

# R&S FSH News, August 2006

## New functions for 3GPP BTS code domain power analysis (R&S FSH-K4):

### Automatic scrambling code search

A 3GPP signal can only be demodulated if the scrambling code used is known. If the scrambling code of a 3GPP base station is not known, the new firmware version 11 provides an automatic scrambling code search function at the press of a button. Two different search modes are available:

- The *Single mode* determines the scrambling code of the base station with the maximum power. After the scrambling code has been detected, it is automatically used for demodulation.
- The *Multiple mode* allows the R&S FSH to detect the scrambling codes of up to eight nearby base stations. The R&S FSH displays the detected codes and their CPICH power in a list. Thus, the Multiple mode provides a quick overview of all 3GPP base stations that can be received in the environment.

### Easy to operate:

In practical applications, only four operating steps are required to display the measured code domain values:

- Select the 3GPP CDP function
- Set the center frequency
- Use "Level Adjust" to optimize the level setting
- Start the scrambling code search

### $E_c/I_0$ measurement:

In addition to the EVM value, the signal-to-noise ratio considerably affects signal quality. In a WCDMA system, the  $E_c/I_0$  value is decisive, i.e. the ratio of the chip energy ( $E_c$ ) to the power density of the interference signal ( $I_0$ ). This value is calculated and can be displayed instead of the EVM value, if requested.

3GPP BTS CDP	
Synchronization Result	SYNC OK
Scrambling Code (prm/sec)	312 / 0
CPICH Slot Number	10
Center Frequency	2.1326 GHz
Carrier Frequency Error	166 Hz
Total Power	-32.6 dBm
CPICH (15 ksps, Code 0)	
Power	-43.1 dBm
Ec/Io	-10.5 dB
P-CCPCH (15 ksps, Code 1)	
Power	-43.3 dBm
Ec/Io	-10.5 dB
P-SCH Power	-45.8 dBm
S-SCH Power	-47.3 dBm
<input type="radio"/> AUTO DETECT SINGLE <input type="radio"/> AUTO DETECT MULTIPLE <input type="radio"/> PRIMARY SC... <input type="radio"/> SECONDARY SC...	
VIEW SCR CODES	LEVEL ADJUST
SCRAMB CODE	ANT DIV
DISPLAY	

Two modes are available for the scrambling code search

3GPP BTS CDP	
Synchronization Result	SYNC OK
Scrambling Code (prm/sec)	381 / 0
CPICH Slot Number	2
Center Frequency	2.1326 GHz
Carrier Frequency Error	-75 Hz
Total Power	-57.3 dBm
CPICH (15 ksps, Code 0)	
Power	-66.3 dBm
Ec/Io	-9.0 dB
P-CCPCH (15 ksps, Code 1)	
Power	-72.0 dBm
prm / sec	CPICH Power
381 / 0	-66.4 dBm
377 / 0	-68.2 dBm
57 / 0	-71.6 dBm
<input type="radio"/> AUTO DETECT SINGLE <input type="radio"/> AUTO DETECT MULTIPLE <input type="radio"/> PRIMARY SC... <input type="radio"/> SECONDARY SC...	
VIEW SCR CODES	LEVEL ADJUST
SCRAMB CODE	ANT DIV
DISPLAY	

Display of the detected scrambling codes in the Multiple mode

3GPP BTS CDP	
Synchronization Result	SYNC OK
Scrambling Code (prm/sec)	312 / 0
CPICH Slot Number	11
Center Frequency	2.1326 GHz
Carrier Frequency Error	239 Hz
Total Power	-32.7 dBm
CPICH (15 ksps, Code 0)	
Power	-43.0 dBm
Ec/Io	-10.2 dB
P-CCPCH (15 ksps, Code 1)	
Power	-43.3 dBm
Ec/Io	-10.5 dB
P-SCH Power	-45.8 dBm
S-SCH Power	-47.3 dBm
<input type="radio"/> AUTO DETECT SINGLE <input type="radio"/> AUTO DETECT MULTIPLE <input type="radio"/> PRIMARY SC... <input type="radio"/> SECONDARY SC...	
VIEW SCR CODES	LEVEL ADJUST
SCRAMB CODE	ANT DIV
<input type="radio"/> SYMBOL EVM <input type="radio"/> Ec/Io	
DISPLAY	

