CDS: Error...

In this case the unit needs to be switched off and on again. This system message does not appear again during further power-on cycles.

***Note:*** *If the unit is not restarted as described, system error correction data (CAL TOTAL) of a later date will be lost when switching the unit on again.*

**Messagebox: Can't open front panel driver, errorcode=0x2**

For some constellations this messagebox occurs after the last reboot of the device. Please start the WDMutility with START | PROGRAMS | WDM Utility and click the START button. The device will boot twice (the messagebox will be still shown after the first boot) and after the second boot the measurement application comes up and the problem is solved.

# Modified Functions

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

**1. (V3.83 SP2) The Maxhold display of the Bargraph is reset after the settling time of the used detectors**

**2. (V3.83 SP2) The maximum number of transducer sets has been enhanced from 10 to 100**

**3. (V3.83 SP2) The RBW filters used with the IF analysis are marked with IFA in the CAL results table.**

**4. (V3.83 SP2) A Final Measurement can be done while the instrument displays the IF analysis**

**5. (V3.83 SP2) The grid level borders of the IF analysis are dependent of the bargraph**

**6. (V3.83 SP2) The units dB*/MHz and dBpT are now available in the spectrum analyzer**

**7. (V3.83 SP2) A running scan will be stopped when doing a hardcopy or when saving and recalling data.**

**8. (V3.83 SP2) The length of a test report will be limited due to internal memory ressources.**

**9. (V3.83 SP4) The possibility of a wrong level measurement due to an AC coupled input is displayed by a red AC enhancement label and by the AC IN label.**

**10. (V3.83 SP4) The level accuracy with preselector has been improved.**

**11. (V3.83 SP4) The option FS-K7 is now available for the ESU.**

**12. (V3.83 SP4) The default scan table does now start at 30 MHz.**

**13. (V3.83 SP5) REFLVL ADJ AUTO (SETUP TRANSDUCER menu) does now affect the Y axis scaling of the IF analysis.**

**14. (V3.93) Mimimum Sweep time with 6 dB type RBWs has been reduced.**

**15. (V3.93 SP3) Modification for production internal purposes.**

**16. (V4.13) Additional number of sweep points: an increment of 100 is possible now for number of points ≥ 201**

**17. (V4.13) HP emulation: Additional HP Models 8568A_DC and 8568B_DC using DC coupling.**

**18. (V4.13) HP emulation: GENERAL SETTINGS - GPIB menu extended by IF GAIN NORM / PULS**

**19. (V4.13) New spurious emissions measurement LIST EVALUATION**

**20. (V4.13) New function MARKER FILE EXPORT.**

**21. (V4.13) Improved Firmware Update.**

**22. (V4.13) Gated statistics measurements APD, CCDF.**

**23. (V4.13) GPIB: Basic remote control of the signal generator which is connected to the additional FSP-B10 GPIB Interface.**

**24. (V4.13) GPIB: SCPI format for binary block data extended for byte counts > 999.999.999 bytes.**

**25. (V4.13) GPIB: New commands available**

| | |
|---|---|
| :[SENSe<1\|2>:]CORRection:TRANsducer:ACTive? | returns active transducer |
| :CALCulate<1\|2>:LIMit<1...8>:ACTive? | returns active limit line(s) |

**26. (V4.13) Trigger Line for video trigger now also visible outside of the trigger menu.**

**27. (V4.13) HP emulation: The OL command returns the mixer level in byte 23**

**28. (V4.13) HP emulation: The commands MKPK NH | NL | NR and KSK do not perform a sweep start when marker is already switched on**

**29. (V4.13) HP emulation: The commands SNGLS and CONTS are setting the command complete bit (bit 4) in STB**

**30. (V4.13) HP emulation: New softkey SETUP - GENERAL SETUP - GPIB - SWEEP REP ON/OFF"**

**31. (V4.13) HP emulation: New commands: VARDEF, CTA, ADD, SUB, MPY, DIV**

**32. (V4.13) HP emulation: New command NORMLIZE for tracking generator**

**33. (V4.13) HP emulation: The command LF performs a reset**

**35. (V4.13) Support for EMI APD function**

**35. (V4.13) Increased dwell time for Time Domain Scan**

**36. (V4.13) Scan needs to be interrupted for a hardcopy but it may be resumed after having done the hardcopy.**

**37. (V4.13SP1) The Aquisition Time (for FFT filter) is now readable with remote command "SENS:SWE:TIME?".**

# Problems Eliminated

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

**1. (V3.83) Overload display**
The overload indication is cleared when changing from scan display to IF analysis display.

**2. (V3.83) Autorange function**
The ranging limits of the autorange function have been changed.

**3. (V3.83) Hardcopy in IF analysis**
A hardcopy in IF analysis mode does now contain the traces.

**4. (V3.83) IF Analysis.**
The spurious signal 60 dB under the signal level has been removed.

**5. (V3.83) Overload display**
The overload indication in scan mode without any signal has been removed.

**6. (V3.83) Time Domain Scan (ESU-K53)**
The time domain scan does now work up to 40 GHz with a small resolution bandwidth.

**7. (V3.83) AC/DC switch**
Changing the AC/DC coupling of the RF input could modify the video bandwidth in spectrum analyzer mode.

**8. (V3.83) IF Analysis**
The selected level unit is now displayed correctly in IF analysis.

**9. (V3.83) Templates for the Test Report**
Templates for the Test Report are now saved correctly.

**10. (V3.93) Marker Menu: Next Peak Left and NEXT PEAK RIGHT**
The a.m. marker functions do now work correct.

**11. (V3.83) Entering the HARDCOPY Menu**
Open tables are not longer closed when entering the HARDCOY menu.

**12. (V3.83) Spurious in Time Domain Scan**
Due to a numerical problem the time domain scan trace could have spurious with an RBW of 10 kHz.

**13. (V3.83) Instrument indicates UNCAL after following steps:**
- Firmware Update

- CAL TOTAL
- Reboot of the instrument

**14. (V3.83) Statistic measurements CCDF/APD in analyzer mode does not work if a transducer is switched on.**

**15. (V3.83) Overload is not displayed in scan data**
An overload condition has not been displayed in the scan data in Time Domain Scan (TRACe? SCAN).

**16. (V3.83) MMEMory command could block instument**
The instrument firmware could be blocked after several hundred MMEMory commands.

**17. (V3.93) Marker not available after Hardcopy**
Pressing the Hardcopy key while scaning made the marker function unavailable.

**18. (V4.13) Wrong measurement results in spectrum analyzer with option B24**
In some cases wrong levels may be displayed in analyzer mode (dependant from span settings). Already delivered ESUs don't show this error.

**19. (V4.13) Some old savesets could not be recalled.**

# Known Problems

none

# Modifications to the Operating Manual

The order number for the current manual set is

- 1302.6163.12-**01** (English).

The firmware options FS-Kxx come with their own operating manual and release notes. Please refer to the corresponding release notes for more information on changes to these packages.

## Last minute changes to the Operating Manual

### Mode Selection – Hotkey Bar


**APD** The APD Hotkey activates the CISPR weighting function for measuring the Amplitude Probability Distribution (APD) of a disturbance signal.

IEC/IEEE bus command: `INST:SEL APD`

### Instrument Functions – APD Mode

#### Introduction

With Firmware Version 4.13 of R&S Test Receiver ESU series a new CISPR weighting function is available for measuring the Amplitude Probability Distribution (APD) of a disturbance signal.

This new measuring function was introduced by Amendment 1:2005 to CISPR 16-1-1:2003. In this standard the APD of a disturbance signal is defined as:

“The cumulative distribution of the probability of time that the amplitude of disturbance exceeds a specified level”.

In R&S Test Receiver ESU the APD is measured at the output of the envelope detector. The APD measurement method gives all amplitude probability information taken over the entire disturbance envelope within the measurement bandwidth at a certain frequency within a specified time interval, i.e., it provides a statistical characterization of the disturbance signal in question.

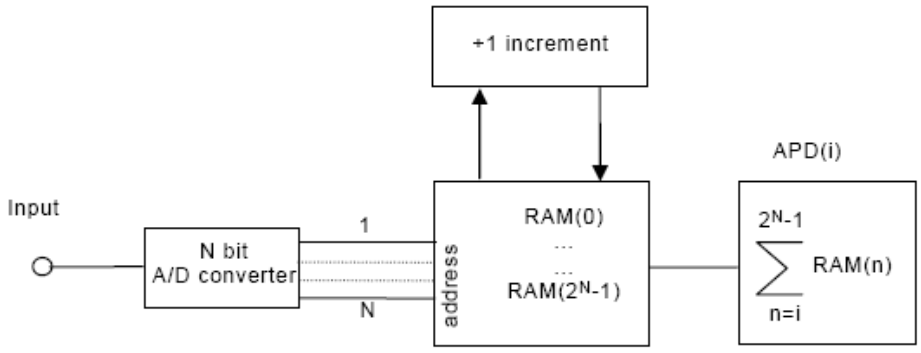



Figure 1: Block diagram of APD measurement circuit with A/D converter [2]

The amplitude of the disturbance is expressed in terms of the corresponding field strength or voltage at the receiver input. The method of measuring the probability of time $p_{meas}$ during which the disturbance envelope exceeds a specified level $E_{limit}$ is applied. Usually, an APD measurement is carried out at a fixed frequency.

Advantages of the APD measurement method:

- Is expected as an alternative method to present logarithmic average measurements.
- Can also be used to calculate the true average value.

