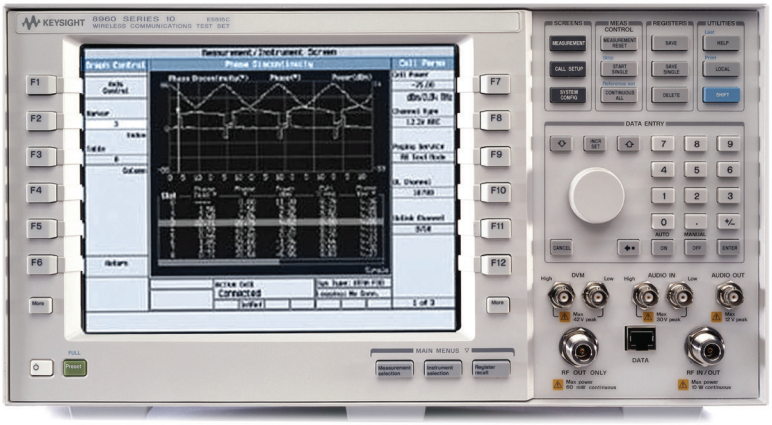
Keysight Technologies
E1963A W-CDMA Mobile Test Application
For the E5515C/E (8960) Wireless Communications Test Set

Technical Overview



KEYSIGHT TECHNOLOGIES
Unlocking Measurement Insights

Introduction

Accelerate UMTS test plan development and get your devices to market sooner, while ensuring compliance with TS 34.121-1 test standards.

The Keysight Technologies, Inc. E1963A W-CDMA mobile test application, when used with the Keysight GSM, GPRS, and EGPRS applications, is the industry standard for universal mobile telecommunications (UMTS) mobile test. Keysight's 8960 (E5515C/E) test set provides you with a single hardware platform that covers all the UMTS/3GPP (Third Generation Partnership Project) radio formats: W-CDMA, HSPA, GSM, GPRS, EGPRS, and TD-SCDMA.

Exceed your calibration test time goals with the E1999A-202 fast device tune measurement. Simultaneously calibrate your device's transmitter (Tx) output power and receiver (Rx) input level across level and frequency. E1999A-202 is a superset of the discontinued E1999A-201. It not only offers the equivalent capabilities of the E1999A-201, it is enhanced to reduce the calibration test times for W-CDMA, cdma2000®, and 1xEV-DO wireless devices with smaller step size support (10 ms step size versus 20 ms step size).

Reach your high-volume production goals by moving prototypes quickly into production with this test solution's fast and repeatable measurements, accurate characterization, and ease of programming.

The HSPA, W-CDMA, GSM, GPRS, and EGPRS product combination delivers a complete and integrated UMTS test solution in a single box. FM radio source, a single channel GPS source (E1999A-206), and PESQ measurement (E1999A-301) are also added into the test box for FM radio receiver calibration, GPS receiver calibration, and audio quality test without the need for an external audio analyzer. This fast, one-box approach simplifies your production process and increases your production line effectiveness.

With the most complete test functionality for 3GPP TS 34.121-1 Section 5 and 6 tests, E1963A HSPA Options 403, 405, 413, 423, 433, and 435 provide fast, flexible measurements and options in user equipment (UE) connectivity, giving design and manufacturing test engineers more flexibility in creating test plans and the assurance that designs meet technology standards. Option 433 provides you with the functionality to test 42 Mbps downlink dual carrier (DC-HSDPA) and dual band dual carrier HSDPA (DB-DC-HSDPA) throughput in RB test mode and FDD test mode connection, and Option 435 allows validation of single and dual stream MIMO using 16QAM for a maximum data rate of 28 Mbps or 64QAM for 42 Mbps in RB test mode and FDD test mode connection.

Key Capabilities

- CS voice handovers between GSM and W-CDMA on two test sets
- Fast device calibration across level and frequency simultaneously
- Test HSDPA MIMO devices (HS-DSCH categories 15-20) as defined in 3GPP TS 34.121-1
- Test devices that support downlink dual carrier and dual band dual carrier (HS-DSCH categories 20-24)
- Test HSPA devices (HS-DSCH categories 1-14, 17-18 and E-DCH categories 1-7) as defined in 3GPP TS 34.121-1
- Switch between HSPA sub-test conditions while on an active connection
- Test all UMTS technologies with one connection maintained throughout
- Test all frequency bands I through XIV, XIX, XX, and XXI
- FM and GPS receiver calibration in one box
- Test vocoder speech quality using the industry standard PESQ algorithm

