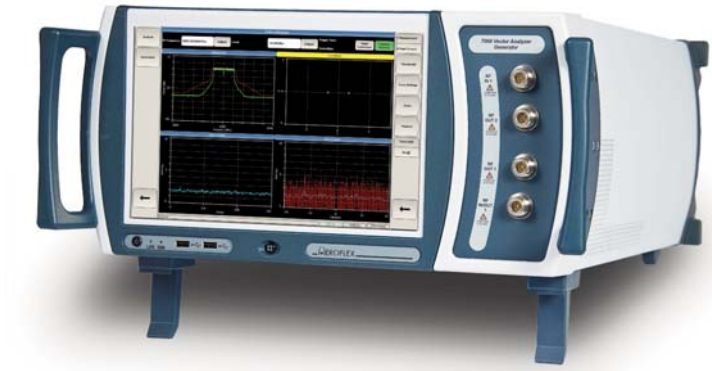
LTE

7000 Vector Signal Analyzer and Generator

AEROFLEX
A passion for performance.



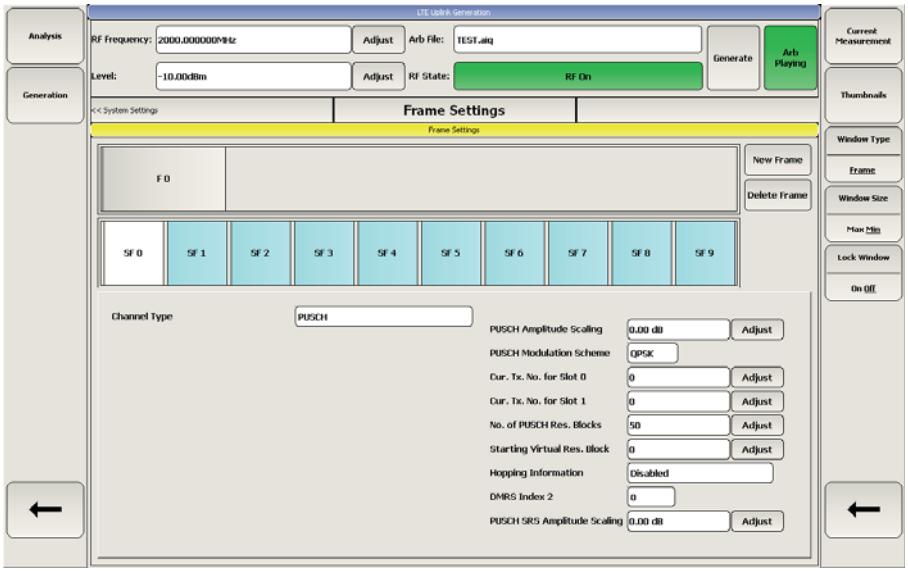
- Combined Vector Signal Analyzer and Generator
- 1 MHz to 6 GHz frequency range
- 90 MHz generation and analysis bandwidth
- Second signal generator option
- Supports multiple cellular and wireless broadband standards
- Ideal for characterization of mobile devices and modules
- Comprehensive solution for development and manufacturing
- Easy to use operator touch screen interface
- Comprehensive waveform generation package
- 2 GB AWG

The 7000 Vector Analyzer Gnerator is an advanced test system providing RF parametric measurements for the wireless professional. It's unique modularity embracing both software and hardware enables the 7000 VAG to provide a flexible platform able to track the changes in the fast evolving cellular and wireless broadband markets. The 7000 VAG comprises a full featured vector signal generator and vector signal analyzer with a frequency range from 1 MHz to 6 GHz and a modulation and analysis bandwidth of 90 MHz. This has been achieved with no compromises to performance which is equivalent to that of conventional individual instruments, reducing interconnection and providing a measurement focused user experience for the operator. The signal generator and analyzer can be used individually from their respective N type connectors for component characterization or coupled to a single port (Duplex) for characterization of devices.

Preliminary

Signal Generation

The Vector Signal Generator includes a range of “standard“ waveforms representing all the popular cellular standards and an intuitive waveform generation package which enables user specific waveforms to be developed and played on the internal AWG. In addition user created waveforms from Matlab and similar packages may be entered and stored on the instrument for use in the AWG. The integrated Signal Generator has all the performance offered by stand alone generators with an output level up to +12 dBm and a typical phase noise of -115 dBc (20kHz offset) at 2 GHz. Also the 7000 VAG is available with a second signal generator with the same capability for advanced analog measurements such as IP3 characterization and mixer testing.