As an alternative to the latter, state-of-the-art spectrum analyzers with a wide dynamic range (>70 dB) can be used to measure the true average value directly.

Background material on the application of the APD-measuring function is provided in [1].

**Examples of APD**

When there is no input signal at the measuring receiver, the envelope of the receiver noise is shown as in Figure 1 with zero span mode at center frequency $f_c$. The corresponding APD response of the receiver noise is shown in Figure 3. The ordinate axis of the APD function displays the probability that the disturbance envelope exceeds the disturbance level.

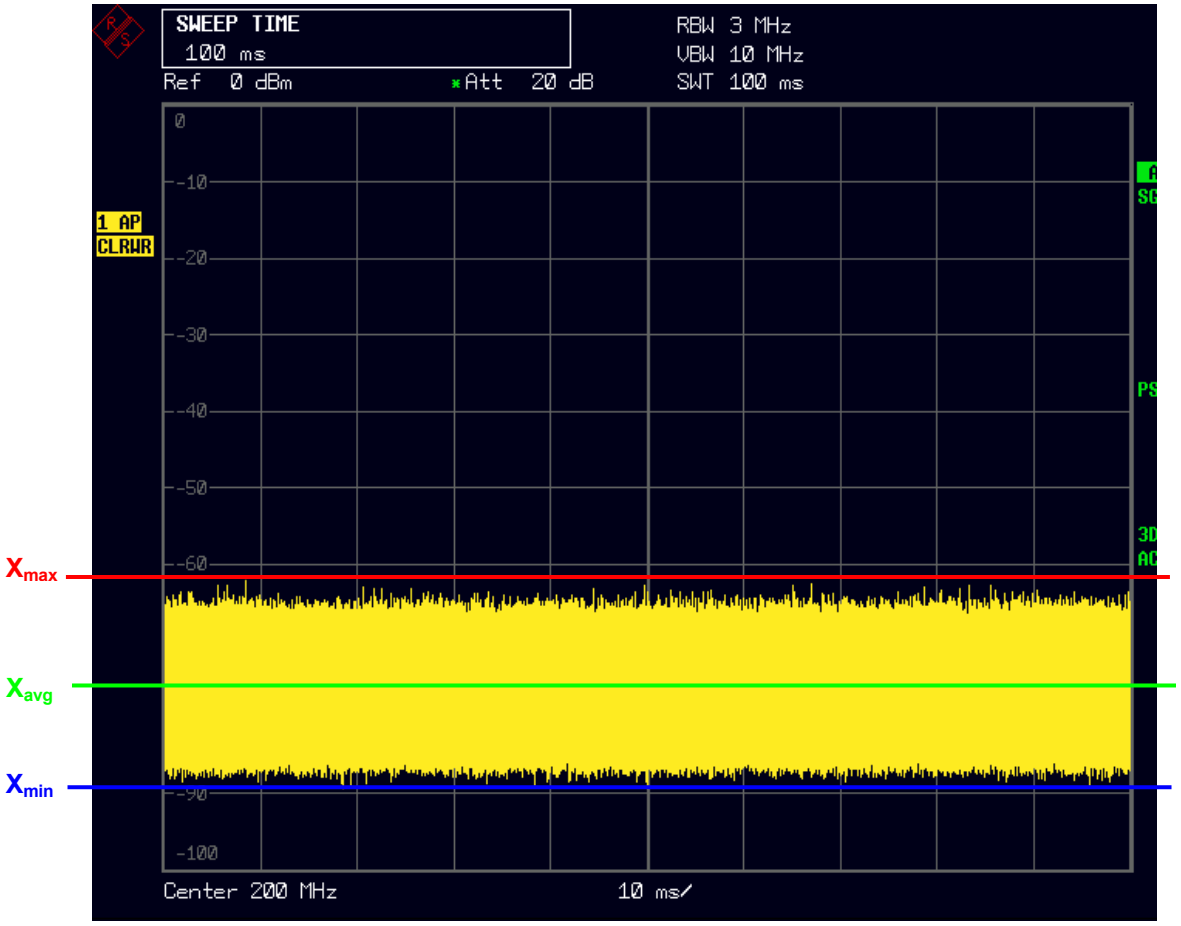



Figure 2: Zero Span of receiver noise

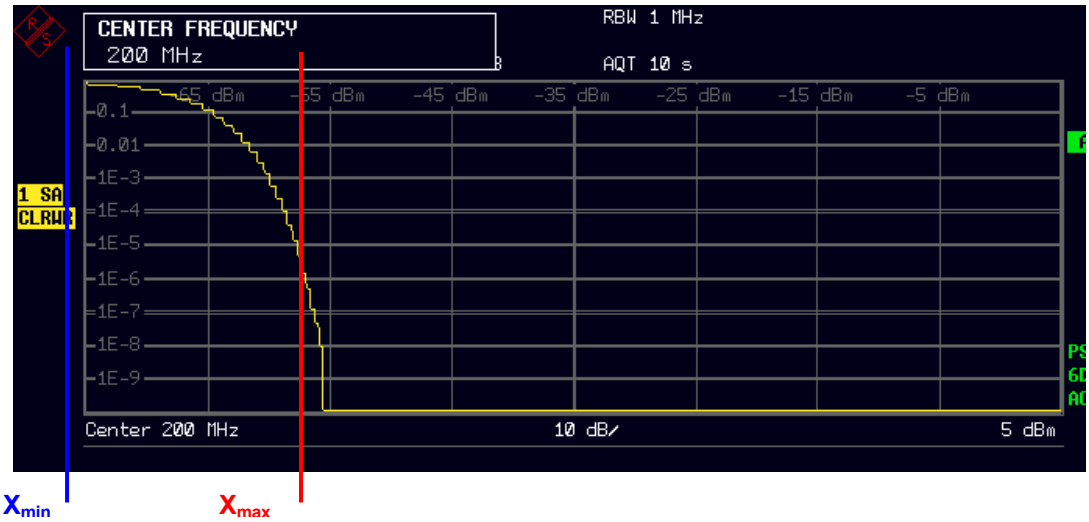



Figure 3: APD of receiver noise

If one impulse is received within 1% of time, as shown in Figure 4, the APD shows drastic extension to the right side at the bottom of Figure 5, indicating a high disturbance level but at low probability. The difference between Figure 2 and Figure 4 is their peak value ($X_{max}$), it appears dominantly on the abscissa of APD.

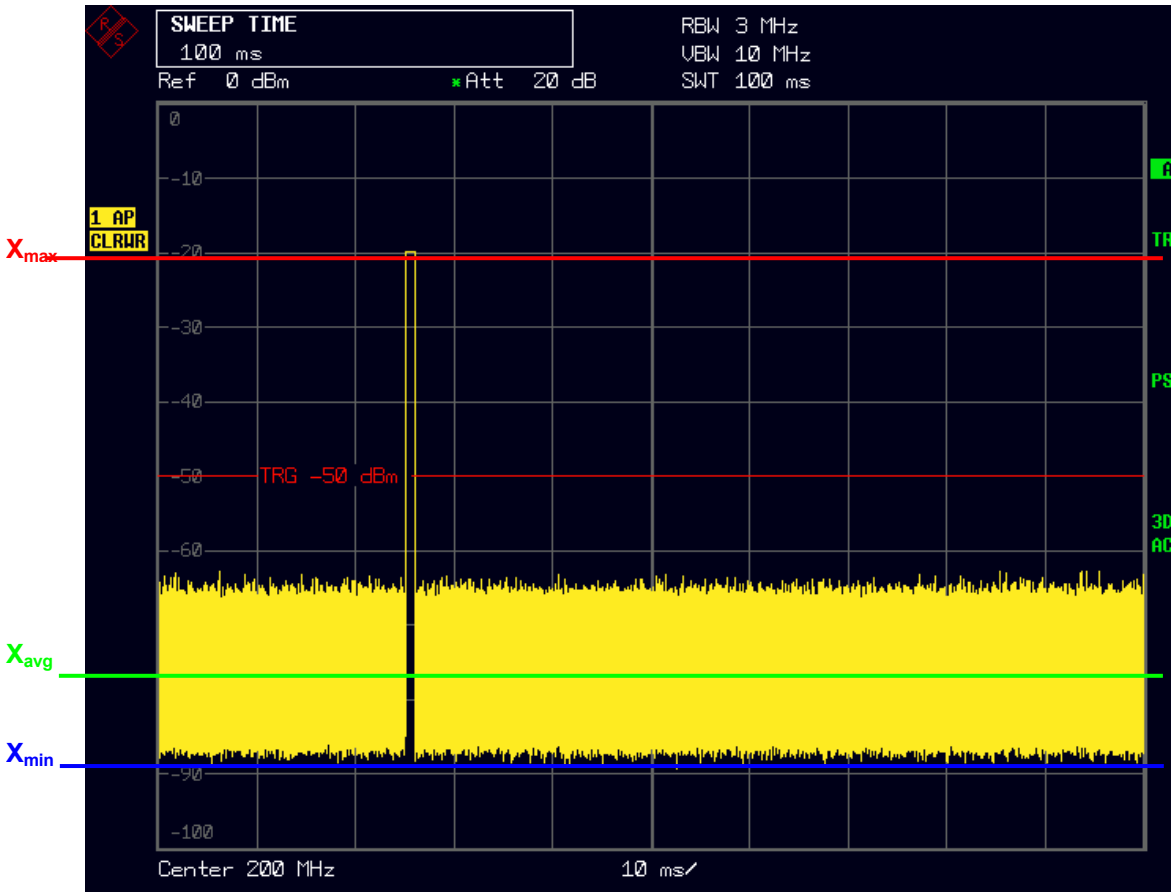



Figure 4: Zero Span of a pulsed singnal (single or low PRF)