Display either of  $E_c/I_0$  or EVM



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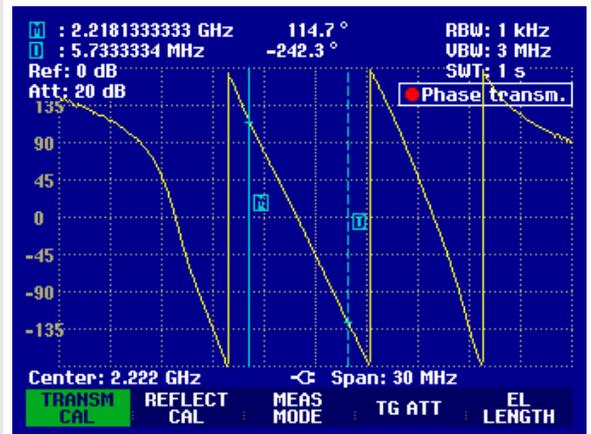
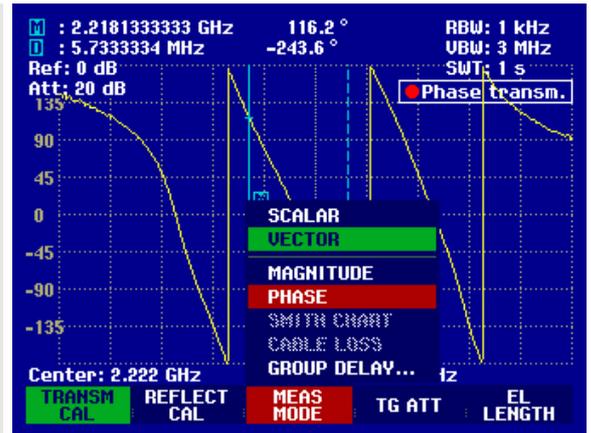
## New measurement functions for vector transmission and reflection measurement (option R&S FSH-K2)

The new firmware version 11 adds the following new features to the scope of functions provided by option R&S FSH-K2:

- $S_{21}$  and  $S_{11}$  phase measurement
- Group delay measurement
- Electrical length measurement
- New marker formats for the Smith chart
- Change of reference impedance in the Smith chart

### Phase measurement

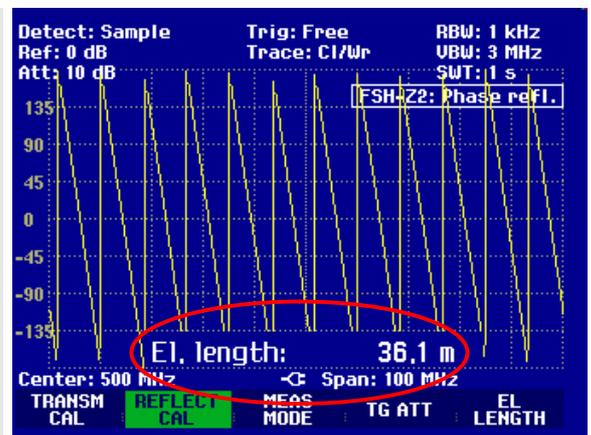
The phase measurement is available for transmission and reflection measurements. Values between  $-180^\circ$  and  $+180^\circ$  are displayed in the default scaling. The UNWRAP function removes the restriction limiting the value range to  $\pm 180^\circ$ . With this function, no more shifts will occur, and the phase can have any value from  $0^\circ$  to  $54360^\circ$ .



$S_{21}$  phase measurement in the  $\pm 180^\circ$  display

### Electrical length measurement

When performing phase measurements, the R&S FSH can additionally calculate and display the electrical length of the DUT.