Tx measurements	**W-CDMA**	**HSDPA**	**HSUPA**
Thermal power	Yes	Yes	Yes
Channel power	Yes	Yes	Yes
Adjacent channel leakage ratio	Yes	Yes	Yes
Waveform quality	Yes	Yes	Yes
Spectrum emission mask	Yes	Yes	Yes
Phase discontinuity	Yes	Yes	Yes
Inner loop power	Yes		
Occupied bandwidth	Yes	Yes	Yes
Code domain power	Yes	Yes	Yes
IQ constellation	Yes	Yes	Yes
Tx on/off power	Yes	Yes	Yes
Frequency stability	Yes	Yes	Yes
Dynamic power analysis	Yes	Yes	Yes
Tx dynamic power	Yes		
Spectrum monitor	Yes	Yes	Yes

Rx measurements	**W-CDMA**	**HSDPA**	**HSUPA**
Loopback BER	Yes	N/A	N/A
BLER on DPCH (W-CDMA)	Yes	N/A	N/A
HBLER on HS-DPCCH (HSDPA)	N/A	Yes	N/A

3GPP TS 34.121 Adherence

3GPP TS 34.121-1

	Test description	E1963A
5.2	Maximum output power	Yes
5.2A	Maximum output power with HS-DPCCH (Release 5 only)	Yes[5]
5.2AA	Maximum output power with HS-DPCCH (Release 6 and later)	Yes[5]
5.2B	Maximum output power with HS-DPCCH and E-DCH	Yes[5]
5.2C	UE relative code domain power accuracy	Yes[5]
5.2D	UE relative code domain power accuracy for HS-DPCCH and E-DCH	Yes[5]
5.2E	UE relative code domain power accuracy for HS-DPCCH and E-DCH with 16QAM	Yes[5]
5.3	Frequency error	Yes
5.4.1	Open-loop power control	Yes
5.4.2	Inner-loop power control	Yes
5.4.3	Minimum output power	Yes
5.4.4	Out-of-sync handling of output power	E6703X[2]
5.5.1	Transmit off power	Yes
5.5.2	Transmit on/off time mask	Yes
5.6	Change of TFC	E6703X
5.7	Power setting in UL compressed mode	
5.7A	HS-DPCCH	Yes[5]
5.8	Occupied bandwidth (OBW)	Yes
5.9	Spectrum emission mask (SEM)	Yes
5.9A	Spectrum emission mask with HS-DPCCH	Yes[5]
5.9B	Spectrum emission mask with E-DCH	Yes[5]
5.10	Adjacent channel leakage power ratio (ACLR)	Yes
5.10A	ACLR with HS-DPCCH	Yes[5]
5.10B	ACLR with E-DCH	Yes[5]
5.11	Spurious emissions	Yes[2]
5.12	Transmit intermodulation	Yes[3]
5.13.1	Error vector magnitude (EVM)	Yes
5.13.1A	Error vector magnitude (EVM) with HS-DPCCH	Yes[5]
5.13.1AA	EVM and phase discontinuity with HS-DPCCH	Yes[5]
5.13.1AAA	EVM and IQ origin offset for HS-DPCCH and E-DCH with 16QAM	Yes[5]
5.13.2	Peak code domain error	Yes
5.13.2A	Relative code domain error with HS-DPCCH	Yes[5]
5.13.2B	Relative code domain error with HS-DPCCH and E-DCH	Yes[5]
5.13.2C	Relative code domain error for HS-DPCCH and E-DCH with 16QAM	Yes[5]
5.13.3	Phase discontinuity measurement	Yes
5.13.4	PRACH preamble quality	E6703X

1. Requires use of external source.
2. Requires use of external spectrum analyzer.
3. Requires use of external spectrum analyzer and source.
4. Internal fading is possible using the N5106A PXB baseband generator and channel emulator. Most of these tests require external instrumentation such as faders. Consult TS 34.121-1 for details.
5. Requires feature option license.