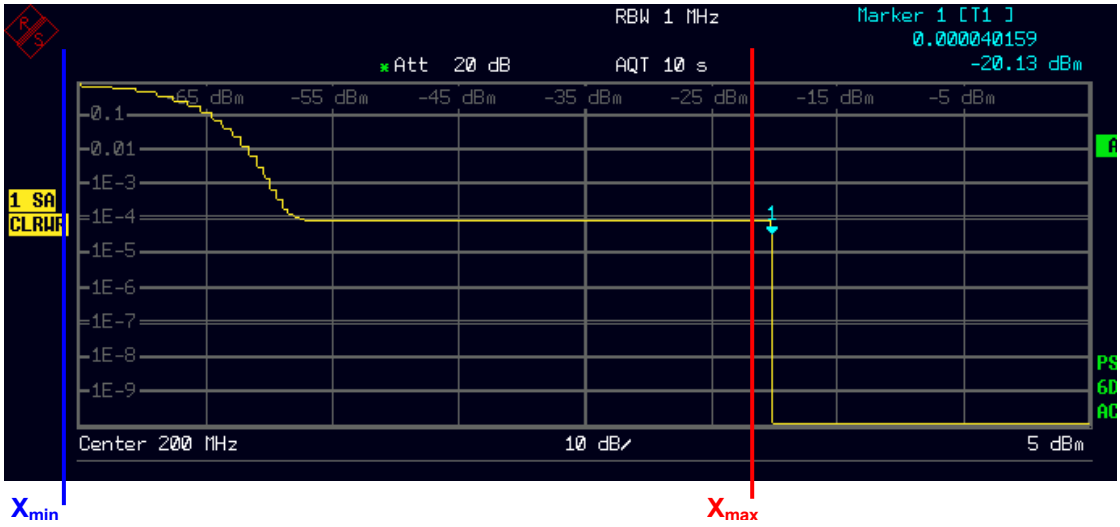



Figure 5: APD of a pulsed signal (single or low PRF)

Next, let us consider the case that the repetition frequency of the impulse increases as shown in Figure 6. The disturbance shown in Figure 6 has a higher average value than Figure 4 because of the increasing

pulse repetition frequency, but the log-average value ($X_{avg}$) of Figure 6 does not show any difference from that of Figure 4. This is because the log-average value mainly depends on the receiver noise and strongly suppresses impulsive noise in this case. But the APD of the disturbance, shown in Figure 7, has high sensitivity to variation in the average value. Clearly the probability presented in Figure 7 increases when compared with Figure 5.

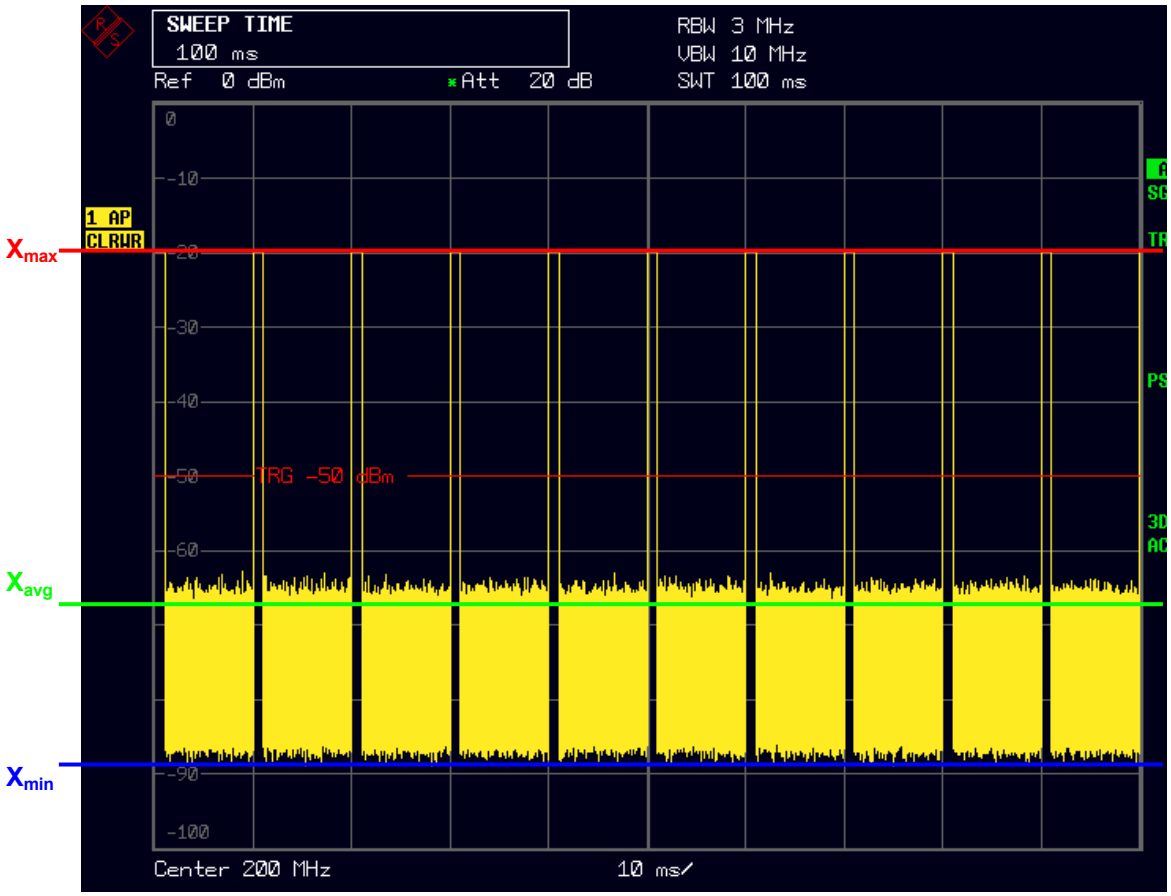



Figure 6: Zero Span of of a pulsed signal (high PRF)

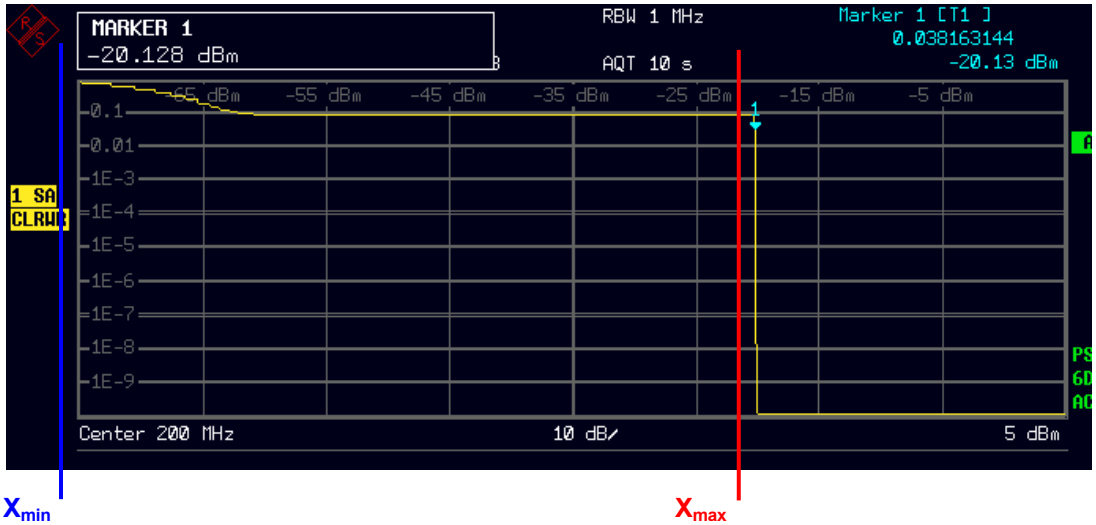



Figure 7: APD of a pulsed signal (high PRF)

For the disturbance which has high peak and average value, such as in Figure 8, the APD curve shows high probability at high level as shown in Figure 9.