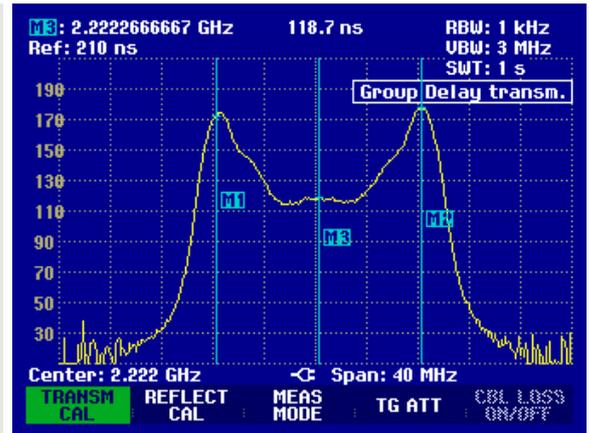


Measuring the electrical length of a cable

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## Group delay measurement

The R&S FSH can calculate the group delay of amplifiers, filters, cables and so on from the phase difference and frequency difference (aperture) of two test points and display it over the frequency.



Measuring the group delay

## Enhanced functions complement the Smith chart

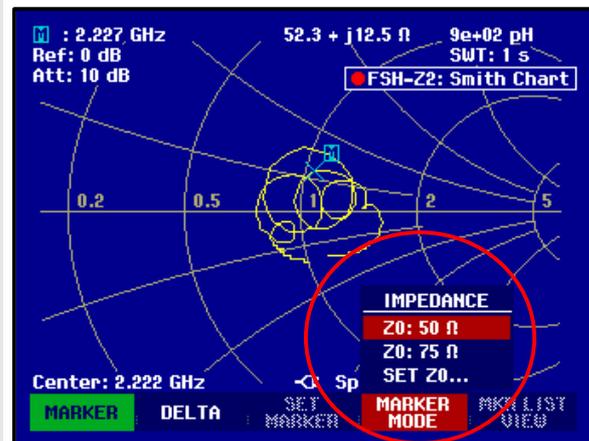
**New marker formats:** Six more marker formats - in addition to the known R+jX - make the evaluation of measurement results even more flexible:

- dB MAG AND PHASE (RHO) outputs the marker value for the reflection factor in complex magnitude phase format, where the magnitude is converted to dB.
- LIN MAG AND PHASE (RHO) outputs the marker value for the reflection factor in complex magnitude phase format, where the magnitude is linearly converted to a percent value.
- REAL AND IMAG (RHO) outputs the marker value for the reflection factor in complex format with real and imaginary components.
- R+jX shows the marker value for the impedance in complex format with real and imaginary components. In addition, the imaginary component of the impedance is converted to inductance or capacitance and displayed with the marker frequency and sign taken into account.
- G+jB shows the marker value for the admittance in complex format with real and imaginary components. In addition, the imaginary component of the admittance is converted to inductance or capacitance and displayed with the marker frequency and sign taken into account.
- (R+jX/Z0) shows the marker value for the standardized impedance in complex format with real and imaginary components.
- (G+jB/Z0) shows the marker value for the standardized admittance in complex format with real and imaginary components.



A total of seven different marker formats now available in the Smith chart

**Defining the reference impedance:** The Smith chart is standardized to an impedance of 50 Ω. In other words, the matching point in the center of the Smith chart corresponds exactly to 50 Ω. However, reflection measurements using suitable matching networks and calibration standards can also be carried out in systems with different impedance values. For this purpose, the reference impedance for the Smith chart can be modified as needed. The reference impedance has a value range from 1 mΩ to 10 kΩ.