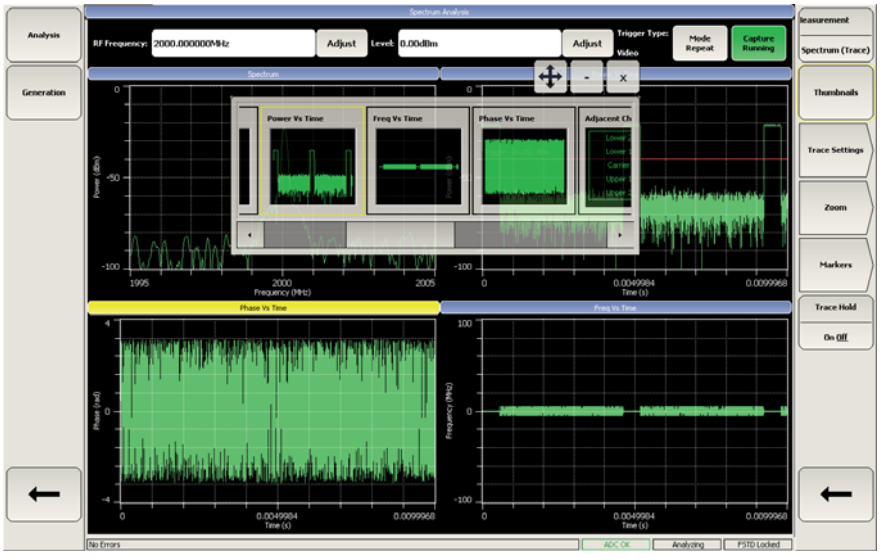


Signal Analysis

The Vector Signal Analyzer has an analysis bandwidth of 90 MHz with wider analysis bandwidths being addressed by intelligent “stitching” of the spectrum. As standard the analyzer provides a range of RF measurement capabilities including FFT spectrum analysis, power measurement, occupied bandwidth and ACLR measurement. Additional technology specific measurement packages are available to cover parametric measurement of a wide range of cellular and broadband wireless standards. These packages personalize the measurements to comply with the specific standards supported. Because of the unique design of the 7000 VAG future wireless standards can be incorporated into the product by purchasing the appropriate software package, additionally to ensure your measurements are always up to date you can download upgrades to your existing measurements from the Aeroflex web site.

Spectrum Analysis

Both spectrum and time domain measurements are available in the 7000. Spectrum measurements can be made over a maximum span width of 200 MHz with continuously variable resolution bandwidths from 1 Hz to 10 MHz. Measurements of occupied bandwidth and adjacent channel power are available with arbitrary channel spacing and channel bandwidth. In addition, displays of power, frequency and phase versus time are available.



GSM/EDGE Measurements

A complete suite of measurement functions is available to characterize GSM and EDGE mobile transceiver RF performance using procedures as defined in 3GPP 51-010-1 V5.2.1 sections 13.17.1-4 and 13.14.2.

- TX average power and burst power profile
- GMSK phase error (peak and RMS)
- 8PSK EVM, origin offset suppression, phase error
- 95th percentile EVM
- Frequency error
- Output radio frequency spectrum
- Receiver BER measurement (GSM only)

All specifications are defined when used in conjunction with the 3030 Series PXI RF digitizer operating in any GSM band between 400 MHz and 2000 MHz. GSM BER measurements additionally require a 3020 Series PXI digital RF signal generator.

UMTS Measurements

A complete suite of measurement functions is available to characterize UMTS mobile transceiver performance in accordance with 3GPP TS 34.121 release 6.

- Output power
- Spectrum emission mask
- ACLR
- Phase and amplitude errors
- Origin offset
- HS-DPCCH timing offset
- Peak code domain error
- Enhanced physical channels and HS-DPCCH
- Frequency stability
- Occupied bandwidth
- EVM (Peak and RMS)
- IQ skew and gain imbalance
- Tx slot timing error
- Code domain power
- Demodulated symbol data for active channels
- Receive sensitivity (BER) using loopback

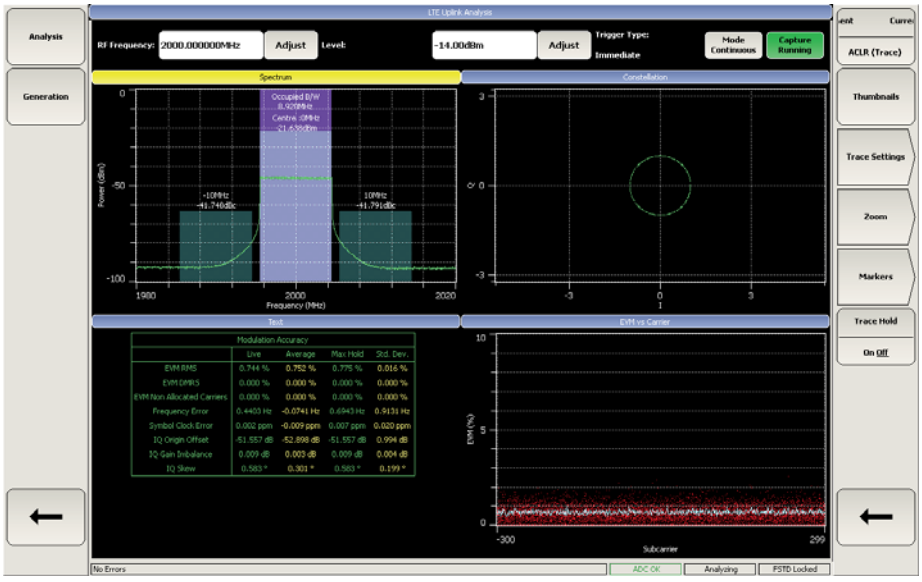
All specifications are defined when used in conjunction with the 3030 Series PXI RF digitizer operating in all WCDMA 3GPP FDD bands.

LTE FDD Measurements

The LTE FDD measurement suite is a library of measurement functions designed to characterize LTE FDD signals in accordance with the requirements of ETSI TS 36.521-1.(3GPP release 8).

- Transmit signal quality
- Frequency error
- Error vector magnitude (EVM)
- Symbol clock error
- In-band emissions for non allocated RB
- Output RF spectrum emissions
- Spectrum emission mask
- CCDF
- IQ skew/gain imbalance
- IQ-component (carrier leak)
- Spectrum flatness
- Occupied bandwidth
- Adjacent cchannel leakage power ratio

LTE analysis is supported for uplink (SC-FDMA) transmissions for all bandwidths, 1.4 MHz, to 20 MHz and modulation types QPSK, QAM16 and QAM64. In addition to numerical measurement results, the measurement suite provides trace displays for spectrum emission mask, CCDF, constellation plots, EVM vs. Carrier and EVM vs. Symbol. EVM analysis for uplink PUSCH is supported. A user defined window position can be selected when performing EVM measurements. This helps to track down problems associated with baseband timing and windowing.