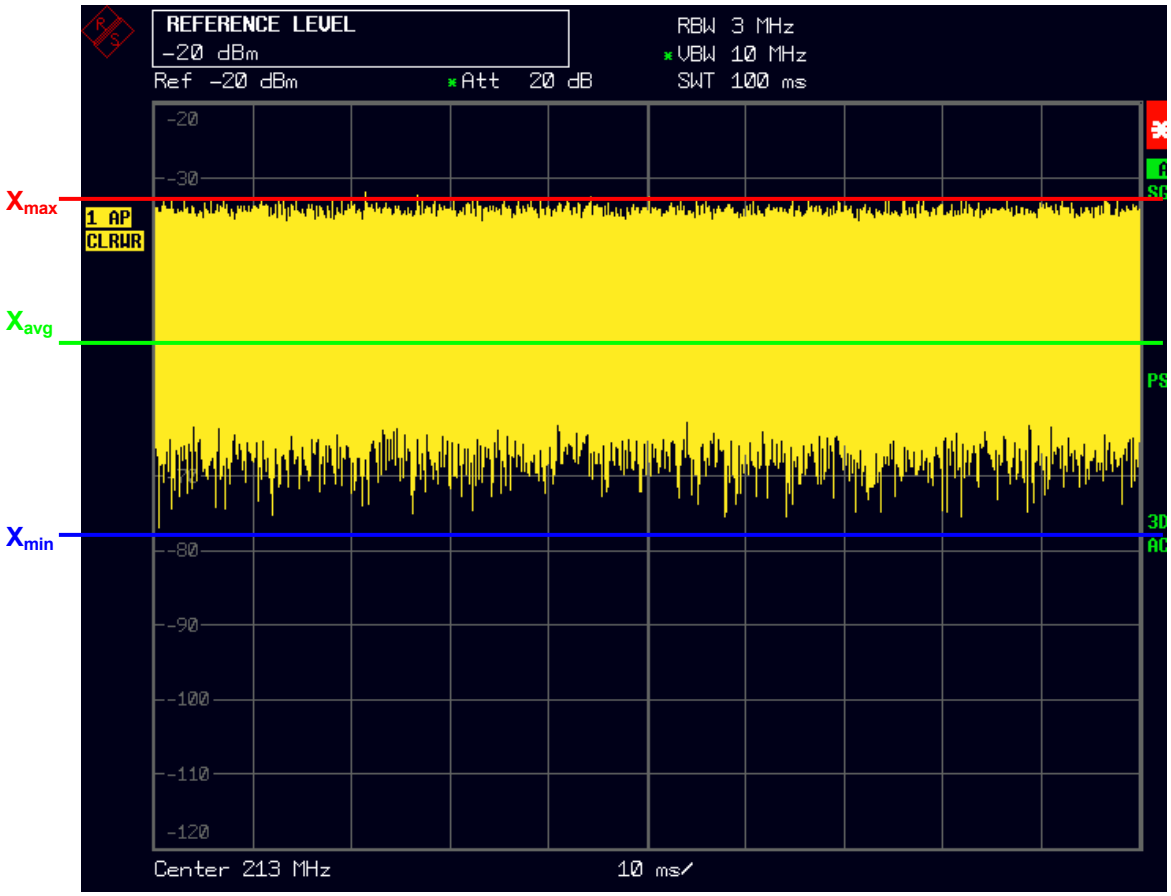



Figure 8: Zero Span of a broadband signal (high level)

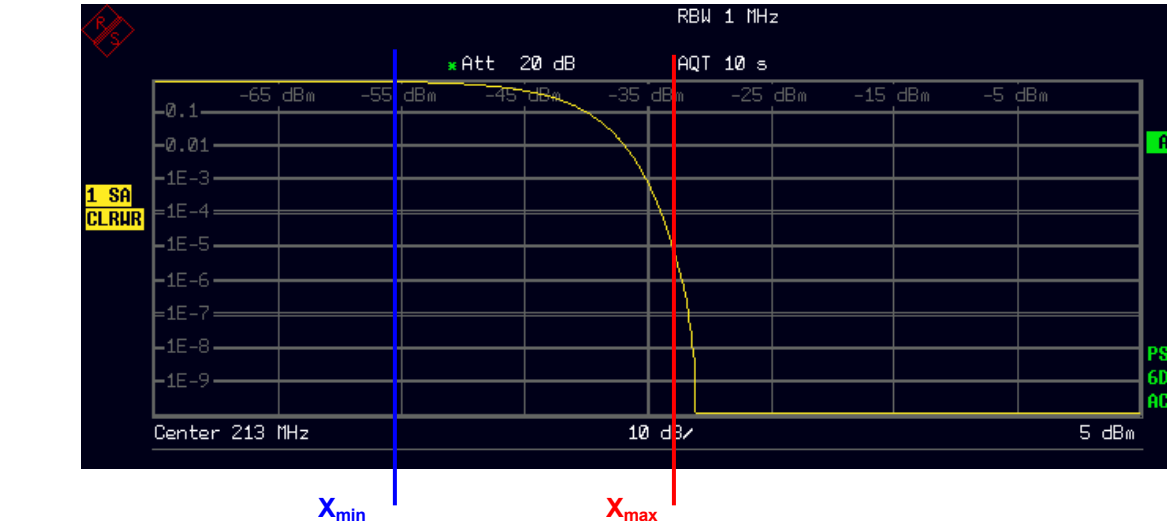



Figure 9: APD of a broadband signal (high level)

**Measurement Method**

In R&S Test Receiver ESU, the method of measuring the probability of time $p_{meas}$ during which the disturbance envelope exceeds a specified level $E_{limit}$ is applied.

The measurement shall be carried out using the following procedure [3]:

1) Set the resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyzer according to CISPR 16-1-1 (for measurements above 1 GHz).
2) Find the frequencies at which high disturbances are observed. This can be accomplished by using the maximum hold function during a specified amount of time (e.g. 2 min) in the frequency span of interest. Peak detection shall be used when applying this procedure.
3) Determine the frequencies for the APD measurement.
4) Set the center frequency of the measuring receiver to the frequency at which the highest level is observed during the application of step 2) of this procedure.
5) Set the reference level of the measuring receiver to minimum 5 dB above the maximum level of disturbance that is obtained in step 2).
6) Set the measuring receiver to the APD mode and measure the APD of the disturbance during the measurement time that is specified by the product family standard. The measurement time shall be longer than the period of the disturbance.
7) Change the center frequency of measuring receiver to the next frequency determined in step 2), then repeat the procedures of steps 4) - 6) until the APD measurements for all frequencies are carried out.
8) Read the probabilities $p_{meas}$ during which the disturbance envelope exceeds a specified level $E_{limit}$ from the results of step 6).
9) Compare $p_{meas}$ against the limit $p_{limit}$. The EUT complies if $p_{meas}$ is less than or equal to $p_{limit}$ at all frequencies.
10) Or, read the levels $E_{meas}$ for a given probability $p_{limit}$
11) Compare $E_{meas}$ against the limit $E_{limit}$. The EUT complies if $E_{meas}$ is less than or equal to $E_{limit}$.

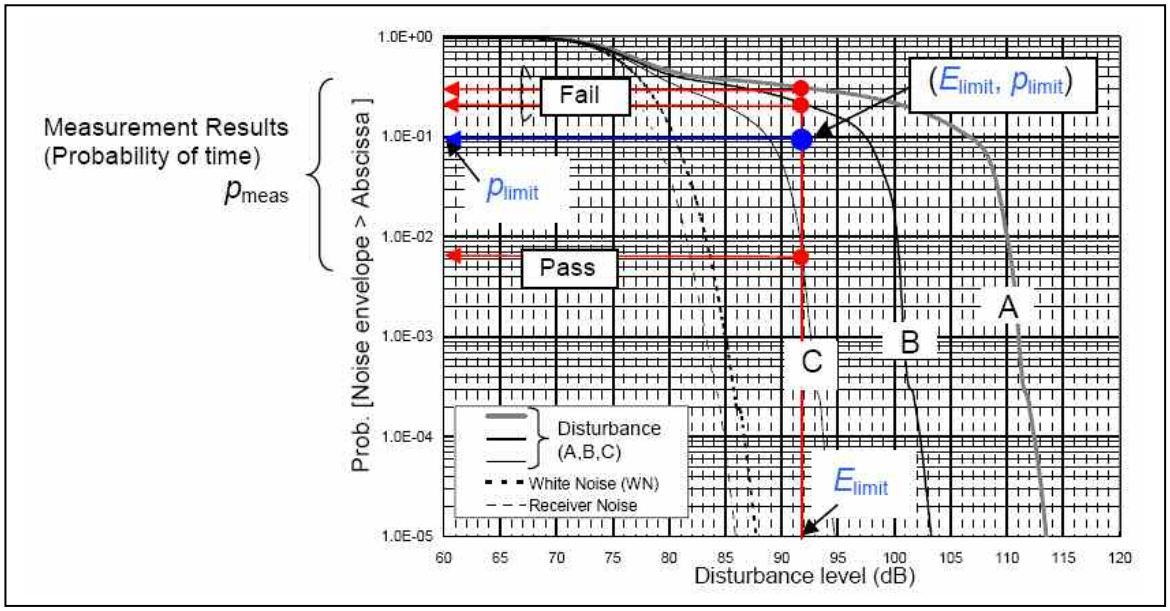



Figure 10: Compliance test using the APD method (Cases A and B are failing, C is passing.)

**Specification**

The following specifications described in [2] shall be applied to the APD measuring function. A rationale for these specifications is provided in Annex G of CISPR 16-1-1 [2].

| | CISPR 16-1-1 | R&S Test Receiver ESU |
|---|---|---|
| Dynamic range of the amplitude | >60 dB | >70 dB |
| Amplitude accuracy | better than ±2,7 dB | <2,5 dB for f<18 GHz |
| Maximum measurable time | longer than or equal to 2 min [1)] | 2 min (no dead time) |
| Minimum measurable probability | $10^{-7}$ | $10^{-7}$ |
| Assignment of amplitude levels | at least two amplitude levels with a resolution of 0,25 dB or better [2)] | no limitation by using external software [3)] |
| Sampling rate | ≥ 10 MSamples, when using an RBW of 1 MHz | 10,2 MSamples for RBW = 1 MHz<br>4,0 MS for RBW = 200 Hz, 9 kHz, 120 kHz |
| Display resolution of APD measurement data | less than 0,25 dB | 0,128 dB |

1) The intermittent measurement can be used if the dead time is less than 1 % of the total measurement time.
2) The probabilities corresponding to all pre-assigned levels shall be measured simultaneously.
3) In R&S Test Receiver ESU for each of the 625 disturbance levels the probability of time $p_{meas}$ is recorded.