To standardize the Smith chart, the reference impedance can be defined



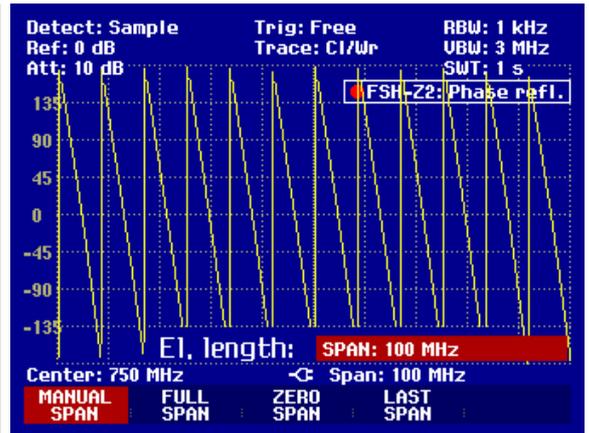
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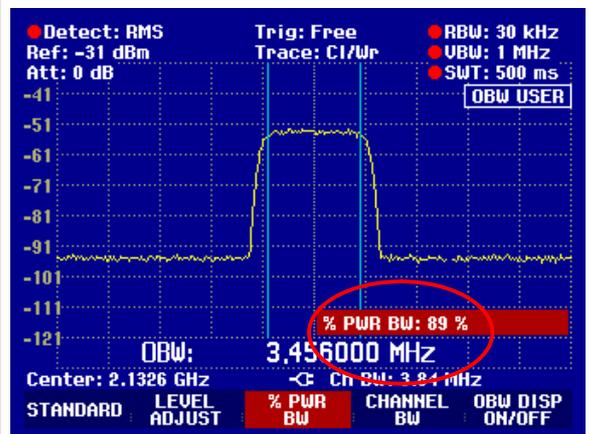
## Other new features of firmware 11.0

- Improved handling of scalar and vector network analysis:  
The calibration remains valid if the start frequency, stop frequency, center frequency and span are subsequently changed within the calibrated frequency range. In this case, the R&S FSH interpolates the correction data between the reference points of the calibration. The R&S FSH retains the calibration values but displays a red circle before the tracking generator status display in the upper right-hand corner of the screen to indicate a possible increase in measurement uncertainty.
- When the occupied bandwidth (OBW) is defined, the power percent can be set between 10 % and 99.9 %.
- The AM/FM audio demodulator is now also available for measurements on a fixed frequency in the Receiver mode (R&S FSH-K3).

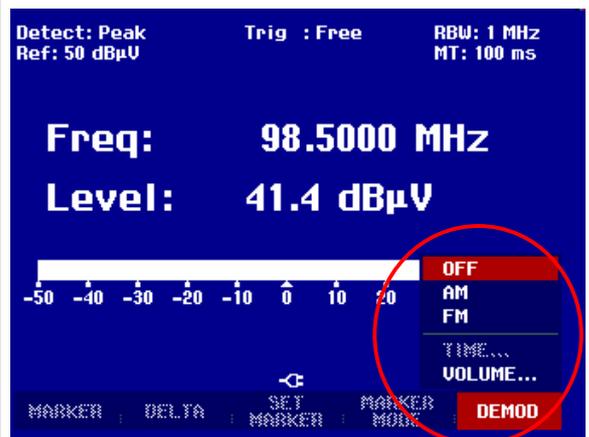
*Firmware version 11 and the associated R&S FSHView version 11 software, which supports the new firmware functions, can be downloaded from the R&S Homepage.*



The calibration remains valid if the start frequency, stop frequency, center frequency and span are subsequently changed within the calibrated frequency range



Defining the power percent when measuring the occupied bandwidth



Use of the AM /FM audio demodulator in the Receiver mode on a fixed frequency



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## R&S FSH-Z2 VSWR bridge

### Additional equipment supplied:

The R&S FSH3-Z2 3 GHz VSWR bridge is now supplied together with the R&S FSH-Z29 calibration standard as standard. The R&S FSH-Z29 calibration standard has been specially designed for field applications. It combines all calibration standards (open, short, 50  $\Omega$  load) necessary for scalar or vector network analysis as well as DTF measurement.



The R&S FSH-Z29 calibration standard is now supplied as standard together with the R&S FSH-Z2 VSWR bridge



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