

# EUTRA/LTE NB-IoT Measurement Application Specifications

R&S®FSW-K106 EUTRA/LTE NB-IoT Downlink Measurement Application  
 R&S®FSV3-K106 EUTRA/LTE NB-IoT Downlink Measurement Application  
 R&S®FSV-K106 EUTRA/LTE NB-IoT Downlink Measurement Application  
 R&S®FPS-K106 EUTRA/LTE NB-IoT Downlink Measurement Application  
 R&S®VSE-K106 EUTRA/LTE NB-IoT Downlink Measurement Application



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## Definitions

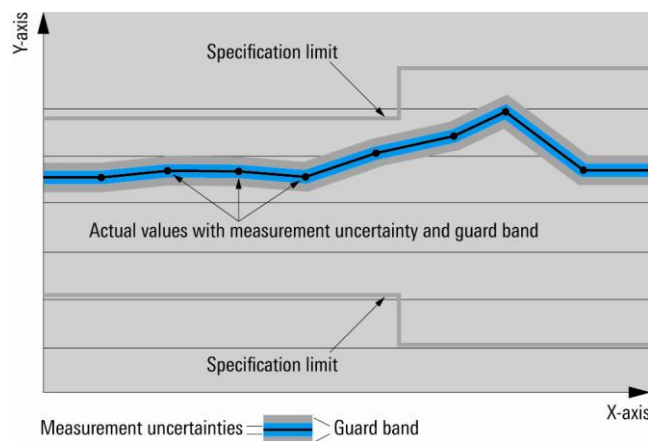
### General

Product data applies under the following conditions:

- Three hours storage at ambient temperature followed by 30 minutes warm-up operation
- Specified environmental conditions met
- Recommended calibration interval adhered to
- All internal automatic adjustments performed, if applicable

### Specifications with limits

Represent warranted product performance by means of a range of values for the specified parameter. These specifications are marked with limiting symbols such as  $<$ ,  $\leq$ ,  $>$ ,  $\geq$ ,  $\pm$ , or descriptions such as maximum, limit of, minimum. Compliance is ensured by testing or is derived from the design. Test limits are narrowed by guard bands to take into account measurement uncertainties, drift and aging, if applicable.



### Non-traceable specifications with limits (n. trc.)

Represent product performance that is specified and tested as described under "Specifications with limits" above. However, product performance in this case cannot be warranted due to the lack of measuring equipment traceable to national metrology standards. In this case, measurements are referenced to standards used in the Rohde & Schwarz laboratories.

### Specifications without limits

Represent warranted product performance for the specified parameter. These specifications are not specially marked and represent values with no or negligible deviations from the given value (e.g. dimensions or resolution of a setting parameter). Compliance is ensured by design.

### Typical data (typ.)

Characterizes product performance by means of representative information for the given parameter. When marked with  $<$ ,  $>$  or as a range, it represents the performance met by approximately 80 % of the instruments at production time. Otherwise, it represents the mean value.

### Nominal values (nom.)

Characterize product performance by means of a representative value for the given parameter (e.g. nominal impedance). In contrast to typical data, a statistical evaluation does not take place and the parameter is not tested during production.

**Measured values (meas.)**

Characterize expected product performance by means of measurement results gained from individual samples.

**Uncertainties**

Represent limits of measurement uncertainty for a given measurand. Uncertainty is defined with a coverage factor of 2 and has been calculated in line with the rules of the Guide to the Expression of Uncertainty in Measurement (GUM), taking into account environmental conditions, aging, wear and tear.

Device settings and GUI parameters are indicated as follows: "parameter: value".

Non-traceable specifications with limits, typical data as well as nominal and measured values are not warranted by Rohde & Schwarz.

In line with the 3GPP/3GPP2 standard, chip rates are specified in Mcps (million chips per second), whereas bit rates and symbol rates are specified in Mbps (million bits per second), kbps (thousand bits per second) or ksps (thousand symbols per second), and sample rates are specified in Msample/s (million samples per second). Mcps, kbps, ksps and Msample/s are not SI units.

## Specifications

The specifications of the R&S®VSE-K106, R&S®FSW-K106, R&S®FSV3-K106, R&S®FSV-K106 and the R&S®FPS-K106 are based on the specifications of the R&S®FSW, R&S®FSVA3000, R&S®FSV3000, R&S®FSVA, R&S®FSV, R&S®FPS and R&S®FPL1000 signal and spectrum analyzers and the R&S®RTO2044 oscilloscope. They have not been checked separately and are not verified during instrument calibration. Measurement uncertainties are given as 95 % confidence intervals. The specified level measurement errors do not take into account systematic errors due to reduced signal-to-noise ratio (SNR).