**Application of the APD method for compliance testing of microwave ovens**

CISPR 11, the current standard for microwave ovens, specifies peak and average limits for the radiated emission test of microwave ovens. The average (weighted) value is measured by reducing the VBW (10 Hz) in logarithmic mode. Therefore, the result does not give a true average value. The linear mode shall be used to obtain the true average. However, in linear mode, the conventional spectrum analyzer offers a dynamic range of less than 40 dB. This makes it difficult to make true average measurements of disturbances from microwave ovens.

The APD measurement is expected as an alternative method to the present weighted measurement in CISPR 11 with the benefit that the true average value can be evaluated.

By using the ESU, compliance with the APD limit is determined by measuring the probability of time $p_{limit}$ corresponding to a specified limit level $E_{limit}$. As peak and average (weighted) limits are already specified in CISPR 11, it is recommended to use the existing peak limit together with an APD limit point. The EUT is deemed to be compliant if the measured values are less than both limits.

The problem is how to determine the APD limit point ($E_{limit}$, $p_{limit}$). This can be done in accordance with [4] as follows:

- The limit of disturbance level $E_{limit}$ is set to the same value as the present average (weighted) limit.
- Measure the APD of the typical disturbance from a microwave oven which is almost compliant to the present limit.
- The average value is calculated from APD measurement results and the probability of time corresponding to the average value is taken from the APD plot. This value, the probability of time, is set to the limit, $p_{limit}$.
- Repeat 2)-3) for various types of microwave ovens to determine the final $p_{limit}$.

If the preliminary measurement results, obtained by using the maximum hold mode and peak detection, exceeds the specified APD limit at certain frequencies, then the APD measurement should be performed at these identified frequencies.

**References**

[1] Amendment 1:2005 to TR CISPR 16-3:2003 (2nd Ed.): *Correlation between amplitude probability distribution (APD) characteristics of disturbance and performance of digital communication systems*

[2] Amendment 1:2005 to CISPR 16-1-1:2003 (1st Ed.): *Radio disturbance and immunity measuring apparatus – Measuring apparatus*

[3] CISPR 16-2-3:2006 (2nd Ed.): *Methods of measurement of disturbances and immunity – Radiated disturbance measurements*

[4] CISPR/A/675/DC: *Guidance for applying the APD method to the compliance testing and for developing APD emission limits*

## Frequency Scan and Time Domain Scan - SWEEP Key - Entry of Scan Data

**Meas Time - Entry of measurement time**
The measurement time can be set between 100 µs and 100 s separately for each subrange. In the case of quasi-peak weighting, the minimum is 1 ms. The measurement time can be set independently for each scan range.

With option ESU-K53 (Time Domain Scan) is the measurement time range dependent on the selected resolution bandwidth.

| Resolution Bandwidth | Minimum Measurement Time | Maximum Measurement Time |
|---|---|---|
| 10 Hz … 50 Hz | 10 ms | 100 s |
| 100 Hz … 500 Hz | 1 ms | 100 s |
| 1 kHz … 30 kHz | 100 µs | 100 s |
| 50 kHz | 100 µs | 50 s |
| 100 kHz … 120 kHz | 10 µs | 30 s |
| 200 kHz | 10 µs | 16 s |
| 300 kHz | 10 µs | 10 s |
| 500 kHz | 10 µs | 6 s |
| 1 MHz | 10 µs | 3 s |

IEC/IEEE bus command: `SCAN1:TIME 1ms`

## Instrument Functions – Receiver Mode – Level Display and RF Input Configuration

**RF INPUT AC/DC**

The RF INPUT AC/DC softkey switches between AC and DC coupling of the instrument input. The state of the input coupling is displayed with an enhancement label on the right side of the diagram.


| | | |
|---|---|---|
| **Frequency range** | R&S ESU8 | |
| | DC coupled | 20 Hz to 8 GHz |
| | AC coupled | 1 MHz to 8 GHz |
| | R&S ESU26 | |
| | DC coupled | 20 Hz to 26.5 GHz |
| | AC coupled | 10 MHz to 26.5 GHz |
| | R&S ESU40 | |
| | DC coupled | 20 Hz to 40 GHz |
| | AC coupled | 10 MHz to 40 GHz |
| | R&S ESU8/26/40 | |
| | DC coupled, input 2 | 20 Hz to 1 GHz |
| | AC coupled, input 2 | 9 kHz to 1 GHz |

Measurements outside the valid frequency range are marked with the AC label in red and the AC IN label

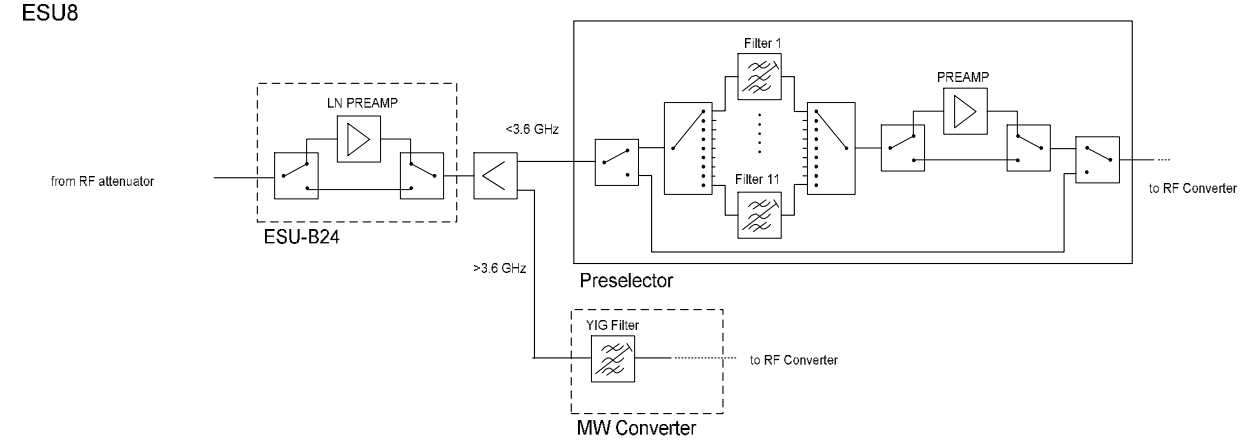

IEC/IEEE bus command: INP:COUP AC|DC

## Receiver Mode - Level Display and RF Input Configuration - AMPT Key

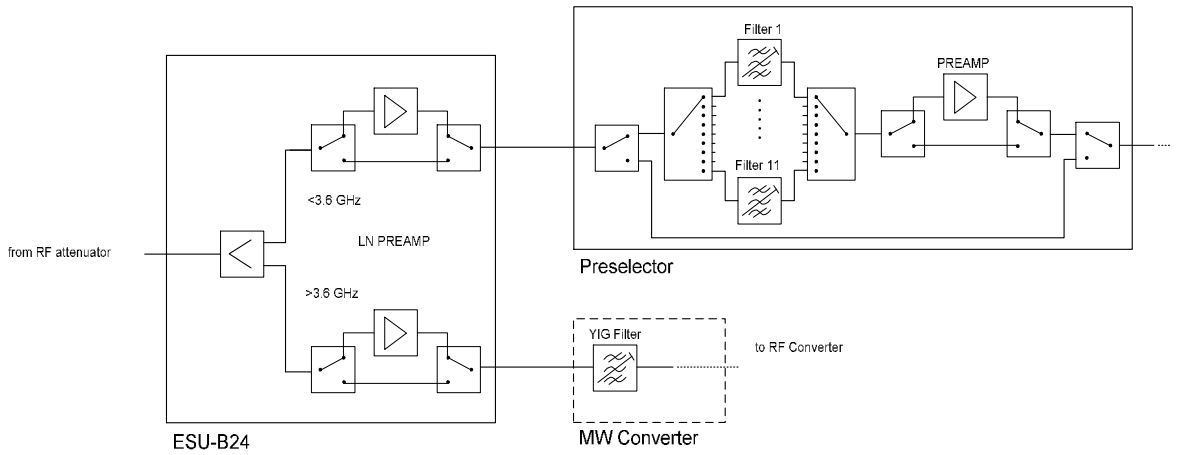
## Spectrum Analyzer – SETUP Key – Preamplification and Preselection

The R&S ESU is provided with a switchable preamplifier of 20 dB gain in the frequency range up to 3.6 GHz as standard. An additional low noise preamplifier which covers the whole frequency range is available as option R&S ESU-B24. Switching on the preamplifier reduces the total noise figure of R&S ESU and thus improves the sensitivity. In case of the standard preamplifier, the disadvantage of a poorer large-signal immunity (intermodulation) is reduced by the connected preselector: the preamplifier follows the preselection filters so that the risk of overdriving by strong out-of-band signals is reduced to a minimum.

ESU8




ESU26/40




The low noise preamplifier R&S ESU-B24 is located between RF attenuator and the preselection.

The signal level of the subsequent mixer is 20 dB higher so that the maximum input level is reduced by the gain of the preamplifier. The use of the preamplifier is recommended when measurements with a maximum sensitivity are to be performed. On the other hand, if the measurement should be performed at maximum dynamic range, the preamplifier should be switched off.
The gain of the preamplifier is automatically considered in the level display.