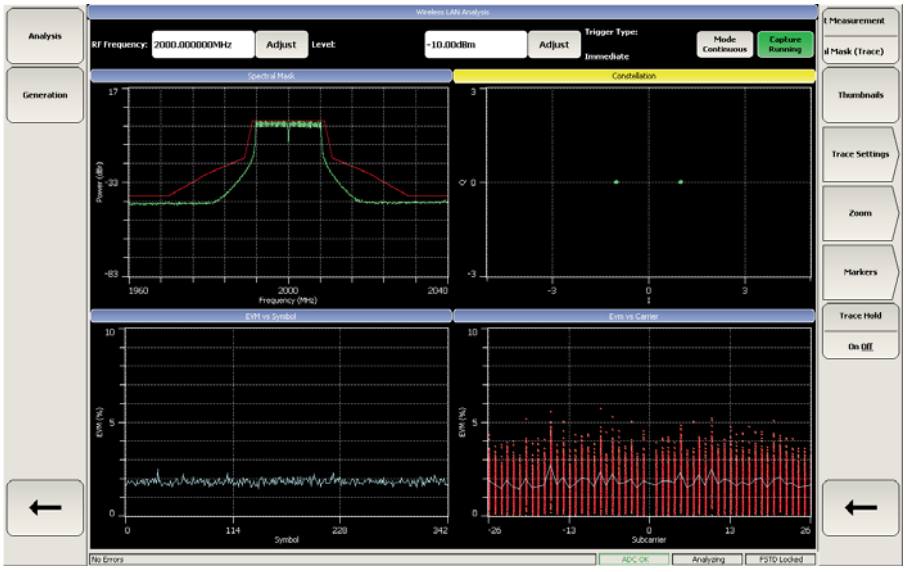


WLAN Measurements

A comprehensive suite of measurement tools is available for enabling the analysis of WLAN OFDM, DSS and DSS-OFDM RF signal characteristics in accordance with the requirements of IEEE 802.11a,b PMD 1999, IEEE802.11g PMD 2003 and IEE 802.11n /D7.0.

- Transmit power
- Transmit power on, off timing
- Occupied bandwidth
- Symbol/chip clock frequency tolerance
- Skew / gain imbalance
- Spectral flatness
- Transmit burst length
- Spectral mask
- Frequency tolerance
- Carrier suppression/leakage
- Modulation accuracy

Data rates and corresponding modulation and encoding formats up to 150 MB/s are supported. Modulation format, data rate, and modulation type are all determined automatically from the preamble and header decoding. Measurements can be performed with and without compensation for pilot time, amplitude and phase tracking enabled. For 802.11n modulation and coding schemes (MCS) 0 through 7 and 32 are supported which correspond to a single special stream.



SPECIFICATIONS

RF SIGNAL GENERATOR

FREQUENCY

Range

RF OUT 1,2	1 MHz to 6 GHz
RF IN/OUT	70 MHz to 6 GHz

Resolution

Below 3 GHz;	1 Hz
Above 3 GHz;	2 Hz

Accuracy

As per frequency reference (+ 58 mHz for carriers < 85 MHz)

Settling Time

F< 3 GHz:	1.1 ms typical settling time to within 0.7 ppm or 1 kHz of final frequency
F> 3 GHz: :	1.1 ms typical settling time to within 2 kHz of final frequency.

Option 04 (subject to Export control)

F< 6 GHz	250 µs typical settling time to within 2 kHz of final frequency.

LEVEL

Output level Range

RF OUT 1,2

Below 85 MHz	-120 dBm to +9 dBm CW
85 MHz to 3.5 GHz	-120 dBm to +12 dBm CW
3.5 GHz to 6 GHz	-120 dBm to +9 dBm CW
	Note: PEP for modulated signals is 3 dB below CW

RF IN/OUT

Below 85 MHz	-120 dBm to 0 dBm CW
85 MHz to 3.5 GHz	-120 dBm to +2 dBm CW
3.5 GHz to 6 GHz	-120 dBm to -4 dBm CW
	Note: PEP for modulated signals is 3 dB below CW

RF IN/OUT

Applies to TX1 only in duplex and interferer mode.

Below 85 MHz	-120 dBm to -6 dBm CW
85 MHz to 3.5 GHz	-120 dBm to -4 dBm CW
3.5 GHz to 6 GHz	-120 dBm to -8 dBm CW
	Note: PEP for modulated signals is 3 dB below CW

Resolution

+0.01 dB

Accuracy (23 °C+/-5 °C)

RF OUT

F< 3GHz	+0.6 dB (typ. +0.3 dB) -83 dBm to +7 dBm 0.75 dB (typ. +0.5 dB) -98 dBm to -83 dBm
	+1.0 dB (typ. +0.5 dB) at all other power levels
F> 3 GHz	+1.0 dB (typ. +0.6 dB) above -118 dBm

RF IN/OUT

F< 3GHz	+0.6 dB (typ. +0.3 dB) -92 dBm to -2 dBm +0.75 dB (typ. +0.5 dB) -107 dBm to -92 dBm
	+1.0 dB (typ. +0.5 dB) at all other power levels
F> 3 GHz	+1.0 dB (typ. +0.6 dB) above -114 dBm

RF IN/OUT

Applies to TX1 only in duplex and interferer mode.

F< 3GHz	*+0.6 dB (typ. +0.3 dB) -98 dBm to -8 dBm*
	+0.75 dB (typ. +0.5 dB) -113 dBm to -98 dBm
	+1.0 dB (typ. +0.5 dB) at all other power levels
F> 3 GHz	*+1.0 dB (typ. +0.6 dB)*

Temperature stability

+0.01 dB/0C

Switching Time (within 0.3 dB of final value)

< 3 ms to within 0.3 dB of final value (230C +5 0C)

Output Impedance

50Ω

Output VSWR

RF OUT 1,2:	*1.5:1 70 MHz to 3 GHz below -6 dBm (typical above -6 dBm)*
	1.5:1 3 GHz to 5 GHz below -13 dBm (typical above -13 dBm)
	1.6:1 5 GHz to 6 GHz below -14 dBm (typical above -14 dBm)
RF IN/OUT:	*1.3:1 70 MHz to 3 GHz below -15 dBm (typical above -15 dBm)*
	1.5:1 3 GHz to 5 GHz below -23 dBm (typical above -23 dBm)
	1.6:1 5 GHz to 6 GHz below -24 dBm (typical above -24 dBm)