## General remarks

This data sheet covers the R&S®VSE-K106, R&S®FSW-K106, R&S®FSV3-K106, R&S®FSV-K106 and the R&S®FPS-K106 EUTRA/LTE NB-IoT measurement applications.

The R&S®VSE-K106 runs on a PC that can be connected to analyzers and oscilloscopes as specified below.

## Overview

### Assignment of option numbers to link modes and access modes

R&S®VSE-K106	EUTRA/LTE NB-IoT downlink and uplink. This application runs on the devices R&S®FSW, R&S®FSVA, R&S®FSV, R&S®FPS and R&S®FPL1000
R&S®FSW-K106	EUTRA/LTE NB-IoT downlink
R&S®FSV3-K106	EUTRA/LTE NB-IoT downlink
R&S®FSV-K106	EUTRA/LTE NB-IoT downlink
R&S®FPS-K106	EUTRA/LTE NB-IoT downlink

### Running on a PC (R&S®VSE-K106)

Operating system	Windows7 64 bit/Windows10 64 bit
Hard disk space	5 Gbyte required
RAM	≥ 4 Gbyte required
CPU	1.5 GHz minimum (> 2.5 GHz recommended)
Graphics resolution	≥ 1280 × 1024 pixel
USB	1 free USB port for connecting the smart card reader R&S®FSPC (if no PC built-in smart card reader is used)
Measuring instrument connection	LAN connection (VXI-11, Hi-Slip), VISA driver

### Running on an instrument

Using a keyboard and mouse with the instrument is suggested for optimum operation. Front panel keys of the instrument are only for operating the firmware and not the R&S®VSE.

R&S®FSW	requires R&S®FSW firmware version 2.60 or newer
R&S®RTO	requires Windows7 64 bit operating system

## EUTRA/LTE analysis

### Signal acquisition

Supported standards	downlink	EUTRA/LTE NB-IoT in line with 36.211 Rev. 13.2.0 36.104 Rev. 15.4.0
	uplink	EUTRA/LTE NB-IoT in line with 36.211 Rev. 13.2.0 36.101 Rev. 14.0.0
	downlink	2.01 ms to 50.1 ms
	uplink R&S®FSW, R&S®FSVA3000, R&S®FSV3000, R&S®FSVA, R&S®FSV, R&S®FPS	2.01 ms to 20.48 s
Capture length	uplink R&S®FPL1000	2.01 ms to 12 s
	uplink R&S®RTO	2.01 ms to 5 s
	Trigger modes	free run, external

### Measurement parameters downlink

	<b>R&amp;S®VSE-K106, R&amp;S®FSW-K106, R&amp;S®FSV3-K106, R&amp;S®FSV-K106, R&amp;S®FPS-K106</b>
Deployment	in-band, guard-band, stand-alone
Input	RF, file
Channel bandwidth	200 kHz
MIMO configuration	1, 2 TX antennas
Number of input channels	1
NPDSCH resource allocation detection	auto
Switchable multicarrier filter	•
<b>Adjacent channel leakage power ratio (ACLR)<sup>1</sup></b>	
Assumed adjacent channel carrier	stand-alone NB-IoT

### Measurement parameters uplink

	<b>R&amp;S®VSE-K106</b>
Deployment	stand-alone
Input	RF, File
Subcarrier spacing	3.75 kHz, 15 kHz
NPUSCH format	1, 2
Number of subcarriers	1, 3, 6, 12
Modulation types	BPSK, QPSK
Automatic NPUSCH detection	number of subcarriers, start subcarrier, modulation type
<b>Adjacent channel leakage power ratio (ACLR)</b>	
Assumed adjacent channel carrier	GSM, UTRA

<sup>1</sup> Adjacent channel leakage power ratio measurement not available for R&S®FSV-K106.

## Result displays downlink

	R&S®VSE-K106	R&S®FSW-K106 R&S®FSV3-K106 R&S®FPS-K106	R&S®FSV-K106
<b>Result summary</b>			
Center frequency error	•	•	•
Sampling error	•	•	•
RSTP (reference signal TX power)	•	•	•
OSTP (OFDM symbol TX power)	•	•	•
RSSI (received signal strength indicator)	•	•	–
Power	•	•	•
Crest factor	•	•	•
<b>Power versus time</b>			
Capture buffer	•	•	•
Power versus symbol and carrier	•	•	–
<b>EVM</b>			
EVM versus carrier	•	•	•
EVM versus symbol	•	•	•
EVM versus symbol and carrier	•	•	–
Frequency error versus symbol	•	•	•
<b>Spectrum</b>			
Power spectrum	•	•	•
Channel flatness	•	•	•
Channel flatness difference	•	•	•
ACLR	•	•	–
Spectrum emission mask	•	•	–
<b>Constellation</b>			
Constellation diagram	•	•	•
<b>Statistics/miscellaneous</b>			
CCDF	•	•	•
Group delay	•	•	•
Allocation summary list	•	•	•
Allocation ID versus symbol and carrier	•	•	–
Time alignment error	•	•	–