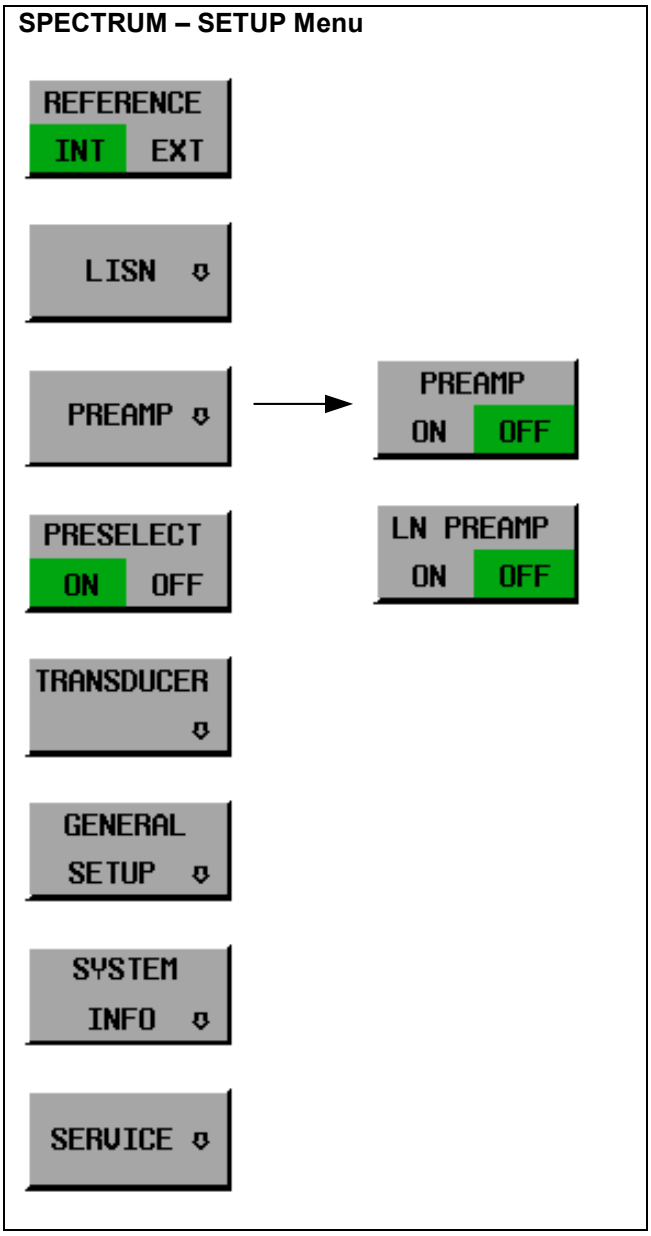
**PREAMP ON/OFF** The *PREAMP ON/OFF* softkey switches the preamplifier (1 kHz to 3.6 GHz) on and off. With option R&S ESU-B24 the frequency range of the preamplifier is extended to the upper frequency limit of the instrument. The frequency range up to 3.6 GHz is covered by the preamplifier in the preselector, the range above by the low noise preamplifier R&S ESU-B24.
The softkey is available only in the analyzer mode when the measurement with preselection is activated.

Default value is OFF.
IEC/IEEE bus command: `:INP:GAIN:STAT ON | OFF`

**LN PREAMP ON/OFF** The *LN PREAMP ON/OFF* softkey switches the low noise preamplifier (100 kHz to upper frequency limit of the instrument) on and off. The softkey is only available with option R&S ESU-B24. The low noise preamplifier cannot be switched on with the preselector set to ON.

Default value is OFF.
IEC/IEEE bus command: `:INP:GAIN:LNA:STAT ON | OFF`

**SPECTRUM – SETUP Menu**



**Display of the different preamplifier settings**

| Preamplifier setting | Spectrum analyzer |
|---|---|
| PREAMP ON OFF<br>LN PREAMP ON OFF | LNA |
| PREAMP ON OFF<br>LN PREAMP ON OFF | PA<br>PS |

***LN Preamp* - Switching the low noise preamplifier on and off**

The low noise preamplifier can be switched on/off separately for each subrange (requires option R&S ESU-B24)
IEC/IEEE bus command: `SCAN1:INP:GAIN:LNA:STAT OFF`

## Instrument Functions – Receiver Mode – Running a Scan

**CONT AT REC FREQ** With the *CONT AT REC FREQ* softkey the scan is continued at the current receiver frequency when the receiver frequency is lower than the frequency at which the scan was interrupted. Otherwise the scan continues at the frequency at which it was interrupted.
The scan is always continued with the settings in the scan table.

IEC/IEEE bus command: `INITiate2`

## Instrument Functions – IF Spectrum Analysis Mode

The displayed level values do have the full accuracy of the instrument only at the center frequency. At all other frequencies the displayed level is typically lower due to the frequency response of the IF filter and of the preselector.

## Instrument Functions – Spectrum Analysis – Sweep Key

**SWEEP POINTS** The *SWEEP POINTS* softkey selects the number of measurement samples acquired during a sweep.
The following numbers of points per sweep are available: 155, 313, 625 (default), 1251, 1999 and 201 up to 30001 in steps of 100.

IEC/IEEE bus command: `SWEEP:POIN 625`

## External Generator Control – Option R&S FSP-B10

**Note**: The external generator control is only available in the spectrum analyzer mode and not in the receiver mode.

## Instrument Functions – Spectrum Analysis – BW Key

**VBW MODE LIN /LOG** The VBW MODE LIN/LOG softkey determines the position of the video filter in the signal path for resolution bandwidths <= 120 kHz:

- If LINear is selected, the video filter will be in front of the logarithmic amplifier (default).
- If LOGarithmic is selected, the video filter will be behind the logarithmic amplifier.

The essential difference between the two operating modes relates to the settling in the case of falling signal edges:

With LINear, the falling signal edge will be "flatter" than with LOGarithmic.

This is due to the conversion from linear power to logarithmic level units: a reduction of the linear power by 50% reduces the logarithmic signal level by only 3 dB.

This is important for **EMI measurements above 1 GHz**. Below 1 GHz, CISPR 16-1-1 defines the linear average detector only. Above 1 GHz both, the linear and the logarithmic average detector may be specified in product standards. Some standards (e.g. ANSI C63.4:2000) require the linear average detector, whereas microwave oven measurements may be made with the log average detector. CISPR 11 specifies weighted measurements with a VBW of 10 Hz.

The figure below shows the response of the linear and the logarithmic average detector for pulse-modulated signals.

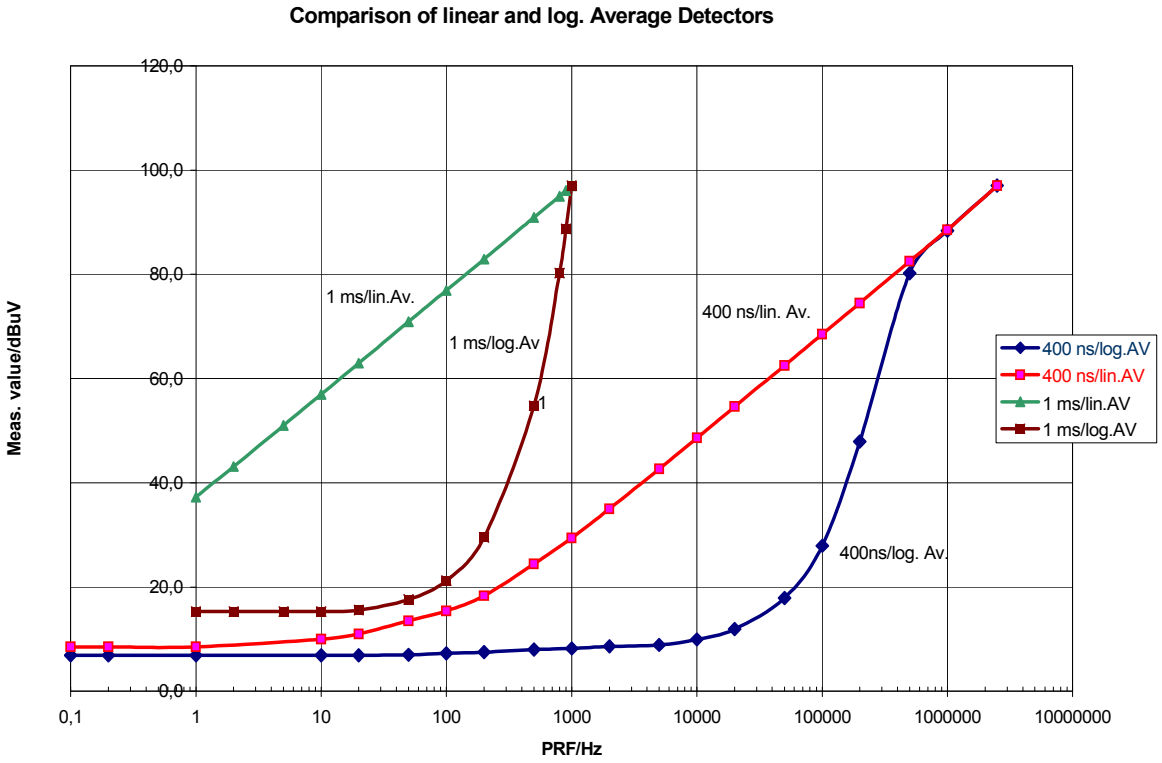
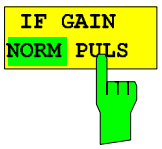



Figure: Reponses of the linear and the logarithmic average detectors as a function of pulse repetition frequency (PRF) for pulse-modulated signals with pulse durations of 400 ns and 1 ms. Resolution bandwidth is 1 MHz.