Reverse Power Handling

RF OUT 1,2:	*Not to exceed +27 dBm, +9V DC*
RF IN/OUT:	*Not to exceed +33 dBm, +6v dc*

SPECTRAL PURITY

SSB Phase Noise

Typical at 50 MHz and at ambient room temperature (DDS clock mode = low noise)

Offset 20 kHz	*-143 dBc/Hz*
Offset 100 kHz	*-149 dBc/Hz*

Typical at 2 GHz and at ambient room temperature

Offset 20 kHz	*-115 dBc/Hz*
Offset 100 kHz	*-132 dBc/Hz*

Typical phase noise at 5 GHz -108 dBc/Hz 20 kHz offset

Noise Floor (10 MHz offset from 2 GHz)

Typically -140 dBc/Hz

Non-Harmonic Related Spurious

Typically -60 dBc at >10 kHz

Typically -70 dBc at >10 kHz offset for CW signals

< 85 MHz typically -60 dBc at >10 kHz offset for CW signals

Sub harmonics

-30 dBc, typically -55 dBc

Harmonics

2nd Harmonic: <-28 dBc, (typ -40 dBc)

3rd Harmonic <-30 dBc, (typ -55 dBc)

MODULATION

Modes

Internal analog AM or FM

Internal digital IQ, (AWG)

INTERNAL AMPLITUDE MODULATION

Modulation Generator

Single tone, sinusoid

Modulation Rate

1 kHz to 50 kHz

Resolution

1 Hz

Mod Depth Range

0% to 99%

Resolution

1%

Accuracy

+4% of set depth +1% (1 kHz mod rate, carrier frequency below 3 GHz)

Total Harmonic Distortion

(1 kHz mod rate, carrier frequency below 3 GHz)

<1.5% for depths of <30%

<2% for depths <80%

INTERNAL FM MODULATION

Modulation Generator

Single tone, sinusoid

Modulation Rate

1 kHz to 2 MHz

Resolution

1 Hz

FM Deviation Range

10 Hz to 500 kHz

Resolution

<1 kHz - 1 Hz

>1 kHz - 10 Hz

Accuracy

<±3% of set deviation (1 kHz mod rate)

Total Harmonic Distortion

<1.5% at max deviation (at 1 kHz mod rate and max deviation)

DIGITAL MODULATION

I and Q Bandwidth (+ 3dB) at RF out

Internal digital: Bandwidth versus carrier frequency

Above 500 MHz, ±45 MHz

Above 375 MHz, typically ±45 MHz

Above 200 MHz, typically ±30 MHz

Above 86 MHz, typically ±20 MHz

Below 86 MHz, up to +45 MHz Limited by LF breakpoint at 500 kHz

Residual Carrier Leak

Typically -50 dBc above 85 MHz After warm-up and self calibration valid for temp range 5°C

IQ Image Suppression

Tone frequency	*Typical image suppression level*
10 kHz	*-50 dBc*
10 MHz	*-48 dBc*
30 MHz	*-38 dBc*
45 MHz	*-30 dBc*

Linearity

>55 dB ACPR on WCDMA signals (Downlink test model 1)

Meets IEEE 802.11a/g spectral mask with >10 dB standoff

Third Order Intermodulation Distortion

Carrier Frequency	*Tone Spacing*	*Tone Spacing*
	25 kHz - 50 MHz	*50 MHz - 100 MHz*
<5 GHz	*typ -55 dBc*	*typ -50 dBc*
>5 GHz	*typ -50 dBc*	*typ -46 dBc*

Note For output levels TBD

Error Vector Magnitude

Below 3 GHz: -typically 1.5% EVM on WCDMA signals

typically 0.5% EVM on GSM EDGE signals

Up to 6 GHz: typically 2% EVM on IEEE 802.11a, b, g signals

ARBITRARY WAVEFORM GENERATOR

Memory

*2 GB 500 Msamples I Q * 14 bit + 4 markers*

Internal File Generation

Waveform creation tool provided based on the capabilities of IQCreator®

External file

ASC11, 16/32 bit integer, 32 bit floating point

Sample Rates

10 kHz to 200 MHz

AWG SEQUENCER

Number of Segments

128

Segment type

AWG file, CW (Mod Off)1, RF Off1

(1)When used in conjunction with list mode

Number of Files

Up to 1 million, (limited to 128 when in List mode)

Length of Segment

128 samples up to limit of AWG memory

Number of Segments

1 to 4095

Sequence Trigger Modes

Stepped, Single, Continuous

RF SIGNAL ANALYZER

FREQUENCY

Range

RF IN

1 MHz to 6 GHz

RF IN/OUT

70 MHz to 6 GHz

Resolution

Up to 3 GHz: 1 Hz

Above 3 GHz: 2 Hz

Accuracy

As per frequency reference

Settling Time

F< 3 GHz: 1.1 ms typical settling time to within 0.7 ppm or 1 kHz of final frequency

F> 3 GHz: 1.1 ms typical settling time to within 2 kHz of final frequency.

Option 04 (subject to Export control)

F< 6 GHz 250 µs typical settling time to within 2 kHz of final frequency.