**Result displays uplink**

	R&S®VSE-K106
<b>Result summary</b>	
3GPP EVM NPUSCH BPSK	•
3GPP EVM NPUSCH QPSK	•
3GPP EVM NDRMS NPUSCH BPSK	•
3GPP EVM NDRMS NPUSCH QPSK	•
3GPP frequency error	•
EVM all	•
EVM physical channel	•
EVM physical signal	•
Center frequency error	•
I/Q offset	•
I/Q gain imbalance (only for 12 carrier signals)	•
I/Q quadrature error (only for 12 carrier signals)	•
Power	•
Crest factor	•
<b>Power versus time</b>	
Capture buffer	•
Power versus symbol and carrier	•
<b>EVM</b>	
EVM versus carrier	•
EVM versus symbol	•
EVM versus symbol and carrier	•
<b>Spectrum</b>	
Power spectrum	•
Spectrum flatness	•
Spectrum flatness difference	•
Group delay	•
ACLR	•
<b>Constellation</b>	
Constellation diagram	•
<b>Statistics/miscellaneous</b>	
CCDF	•
Bitstream	•
Allocation summary list	•



## Measurement uncertainty (nominal)

Specifications apply under the following conditions: temperature from +20 °C to +30 °C; signal level –25 dBm; properly adjusted reference level; external reference frequency applied, frequency range from 700 MHz to 1.98 GHz

### Base station and UE output power

Base station and UE output power	R&S®FSW	R&S®FSVA3000	R&S®FSV3000	R&S®FSVA	R&S®FPS R&S®FSV	R&S®FPL1000	R&S®RTO2044
Level uncertainty	same as R&S®FSW/FSVA3000/FSV3000/FSV/FSVA/FPS/FPL1000/RTO2044 (see R&S®FSW/FSVA3000/FSV3000/FSV/FSVA/FPS/FPL1000/RTO2044 total measurement uncertainty)						

### Transmitted signal quality base station

EVM	R&S®FSW	R&S®FSVA3000	R&S®FSV3000	R&S®FSVA	R&S®FPS R&S®FSV	R&S®FPL1000	R&S®RTO2044
Residual EVM	< 0.33 % (–49.8 dB)	< 0.34 % (–49.4 dB)	< 0.35 % (–49.1 dB)	< 0.40 % (–48.0 dB)	< 0.47 % (–46.6 dB)	< 0.36 % (–48.9 dB)	< 1.00 % (–40.0 dB)

### Transmitted signal quality UE

EVM		R&S®FSW	R&S®FSVA	R&S®FPS R&S®FSV	R&S®FPL1000	R&S®RTO2044
Residual EVM	15 kHz carrier spacing 12/6/3 carrier signals	< 0.12 % (–58.5 dB)	< 0.15 % (–56.5 dB)	< 0.20 % (–54.0 dB)	< 0.22 % (–53.3 dB)	< 0.40 % (–48.0 dB)
	15 kHz carrier spacing 1 carrier signal	< 0.02 % (–74.0 dB)	< 0.04 % (–68.0 dB)	< 0.10 % (–60.0 dB)	< 0.10 % (–60.0 dB)	< 0.20 % (–54.0 dB)
	3.75 kHz carrier spacing	< 0.02 % (–74.0 dB)	< 0.05 % (–66.0 dB)	< 0.18 % (–54.9 dB)	< 0.20 % (–54.0 dB)	< 0.25 % (–52.0 dB)