IEC/IEEE bus command: `BAND:VID:TYPE LIN`

## Menu SETUP - GENERAL SETUP - GPIB

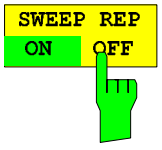



Softkey IF GAIN PULS configures the internal IF gain settings in HP emulation mode due to the application needs. This setting is only taken into account for resolution bandwidth < 300 kHz.

NORMAL Optimized for high dynamic range,
overload limit is close to reference level

PULS Optimized for pulsed signals,
Overload limit up to 10 dB above reference level

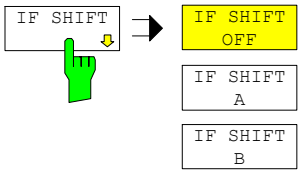
IEC/IEEE bus command: SYSTem:IFGain:MODE NORM | PULSe




Softkey SWEEP REP ON/OFF controls a repeated sweep of the commands E1 and MKPK HI. If the repeated sweep is OFF, the marker is set without sweeping before.

IEC/IEEE bus command: -

## Menu SETUP - NEXT




Input signals at a frequency of half the 1st IF (in the frequency range of 2270 MHz to 2350 MHz) will reduce the dynamic range of the analyzer. This problem only occurs for low RF attenuation values. It can be overcome by shifting the 1st IF.

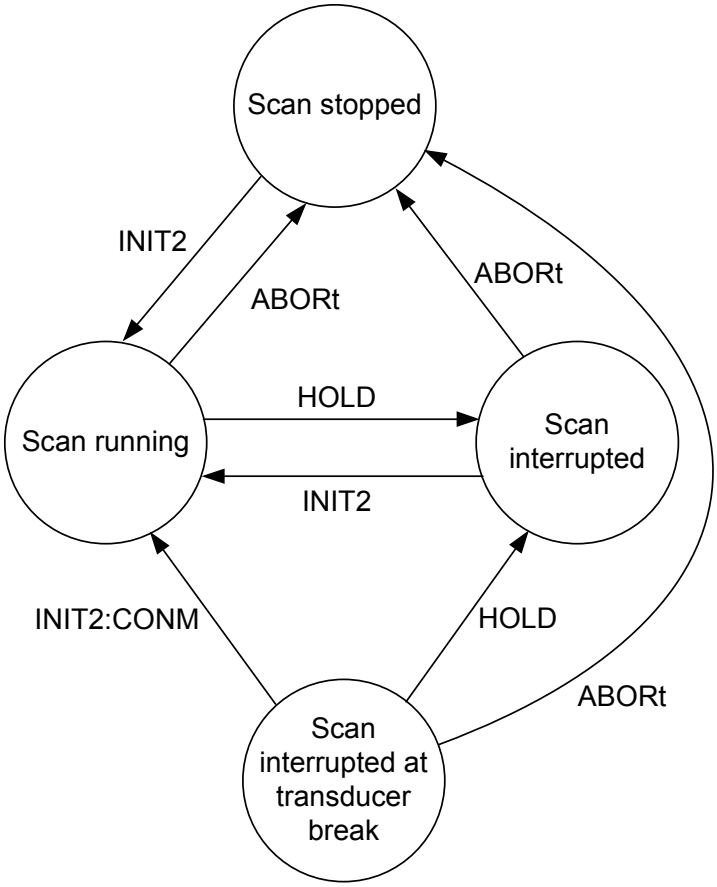
For signals from 2270MHz to 2310 MHz *IF SHIFT A* is appropriate, for 2310 MHz to 2350 MHz *IF SHIFT B* must be used.

***Note:***
*The 1st IF shifting is automatically done for ACP measurements if center frequency ( = signal frequency) is in the range of 2270 MHz … 2350 MHz. The IF SHIFT setting is therefore ignored for ACP measurements.*

**IEC/IEEE-bus command:**

```
[SENS<1|2>:]SWEep:IF:SHIFt OFF | A | B
```

Controlling a scan in Receiver Mode.




## Remote Control – Description of Commands – SENSe:SCAN Subsystem

**[SENSe<1|2>:]SCAN<1 to 10>:INPut:TYPE** INPUT1 | INPUT2

This command defines the input for a receiver subscan.

**Example:** `"SCAN1:INP:TYPE INPUT2"`
'Activates RF input 2 for scan range 1

**Characteristics:** *RST value: INPUT1
SCPI: device-specific

**Mode**: R

**[SENSe<1|2>:]SCAN<1 to 10>:INPut:GAIN:LNA[:STATe]** ON | OFF

This command switches the low noise preamplifier on or off for a receiver subscan.
(Only with option R&S ESU-B24).

**Example:** "SCAN1:INP:GAIN:LNA ON"
'Switches the low noise amplifier on for scan range 1

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

**Mode**: R

## Remote Control – Description of Commands – SENSe:CORRection Subsystem

**[SENSe<1|2>:]CORRection:TRANsducer:CATalog?**

This command reads out the names of all transducer factors stored on the internal drive.
Syntax of output format:
<Sum of file lengths of all subsequent files>,<free memory on hard disk>,
<1st file name>,<1st file length>,<2nd file name>,<2nd file length>,....,<nth file name>,
<nth file length>

**Example:** "CORR:TRAN:CAT?"

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

**Mode**: R, A

**[SENSe<1|2>:]CORRection:TSET:CATalog?**

This command reads out the names of all transducer sets stored on the internal drive.
Syntax of output format:
<Sum of file lengths of all subsequent files>,<free memory on hard disk>,
<1st file name>,<1st file length>,<2nd file name>,<2nd file length>,....,<nth file name>,
<nth file length>

**Example:** "CORR:TSET:CAT?"

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

**Mode**: R, A

## Remote Control – Description of Commands – SENSe:SWEep Subsystem

**[SENSe<1|2>:]SWEep:MODE** AUTO | LIST

This command controls the sweep continuation.

**Example:** `"SWE:MODE LIST"` Activates the spurious emissions measurement.

**Characteristics**: *RST value: AUTO
SCPI: device-specific
**Mode:** A

## Remote Control – Description of Commands – TRACe Subsystem

**TRACe[:DATA]** TRACE1 | TRACE2 | TRACE3 | SINGle | PHOLd | SCAN | STATus | FINAL1 | FINAL2 | FINAL3 | SPURious, <block> | <numeric_value>

This command transfers trace data from the control computer to the instrument, the query reads trace data or receiver results out of the instrument. Programming trace data to the instrument is only available in spectrum analyzer mode. The associated measurement window in spectrum analyzer mode is selected with the numeric suffix of TRACe<1|2>.

**Note**

If the FM demodulator (option FS-K7) is active, only the displayed trace data is read out and recalled. A portion of the measurement data that can be called by means of a marker, however, is calculated from the raw measurement data. These results are no longer available after recalling a trace; the associated queries
generate a query error.

SPURIous reads the peak list in the spurious measurement. As results a list of frequency, level and delta to limit line values is returned. A delta limit of +200dB indicates no limit check is active

**Example**: `"TRAC TRACE1,"+A$` `(A$: data list in the current format)`
`"TRAC? TRACE1"`

**Characteristics**: *RST value: -
SCPI: conforming

**Mode**: all

**Return value:** The returned values are scaled in the current level unit. Returned FM-modulated measurement values (activated option FS-K7) are scaled in Hz.

**ASCII format (FORMat ASCII):**
In ASCII format, a list of values separated by commas is returned (Comma Separated Values = CSV).

**Binary format (FORMat REAL,32):**
If the transmission takes place using the binary format (REAL,32), the data are transferred in block format (Definite Length Block Data according to IEEE 488.2). They are arranged in succeeding lists of I and Q data of 32 Bit IEEE 754 floating point numbers. General structure of return string for a sweep with 625 points:
#42500<meas value 1><meas value value2>...<meas value 625>
with
- #4: digits of the subsequent number of data bytes (4 in the example)
- 2500: Number of subsequent data bytes (2500 in the example))
- <meas value x>: 4 byte floating point measurement values

**Saving and recalling:**
Saving and recalling trace data together with the device settings to/from the device-internal hard disk or to/from a memory stick is controlled via the commands `MMEMory:STORe:STATe` and `MMEMory:LOAD:STATe` respectively. Trace data are selected with "`MMEMory:SELect[:ITEM]:ALL`" or "`MMEMory:SELect[:ITEM]:TRACe`". Trace data in ASCII format (ASCII FILE EXPORT) are exported with the command "`MMEM:STORe:TRACe`".
The commands for final measurement data are "`MMEMory:SELect[:ITEM]:FINal`" and "`MMEM:STORe:FINal`".

## Number and Format of the Measurement Values for the different Operating Modes

The number of measurement values depends on the instrument setting:

**SPECTRUM mode (span > 0 and zero span):**
155 up to 30001 (default 625) results are output in the unit selected for display.

**Note**

With AUTO PEAK detector, only positive peak values can be read out.
Trace data can be written into the instrument with logarithmic display only in dBm, with linear display only in volts.