LEVEL

Maximum RF Input

RF IN:

+22 dBm 0 dB attenuation

+32 dBm (with a min. of 10 dB input attenuation)

RF IN/OUT:

+33 dBm

RF Input Attenuator

0 to 31 dB in 1 dB steps

IF attenuator

0 to 35 dB in 1 dB steps

Input VSWR

RF IN

1.5:1, 1 MHz to 5 GHz

1.6:1, 5 GHz to 6 GHz

RF IN/OUT

1.3:1, 70 MHz to 3 GHz

1.5:1, 3 GHz to 6 GHz

1.6:1, 5 GHz to 6 GHz

LEVEL ACCURACY

RF IN and RF IN/OUT:

+1.0 dB, typically ±0.5 dB, for frequencies < 500 MHz

+0.7 dB, typically ±0.3 dB, for frequencies between 500 MHz and 3 GHz

+1.0 dB for frequencies above 3 GHz

Level Temperature Stability

+ 0.02 dB/°C TBD

Level Settling Time

Typically 2 ms us to within ±0.5 dB of final level

SPECTRAL PURITY

SSB Phase Noise

Typical at 2 GHz and at ambient room temperature

Offset 20 kHz -115 dBc/Hz

Offset 100 kHz -132 dBc/Hz

Typical phase noise at 5 GHz: –108 dBc/Hz 20 kHz offset

LINEARITY AND NOISE

Intermodulation

Typically 75 dB intermodulation free dynamic range for the following input powers in each of 2 tones manual mode

At RF IN	*+5 dBm 1 MHz -3.5 GHz*
	+6 dBm 3.5 GHz -5 GHz
	+8 dBm 5 GHz -6 GHz
At RF IN/OUT	*+14 dBm 1 MHz -3.5 GHz*
	+17 dBm 3.5 GHz -5 GHz
	+20 dBm 5 GHz -6 GHz

At RF IN/OUT in Duplex and interferer mode

	+20 dBm 1 MHz -3.5 GHz
	+21 dBm 3.5 GHz -5 GHz
	+23 dBm 5 GHz -6 GHz

Adjacent Channel Leakage Ratio

Better than 60 dB ACLR on 3GPP (downlink test model 1)

Typically 65 dB ACLR on 3GPP uplink

Spurious

Typically -70 dBc

Residual Responses (No Input)

Residual responses (no input)

RF IN	*-90 dBm 1 MHz -3.5 GHz, -88 dBm 3.5 GHz -6 GHz*
RF IN/OUT	*-81 dBm 70 MHz -3.5 GHz, -76 dBm 3.5 GHz -6 GHz*
RF IN/OUT in internal interferer mode	*-75 dBm 70 MHz -3.5 GHz, -73 dBm 3.5 GHz -6 GHz*

with RF input terminated into 50 ohms and minimum RF and IF attenuation

Noise Spectral Density (No Input)

RF IN

	-130 dBm/Hz, 1 MHz to 500 MHz
	-135 dBm/Hz, 500 MHz to 3.5 GHz
	-133 dBm/Hz, 3.5 GHz to 6 GHz

RF IN/OUT

	-121 dBm/Hz, 70 MHz to 500 MHz
	-126 dBm/Hz, 500 MHz to 3.5 GHz
	-121 dBm/Hz, 3.5 GHz to 6 GHz

RF IN/OUT Interferer Mode (No input)

	-115 dBm/Hz, 70 MHz to 500 MHz
	-120 dBm/Hz, 500 MHz to 3.5 GHz
	-118 dBm/Hz, 3.5 GHz to 6 GHz

FREQUENCY REFERENCE

Frequency

10 MHz

Aging Rate

1 in 10^9 per day, 1in 10^7 per year.

Temperature Stability (0 to 50ºC)

Typically better than +1 x 10^{-8}

Warm up Time

<5 minutes

ANALOG MEASUREMENTS (SUPPLIED AS STANDARD)

SPECTRUM ANALYZER

Frequency Span

Variable between 2 kHz to 200 MHz and zero span, Resolution 1 Hz

RBW

Variable between 1 Hz to 10 MHz, Resolution 1 Hz

Window Type

NEBW: Gaussian 3 dB: Gaussian fixed: Blackman Harris 5 term

Sample Time

Up to 333 seconds Resolution 1 ns

MEASUREMENTS

Channel Power and Adjacent Channel Power

Adjacent channels: 2 upper and 2 lower or user defined up to 99

Channel filter alpha: 0.0 to 1.0

Channel spacing: up to 15 MHz

Channel width: up to 25 MHz

Occupied Bandwidth

Percentage range: 1% to 99.99%

N Peaks

Frequency and power output for up to 10 signal peaks sorted in order of descending power

Average Power

The RMS average power for all IQ samples

CCDF

Peak to Average power distribution

Markers

4 markers plus delta marker

Marker Functions

Marker power and frequency with peak search, next peak, peak track

Power and time

Frequency and time

Traces

Live, avg, max. hold

Spectrum trace

Power versus time trace

Phase vs time trace

Frequency versus time trace

Settling time (frequency and level) Zero span

Text results summary

GSM/EDGE MEASUREMENT OPTION 201

CONFIGURATION

System Type

GSM400 GSM700, GSM850, GSM900, DCS1800, PCS1900

Frequency

ARFCN 0 to 1023 (valid range dependent on system type selected) or Hz

Level (DUT Output)

PCL (power control level) 0 to 31 or Manual dBm*

**valid range and corresponding dBm value is system type dependent*

Burst Type

GMSK: Auto or Manual (Normal / Access)

8PSK: Normal

TSC

Uplink: Auto or Manual (0 to 7)

Path Loss Correction

Tx and Rx (dB)

Acquisition Trigger Source

Immediate (free run), Burst (video), Ext (TTL)

Synchronization (Auto Burst Detection)

Burst detection threshold (dB)

Search length (ms)

Burst Timing Latency Compensation

0 to ±78.125 symbols

BER Loopback (requires 302x)

Mode; A/B or C

Number of frames; 1 to 1000

Measurement Display Types

Captured power versus time

Burst power versus time with/without masks

Spectrum (RBW 10 kHz, 30 kHz, 100 kHz)

Phase error versus time (GSM)

EVM versus time (EDGE)

ORFS (Spectrum due to modulation)

ORFS (Spectrum due to switching)

MEASUREMENTS:

GSM / EDGE AVERAGE BURST POWER

The transmitter output power is the average value of the power over the time that the useful information bits of one burst are transmitted.