## Ordering information

Designation	Type	Order No.
<b>EUTRA/LTE NB-IoT downlink measurement applications</b>		
EUTRA/LTE NB-IoT downlink measurement application	R&S®FSW-K106	1331.6351.02
EUTRA/LTE NB-IoT downlink measurement application	R&S®FSV3-K106	1346.3418.02
EUTRA/LTE NB-IoT downlink measurement application	R&S®FSV-K106	1309.9797.02
EUTRA/LTE NB-IoT downlink measurement application	R&S®FPS-K106	1331.3246.02
EUTRA/LTE NB-IoT downlink measurement application	R&S®VSE-K106	1320.7900.02
<b>Analyzers</b>		
<b>R&amp;S®FSW</b>		
Signal and spectrum analyzer, 2 Hz to 8 GHz	R&S®FSW8	1331.5003.08
Signal and spectrum analyzer, 2 Hz to 13.6 GHz	R&S®FSW13	1331.5003.13
Signal and spectrum analyzer, 2 Hz to 26.5 GHz	R&S®FSW26	1331.5003.26
Signal and spectrum analyzer, 2 Hz to 43.5 GHz	R&S®FSW43	1331.5003.43
Signal and spectrum analyzer, 2 Hz to 50 GHz	R&S®FSW50	1331.5003.50
Signal and spectrum analyzer, 2 Hz to 67 GHz	R&S®FSW67	1331.5003.67
Signal and spectrum analyzer, 2 Hz to 85 GHz	R&S®FSW85	1331.5003.85
<b>R&amp;S®FSVA3000, R&amp;S®FSV3000</b>		
Signal and spectrum analyzer, 10 Hz to 4 GHz	R&S®FSVA3004	1330.5000.05
Signal and spectrum analyzer, 10 Hz to 7.5 GHz	R&S®FSVA3007	1330.5000.08
Signal and spectrum analyzer, 10 Hz to 13.6 GHz	R&S®FSVA3013	1330.5000.14
Signal and spectrum analyzer, 10 Hz to 30 GHz	R&S®FSVA3030	1330.5000.31
Signal and spectrum analyzer, 10 Hz to 44 GHz	R&S®FSVA3044	1330.5000.44
Signal and spectrum analyzer, 10 Hz to 4 GHz	R&S®FSV3004	1330.5000.04
Signal and spectrum analyzer, 10 Hz to 7.5 GHz	R&S®FSV3007	1330.5000.07
Signal and spectrum analyzer, 10 Hz to 13.6 GHz	R&S®FSV3013	1330.5000.13
Signal and spectrum analyzer, 10 Hz to 30 GHz	R&S®FSV3030	1330.5000.30
Signal and spectrum analyzer, 10 Hz to 44 GHz	R&S®FSV3044	1330.5000.43
<b>R&amp;S®FSVA, R&amp;S®FSV</b>		
Signal and spectrum analyzer, 10 Hz to 4 GHz	R&S®FSVA4	1321.3008.05
Signal and spectrum analyzer, 10 Hz to 7 GHz	R&S®FSVA7	1321.3008.08
Signal and spectrum analyzer, 10 Hz to 13.6 GHz	R&S®FSVA13	1321.3008.14
Signal and spectrum analyzer, 10 Hz to 30 GHz	R&S®FSVA30	1321.3008.31
Signal and spectrum analyzer, 10 Hz to 40 GHz <sup>2</sup>	R&S®FSVA40	1321.3008.41
Signal and spectrum analyzer, 10 Hz to 4 GHz	R&S®FSV4	1321.3008.04
Signal and spectrum analyzer, 10 Hz to 7 GHz	R&S®FSV7	1321.3008.07
Signal and spectrum analyzer, 10 Hz to 13.6 GHz	R&S®FSV13	1321.3008.13
Signal and spectrum analyzer, 10 Hz to 30 GHz	R&S®FSV30	1321.3008.30
Signal and spectrum analyzer, 10 Hz to 40 GHz <sup>2</sup>	R&S®FSV40	1321.3008.39
Signal and spectrum analyzer, 10 Hz to 40 GHz	R&S®FSV40	1321.3008.40

<sup>2</sup> Max. bandwidth 10 MHz.

<b>R&amp;S®FPS</b>		
Signal and spectrum analyzer 10 Hz to 4 GHz	R&S®FPS4	1319.2008.04
Signal and spectrum analyzer 10 Hz to 7 GHz	R&S®FPS7	1319.2008.07
Signal and spectrum analyzer 10 Hz to 13.6 GHz	R&S®FPS13	1319.2008.13
Signal and spectrum analyzer 10 Hz to 30 GHz	R&S®FPS30	1319.2008.30
Signal and spectrum analyzer 10 Hz to 40 GHz	R&S®FPS40	1319.2008.40
<b>R&amp;S®FPL1000</b>		
Spectrum analyzer 5 kHz to 3 GHz	R&S®FPL1003	1304.0004.03
<b>Oscilloscope</b>		
Oscilloscope, 4 GHz, 4 channels (requires R&S®RTO-K11 and R&S®RTO-B4)	R&S®RTO2044	1329.7002.44
I/Q software interface	R&S®RTO-K11	1317.2975.02
OCXO 10 MHz	R&S®RTO-B4	1304.8305.02
<b>Vector signal explorer</b>		
R&S®VSE basic edition	R&S®VSE	1345.1011.06
R&S®VSE enterprise edition	R&S®VSE Enterprise Edition	1345.1105.06
R&S®VSE software maintenance	R&S®VSE-SWM	1320.7622.81

## Rohde & Schwarz

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### Sustainable product design

- ▮ Environmental compatibility and eco-footprint
- ▮ Energy efficiency and low emissions
- ▮ Longevity and optimized total cost of ownership



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