`FORMat REAL,32` is to be used as format for binary transmission, and `FORMat ASCii` for ASCII transmission.

**Receiver**

**Note**

For reasons of compatibility with the ESIB test receiver, the data structure of the status information is designed for 4 traces. However, only 3 traces can be activated and transferred.

SINGle is possible only as a query for single measurements in the receiver mode (bargraph). The values of all activated detectors are transferred separated by commas in the following order: POS, NEG, QPE, AVER, CAV, RMS, CRMS. For inactive detectors, the value and the comma are omitted at the position(s) in question.

PHOLD returns the peakhold value or values of the bargraph measurements with the associated frequencies. (`DISP:BARG:PHOL ON`)

SCAN is only possible in form of a query during scan measurements. The number of transmitted measurement results depends on the scan settings.

FORMAT REAL,32 is to be used as format setting for binary transmission.

Structure of transmitted data:

- 4 byte: trace status: bit 0 to 9 subscan; bit 10: last block of subscan; Bit 11: last block of last subscan of scan; Bit 12: last of all blocks (for multiple scans after the last scan)
- 4 bytes:number n of the transmitted measurement results of a trace
- 4 byte:trace1 active (0/1)
- 4 byte:trace2 active (0/1)
- 4 byte:trace3 active (0/1)
- n*4 bytes:measurement results of trace 1 if trace 1 is active
- n*4 bytes:measurement results of trace 2 if trace 2 is active
- n*4 bytes:measurement results of trace 3 if trace 3 is active
- n*1 byte:status information per measurement result:

bit 0: underrange trace1;
bit 1: underrange trace2;
bit 2: underrange trace3;
bit 3: overrange trace1 to trace3

STATus is only possible in form of a query during scan measurements. 1 byte status information per measurement result is transmitted:

bit 0: underrange trace1;
bit 1: underrange trace2;
bit 2: underrange trace3;
bit 3: overrange trace1 to trace3

FINAL1, FINAL2 and FINAL3 are only possible in form of a query. The final measurement values are transmitted.

**TRACe<1|2>:IMMediate:LEVel?**

This query returns the current Y results of the sweep. During a sweep the last measured value is read out.

**Example**: "INIT:CONT OFF"
'switches to single sweep mode
"INIT"
'starts a sweep (without waiting for the sweep end!)
"TRAC1:IMM:LEV?"
'queries the level of the last measured measurement point

**Characteristics**: *RST value:
SCPI: conforming

**Mode**: A

**TRACe<1|2>:IMMediate:RESult?**

This query returns the current X and Y results of the sweep. During a sweep the last measured values are read out.

**Example**: "INIT:CONT OFF"
'switches to single sweep mode
"INIT"
'starts a sweep (without waiting for the sweep end!)
"TRAC:IMM:RES?"
'queries the X and Y values of the last measured measurement point

**Characteristics**: *RST value:
SCPI: conforming

**Mode**: A

**TRACe:POINts** LIMit, 1 to 10000

This command defines the maximum number of measurement points which are transferred in one block after the query command TRACE? SCAN. The total amount of bytes which is transferred depends on the number of active traces.

**Example:** "TRAC:POIN LIM, 8000"
'A maximum of 8000 measurement values per trace will be transferred with a single
'query

**Characteristics:** *RST value: 1000
SCPI: device-specific

**Mode**: R

**TRACe:FEED:CONTrol** ALWays | NEVer

This command switches block data transmission during a scan on and off. The availability of data is reported in the STATus:OPERation-Register.
The block size depends on scan time and the upper limit defined by TRACe:POINts:LIMit.

**Example:** "TRAC:FEED:CONT ALW"

**Characteristics:** *RST Value: NEVer
SCPI: conforming

**Mode**: R

## Remote Control – Description of Commands – CALCulate:PEAKsearch Subsystem

**CALCulate:PEAKsearch:ADD** <numeric_value>

This command adds a frequency value to the peaklist in receiver mode. (RECEIVER – FINAL MEAS – EDIT PEAK LIST). Only frequencies in the currently displayed frequency range of the receiver scan are allowed.

**Example:** "CALC:PEAK:ADD 93 MHZ"
'The frequency 93 MHz as added to the peak list

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

**Mode**: R

**CALCulate:PEAKsearch:CLEar[:IMMediate]**

The peaklist in receiver mode (RECEIVER – FINAL MEAS – EDIT PEAK LIST) is cleared.

**Example:** "CALC:PEAK:CLE"
'The peak list is cleared

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

**Mode**: R

## Remote Control – Description of Commands – SYSTem Subsystem

**SYSTem:LXI:DISPlay** ON | OFF

This command shows or hides the LXI Observer dialog box. To use this command, the LXI Class C functionality must be installed and enabled.

**Example:** ":SYST:LXI:DISP ON" 'shows the LXI Observer dialog box.

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

**SYSTem:LXI:LCI**

This command executes the LAN configuration initialize (LCI) on the instrument. To use this command, the LXI Class C functionality must be installed and enabled.
This command is an event and therefore has no *RST value and no query.

**Example:** ":SYST:LXI:LCI" 'sets the LAN configuration initialize (LCI).

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

**SYSTem:COMMunicate:GPIB:RDEVice:COMMand** 0..30,<command string>

This command sends a command or query string to the device using the GPIB interface FSP-B10. Usually an external generator is connected to this interface.
Note: Only basic I/O is possible with this device. The first parameter is the GPIB address of the device connected with GPIB interface of option FSP-B10.

**Example:**
```
":SYST:COMM:GPIB:RDEF:COMM 18, '*RST'"          ' generator reset
                                                ' gen. frequency 2 GHz
":SYST:COMM:GPIB:RDEF:COMM 18,  'SOURCE:FREQ:CW 2E9' "
                                                ' gen. power 0dBm
":SYST:COMM:GPIB:RDEF:COMM 18, 'SOUR:POW 0'"

":SYST:COMM:GPIB:RDEF:COMM? 18, 'SENS:POW?' "
                                                'queries the generator power
```

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

**SYSTem:IDENtify:FACTory**

With this command it is possible to reset the *IDN string to the factory default (Softkey: ID STRING FACTORY). The command in the form of a query returns "1" for the factory default state and "0" if the ID string is changed.

**Example:** ":SYST:IDEN:FACT" 'sets the ID string to the factory default

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

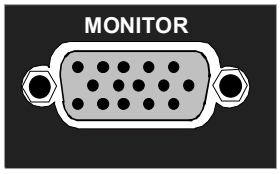
# Last minute changes to the Quick Start Guide

## Connecting an External Monitor

***Caution:***
*Do not connect a monitor unless the instrument is switched off (STANDBY). Otherwise, you run the risk of damaging the monitor.*

.

You can connect an external monitor at the MONITOR connector on the instrument's rear panel.

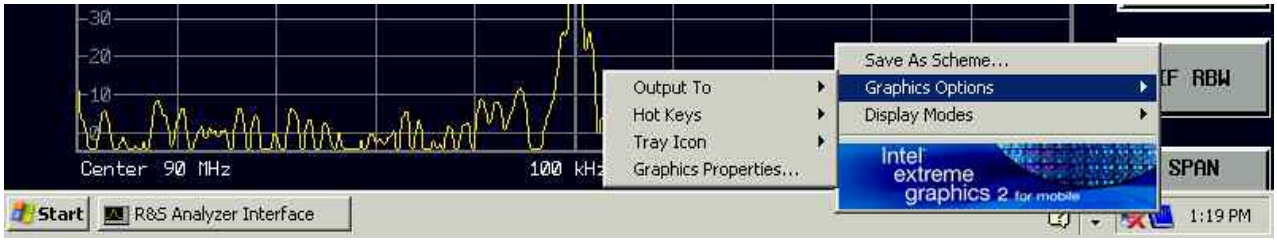



After you connect an external monitor, you must restart the instrument so that it will detect the monitor. The measurement display will then appear on both the external screen and on the instrument. No further settings are necessary.

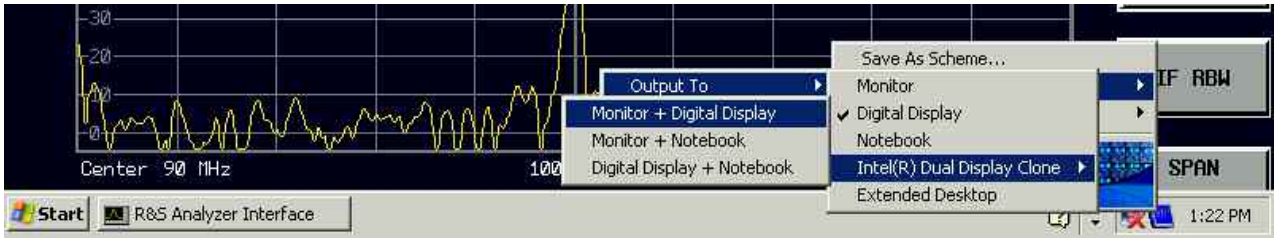
If the external monitor should not be recognized by the instrument, you need to activate it.

USB keyboard/mouse must be connected.
The external monitor must also be connected.

Press <Ctrl> <Esc>, then click on monitor icon (right bottom of the screen) and select *Graphics Options*.




Then select *Output To* ► *Intel(R) Dual Display Clone* ► *Monitor + Digital Display* and click on it.




The activation of the external monitor will be resetted when the instrument is switched on later without a monitor connected.

# 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 |