Fast Burst Power is measured without TSC synchronization.

Indication

GMSK; Average burst power in dBm

EDGE, current avg power, long term average power or estimated long term average power dBm

Detected burst type and TSC

Burst timing error (symbols)

Accuracy

With S/N >40 dB in the temperature range 23°C ±5°C

<±0.7 dB, typically ±0.3 dB

GSM/EDGE POWER PROFILE

Indication

Pass/fail indication with respect to a single burst power template for mobile station (MS)

Values with closest proximity to mask or worst case failure for the complete, rising edge, falling edge and useful parts of the burst

Power versus time traces

Rising/falling edge

Useful part

Complete burst

Dynamic Range

Typically -80 dBc (for input levels > 5 dBm) on RF IN

Accuracy (Rising Falling Edges)

Level: Typically ±0.1 dB/10 dB[1] (relative to peak power)

Time accuracy <0.5 µs

Accuracy (Useful Part)

Level: Typically ±0.02 dB (relative to peak power)

Time accuracy <0.1 symbol

GMSK MODULATION

GMSK phase error measurements performed for a single slot

Phase Error Range

0 to 10 degrees RMS

0 to 40 degrees peak

Indication

Results are expressed as numerical values for RMS + peak phase error

Peak phase error versus time

Accuracy

Typically ±0.5° rms phase error, ±1.0° peak phase error

8PSK MODULATION

The minimum RMS magnitude of the error vector is calculated for a single slot

Burst Type

Normal only

EVM Range

0 to 20% EVM RMS

0 to 40% EVM peak

Indication

rms EVM %, peak EVM %, 95th percentile EVM %, origin offset suppression, and droop

Accuracy

±0.4% RMS, ±1% peak

Offset Origin Suppression Range

>20 dB to 60 dB (floor)

Offset Origin Suppression Accuracy

Typically ±0.5 dB at 33 dB

FREQUENCY ERROR

Measurements are performed for a single slot.

Frequency Error Range

Typically ±300 kHz GMSK (GSM)

Typically ±100 kHz 8PSK (EDGE)

Frequency Error Accuracy

±5 Hz + (Tx freq x freq standard error)

SPECTRUM DUE TO MODULATION & SWITCHING

This measurement determines the peak power and the time gated average power at up to 20 specified frequency offsets.

Burst Type

Normal

Range Offset

Up to ±10 MHz

Measurement Range (typical) Spectrum Due to Modulation

	GMSK		8PSK	
Carrier frequency	1 GHz	2 GHz	1 GHz	2 GHz
Frequency offset	dBc	dBc	dBc	dBc
100 kHz	-76	-70	-73	-67
200 kHz	-81	-75	-78	-72
250 kHz	-82	-76	-79	-73
400 kHz	-83	-77	-80	-74
1.8 MHz	-84	-79	-81	-76
6 MHz	-85	-79	-82	-76

Spectrum Due to Switching

	GMSK		8PSK	
Carrier frequency	1 GHz	2 GHz	1 GHz	2 GHz
Frequency offset	dBc	dBc	dBc	dBc
400 kHz	-73	-67	-70	-64
1.8 MHz	-74	-69	-71	-66

Indication

Table of values;

Reference power (dBm), frequency offset (Hz) and level (dBc) relative to reference power

Accuracy

Typically ±0.05 dB/10 dB[1]

BER, FER

Measurement Results

Mode C burst loopback

Number of bits examined

Number of error bits found

Bit Error Rate (%)

Mode A/B speech loopback

Number of frames examined

Erased Speech Frames

Speech Frame Erasure Rate (%)

Notes

(1) Excluding the effects of noise

UMTS/HSUPA/MEASUREMENT OPTION 202

CONTROL PARAMETERS

Scrambling Code

0 to 16777215 (224 - 1)

Analysis Mode

Random or specific slot

Specific slot number: 0 to 14

DPCCH Slot Format

0 to 3

SLOT POWER

Measurement Range

Up to +30 dBm at digitizer input

Indication

Average power in dBm

Slot power in dBm (random or specific)

Accuracy

<±0.75 dB for S/N >40 dB in the temperature range 23 °C ± 5 °C

OCCUPIED BANDWIDTH

Measurement of the bandwidth containing 99% of the total power of the transmitted spectrum

Indication

Hz

Accuracy

<100 kHz

SPECTRUM EMISSION MASK

The spectral density of the transmitted signal should lie within the relevant spectral mask for each WCDMA 3GPP FDD band or a user defined mask.

Measurement BW

30 kHz and 1 MHz. Depending on frequency offset as defined in the specifications

Measurement Range

±12.5 MHz

Indication

Global Pass/Fail

The worst case dBc level value and its corresponding frequency relative to the mask

Traces

FFT power spectrum and selected mask values

ADJACENT CHANNEL LEAKAGE RATIO

ACLR due to modulation is the ratio of the channel power to the power measured in the upper and lower adjacent and alternate channel.

Number channels

Time domain: 1 to 5

Frequency domain: 1 to 5

Dynamic Range

Residual noise in 3.84 MHz BW: typically better than -68 dB

Indication

Reference channel power dBm

1st upper and lower adjacent channel power dBc

2nd upper and lower adjacent channel power dBc

Accuracy

< ± 0.05 dB/10 dB[1]

FREQUENCY STABILITY

The frequency error measured is the difference between the input signal and the nominal tuned frequency

Frequency Error Range

±7 kHz (±3 kHz for HSUPA)

Frequency Error Accuracy

<±(10 Hz + (freq standard error x transmitter freq))

TRANSMIT MODULATION

Modulation Accuracy

Modulation accuracy results are provided for either composite modulation or for QPSK modulation. Composite EVM results are provided for either a specific or random slot number.

Composite EVM Range

0 to 20% RMS

0 to 40% Peak

Residual Error

<±1%

Composite Modulation Results

Magnitude error peak/rms

in dB

Phase error peak/rms

in degrees

IQ gain imbalance

in dB

IQ skew

in degrees

Carrier leak

in dB

HS-DPCCH Timing Offset

in chips (multiples of n x 256 chips from the start of the slot; where n = 0, 1, ...9)

QPSK EVM range

0 to 10% RMS

0 to 20% Peak

Residual Error

Typically <±1%

QPSK Origin offset (carrier leak)

Range 0 to 20%

Residual Error

Typically <±1%

QPSK Modulation Results

Magnitude and Phase Error

QPSK magnitude and phase component errors are available both with and without origin offset removed.

Range

Magnitude: 0 to 15 %

Phase: 0 to 10 degrees

Residual Error

Magnitude: <1% typically

Phase: <5 °C typically

IQ gain imbalance

in dB

IQ Skew

in degrees

Frequency Error

in Hz

DEMODULATED SYMBOLS

Symbol data is available for each active channel.

Channel Types

DPCCH

DPDCH1 to 6

HS-DPCCH

E-DPCCH

E-DPDCH1 to 4

CHANNEL DETECTION RESULTS

Spreading factor

Code number

Gain factor

Number of bits

TX SLOT TIMING ERROR

Measured relative to an external trigger input with a result expressed in samples

CODE DOMAIN POWER

Code domain power is computed providing dB readings for 256 orthogonal channels.

Indication

Code domain power versus code number

PEAK CODE DOMAIN ERROR

Code domain errors are computed providing dB reading for 4 orthogonal channels. The peak code domain errors are defined as the maximum values for the 4 code domain errors. The measurements interval is 1 slot (2560 chips).

Indication

Peak code domain error for I and Q channels

BER

Measurement Results

Bit error rate (%)

Number of bits examined

Number of bits in error

Number of blocks examined

Number of blocks in error

Block error rate (%)

Setup

Number of DTCH blocks: Up to 100

Number of bits to compare: Up to 24,400

Reference data pattern type: all ones, all zeros, PRBS PN9 or PN15

Notes

(1) Excluding the effects of noise

LTE UE MEASUREMENT OPTION 200

CONFIGURATION

Nominal Bandwidth

1.4, 3, 5, 10, 15, 20 MHz

Subframes (link direction)

Uplink

BURST SET UP

Burst Type

Uplink PUSCH: Normal data

MEASUREMENT SET-UP

Cell ID

0 to 503

Cyclic Prefix Type

Normal or extended

EVM Window Position

Low, middle or high

Analysis Mode

Random slot or specific slot

Number of Slots to Analyze

Dependent on measurement interval

Synchronization Slot (for specific slot analysis only)

0 to 19

PILOT TRACKING

Phase Tracking

On/Off

Amplitude Tracking

On/Off

Symbol Time Tracking

On/Off

PUSCH SETUP

RB Auto Detect

On/Off

DMRS Ass

0 to 29

$n^{(1)}$DMRS

0,2,3,4,6,8,9,10

Slot Configuration

Number of RBs

1 to max number of RBs for selected Bandwidth

RB Offset

0 to max-1

Modulation Type

QPSK, 16QAM, 64QAM

$n^{(2)}$DMRS

0,2,3,4,6,8,9,10

FREQUENCY ERROR

Modulated carrier frequency error over one sub-frame excluding the guard period (Cyclic prefix).

Indication

Hz

Accuracy

As per reference frequency

EVM

The difference between the reference waveform and the measured waveform corrected by the sample timing offset and RF frequency offset with origin offset removed from

Indication

%

Traces

EVM (rms) vs. sub-carrier

EVM (rms) vs. symbol

EVM versus sub-carrier

Constellation

Accuracy

<-40 dB residual EVM

IQ COMPONENT (carrier leak)

Indication

dB

SPECTRUM FLATNESS

Mask Type

Normal conditions

Extreme conditions

User defined

Indication

Mask pass/fail

Mask upper pass/fail

Mask lower pass/fail

Traces

dB values for each sub-carrier

Upper and lower limit traces

SYMBOL/CHIP CLOCK TOLERANCE

Indication

ppm

Accuracy

As per reference frequency

Occupied Bandwidth

Occupied bandwidth is defined as the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on the assigned channel.

Indication

Hz

SPECTRAL EMISSION MASK

The spectral density of the transmitted signal should lie within the spectral mask.

The mask is frequency aligned to the maximum spectrum density.

Mask Type

General, NS_03, NS_04, or NS_06

Measurement BW

As determined by mask type selected

Indication

Global pass/fail

The worst case dBc level value and its corresponding frequency relative to the mask are reported

Traces

FFT power spectrum and mask values

ACLR

Number Channels

1 to 5

Indication

Reference channel power dBm

1st upper and lower adjacent channel power dBc

2nd upper and lower adjacent channel power dBc

Power

Indication

Average power in dBm

Traces

Resource block (RB) power versus slot

Slot power versus resource block

WLAN 802.11A,B,G,N MEASUREMENT OPTION 204

CONFIGURATION

The WLAN measurement suite assumes the measured signal includes a correctly formatted physical layer convergence protocol Service Data Unit PSDU containing valid header information in order to perform demodulation.

Automatic setting of system type (OFDM/DSSS/DSSS-OFDM), data rate, modulation type is decoded from header information. For 802.11n HT signals this also includes the modulation coding scheme (MCS) index.

Analysis Mode

802.11a/b/g, 802.11n HT (high throughput), 802.11n non-HT SISO only

Channel Bandwidth (802.11n only)

20 MHz/40 MHz

Channel Offset (802.11n only)

None, upper, lower

Compensation (OFDM only)

Pilot time tracking, on/off

Pilot amplitude tracking, on/off

Pilot phase tracking, on/off

Burst Profile Type

Average power or peak power

Measurement results

Live, average, min hold, max hold, std dev

BURST POWER MEASUREMENTS

Transmit Power

The Peak and RMS power is measured for a single Physical Protocol Data Unit (PPDU).

Indication

dBm

Burst Length

The burst length is the time between the rising and falling edge of a single PPDU burst.

Indication

µs

Rising/Falling Edge Time

Measures the time taken for the burst power of a single PPDU to change between 10% and 90% of its value (peak or rms)

Indication

Global pass/fail (DSSS - 802.11b and g)

Ramp up pass/fail (DSSS - 802.11b and g)

Ramp up time in µs (10% to 90% points)

Ramp down pass/fail (DSSS - 802.11b and g)

Ramp down time in µs (90% to 10% points)

Burst position µs relative to trigger point

Power versus time trace

OCCUPIED BANDWIDTH

Bandwidth containing 99% of total of the transmitted PPDU spectrum in 34 MHz (20 MHz legacy signals) or 54 MHz (HT 40 MHz signals)

Indication

Hz

Accuracy

Typically <100 kHz

SPECTRAL MASK

The spectral density of the transmitted PPDU signal should lie within the spectral mask

The mask is frequency aligned to the maximum spectrum density.

Mask types *802.11a*

802.11b/g

802.11n

User defined

Measurement BW

100 kHz

Measurement Range

80 MHz

Indication

Global Pass/Fail

The worst case dBc level value and its corresponding frequency relative to the mask

Spectral trace display with mask

Accuracy

Typically ±0.05 dB/10 dB

Assumes common 3030 Series attenuator settings for reference and offset measurements

ADJACENT CHANNEL POWER

The power measured in the upper and lower adjacent and alternate channels relative to the power in the reference channel

Reference Channel Bandwidth

22 MHz

Adjacent and Alternate Channel Bandwidth

±11 MHz, ±22 MHz

Indication

1st lower dBc

2nd lower dBc

1st upper dBc

2nd upper dBc

Measurement Range

Typically 62 dB for IEEE802.11a/g 54 Mbps QAM

Typically 65 dB for IEEE802.11b 11 Mbps CCK

Accuracy

Typically ±0.05 dB/10 dB

Assumes common 3030 Series attenuator settings for reference and offset measurements

MODULATION ACCURACY

The error vector magnitude (EVM) is the magnitude of the IQ vector at the decision point measured relative to the ideal constellation point.

EVM

Composite EVM (% rms) and RCE (rms dB)

EVM (% rms) and RCE (rms dB) all data carriers

EVM (% rms) and RCE (rms dB) all pilot carriers

EVM (Peak) - 802.11b/g only

Indication

Constellation display

Trace of EVM values versus sub carrier or symbol number

System type, modulation type, data rate, number of PSDU bits/symbols HT format (Greenfield or Mixed), 802.11N –HT mode only

Accuracy

Typically <40 dB residual EVM

IQ gain imbalance

in dB

IQ skew

in degrees

FREQUENCY TOLERANCE

Lock Range

±50 ppm

Indication

Hz

Accuracy

As per reference frequency

TX CENTRE FREQUENCY LEAKAGE/RF CARRIER SUPPRESSION (Carrier Leak)

Indication

dB

SYMBOL/CHIP CLOCK TOLERANCE

Range

±50 ppm

Indication

ppm

Accuracy

As per reference frequency

SPECTRAL FLATNESS

Indication

Pass/fail

Upper pass/fail

Lower pass/fail

Trace display of dBr versus sub carrier and mask

INTERFACES

RF

Front Panel

RF OUT 1,2:	*N type*
RF IN/OUT :	*N type*
RF IN:	*N type*

Rear Panel

Freq standard:	*10 MHz I/O BNC Rear Panel*
Trigger input	*TTL BNC*
Trigger out	*TTL BNC*

Ethernet

Connectivity

Front panel

3x USB 2

Rear panel

VGA

GPIB

2x USB 2 (keyboard and mouse)

Ethernet

Remote Control Interfaces

Ethernet

GPIB

GENERAL

Standard Warranty

24 months

Calibration Interval

Recommended 24 months

Electromagnetic Compatibility

EN 61326-1:2006, Emissions Class A, Immunity Table 1

Safety

EN 61010-1:2001 Safety requirements for electrical equipment for measurement, control and laboratory use-Part 1, General requirements

Certification

CE Compliant,

RATED RANGE OF USE

In accordance with MIL-PRF28800 Class 3

WEIGHT AND DIMENSIONS

Dimensions WxDxH

Without Handles:	*443 mm x 580 mm x 237 mm (17.4" x 22.8" x 9.3")*
With Handles:	*480 mm x 632 mm x 237 mm (18.9" x 24.9" x 9.3")*

Mass

21 Kg (46.3 lbs.)

CONDITIONS OF STORAGE AND TRANSPORT

Storage Temperature

-20 to +70°C, meets IEC-60068-2-1 and 60068-2-2

Storage Humidity

5 to 93% non-condensing, tested to IEC-60068-2-56

Shock

30 g peak, half sine, 9 ms pulse. Tested in accordance with IEC-60068-2-27

Random vibration 5 Hz to 500 Hz, 2.46 g rms non-operating. Tested in accordance with IEC-60068-2-64

VERSIONS, OPTIONS AND ACCESSORIES

Standard configuration

6 GHz Vector Analyzer Generator and Analog measurements, GPIB and Ethernet

Hardware Options

Option 01	Second 6 GHz RF Signal Generator
Option 04	High Speed Frequency Switching (250 μs)

Software Options

Option 200	LTE UE Measurements
Option 201	GSM/EDGE Measurements
Option 203	UMTS/ HSUPA Measurements
Option 204	WLAN 802.11a,b,g,n Measurements

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AEROFLEX
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Our passion for performance is defined by three attributes represented by these three icons: solution-minded, performance-driven and customer-focused.

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