3GPP TS 34.121-1 (continued)

	Test description	E1963A/E6703X
6.2	Reference sensitivity	Yes
6.2A	Reference sensitivity level for DC-HSDPA	Yes[5]
6.2B	Reference sensitivity level for DB-DCHSDPA	Yes[5]
6.3	Maximum input level	Yes[5]
6.3A	Maximum input level for HS+DPCCH reception (16QAM)	Yes[5]
6.3B	Maximum input level for HS+PDSCH reception (64QAM)	Yes[5]
6.3C	Maximum input level for DC-HSDPA reception (16QAM)	Yes[5]
6.3D	Maximum input level for DC-HSDPA reception (64QAM)	Yes[5]
6.3E	Maximum input level for DB-DC-HSDPA reception (16QAM)	Yes[5]
6.3F	Maximum input level for DB-DC-HSDPA reception (64QAM)	Yes[5]
6.4	Adjacent channel selectivity (ACS) (Release 99 and Release 4)	Yes[1]
6.4A	ACS (Release 5 and later releases)	Yes[1]
6.4B	Adjacent channel selectivity (ACS) for DC-HSDPA	Yes[1]
6.4C	Adjacent channel selectivity (ACS) for DB-DC-HSDPA	Yes[1]
6.5	Blocking characteristics	Yes[1]
6.5A	Blocking characteristics for DC-HSDPA	Yes[1]
6.5B	Blocking characteristics for DB-DC-HSDPA	Yes[1]
6.6	Spurious response	Yes[1]
6.6A	Spurious response for DC-HSDPA	Yes[1]
6.6B	Spurious response for DB-DC-HSDPA	Yes[1]
6.7	Intermodulation characteristics	Yes[1]
6.7A	Intermodulation characteristics for DC-HSDPA	Yes[1]
6.7B	Intermodulation characteristics for DB-DC-HSDPA	Yes[1]
6.8	Spurious emissions	Yes[1]
7.2	Demod in static propagation	Yes
7.3	Demod in multi-path	E6703X[4]
7.4	Demod in moving channel	E6703X[4]
7.5	Demod in birth-death	E6703X[4]

1. Requires use of external source.
2. Requires use of external spectrum analyzer.
3. Requires use of external spectrum analyzer and source.
4. Internal fading is possible using the N5106A PXB baseband generator and channel emulator. Most of these tests require external instrumentation such as faders. Consult TS 34.121-1 for details.
5. Requires feature option license.

Related Literature Technical Specifications

The Most Complete Test Functionality for HSPA/W-CDMA Wireless Devices, photocard, (5989-3414EN)
Keysight 8960 Wireless Communications Test Set HSPA Applications, photocard, 5989-7515EN
8960 Series 10 Wireless Communications Test Set, configuration guide, 5968-7873E

For More Information

Learn more about the E1963A test application and HSPA options at: **www.keysight.com/find/E1963A**

Technical Specifications

These specifications apply to an E5515C/E mainframe with Option 003 when used with the latest E1963A test application or the E1987A test application.

Specifications describe the test set's warranted performance and are valid for the unit's operation within the stated environmental ranges unless otherwise noted. All specifications are valid after a 30-minute warm-up period of continuous operation.

Supplemental characteristics are intended to provide typical, but non-warranted, performance parameters that may be useful in applying the instrument. These characteristics are shown in italics and labeled as "typical". All units shipped from the factory meet these typical numbers at +25 °C ambient temperature without including measurement uncertainty.

What is Included in This Technical Overview

This data sheet is organized in four sections:

- HSPA specifications
- W-CDMA specifications
- HSPA and W-CDMA common technical specifications
- General specifications

HSPA/HSPA+ Specifications (E1963A Option 403, 405, 413, 423, 433, and 435)

Call connection types

HSPA FDD test mode

HSPA FDD test modes are supported by the E1963A. FDD test mode provides Layer 1 functionality only. No higher-level signaling is provided or accepted. No higher-level call processing operations are performed. The test set assumes that you have appropriately configured the UE.

FDD test mode allows you to test the parametric performance of your UE's transmitter and receiver without call processing. In FDD test mode, the test set does not send any signaling information on the downlink. Rather, it continuously generates a downlink signal and searches for a corresponding uplink signal. The UE must synchronize to the downlink signal and send an appropriate uplink signal, which the test set uses to measure the UE's transmitter and receiver performance. Any changes to the UE configuration must be accomplished by directly sending commands to the UE from a system controller through a proprietary digital interface.

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_gen_bse_fddtest.html

FRC H-set support

H-Set	Modulation	Nominal avg. inf. bit rate (Mbps)
1	QPSK, 16QAM	0.534, 0.777
2	QPSK, 16QAM	0.801, 1.166
3/3A	QPSK, 16QAM	1.601, 2.332
4	QPSK	0.534
5	QPSK	0.801
6/6A	QPSK, 16QAM	3.219, 4.689
8/8A	64QAM	13.252
9	16QAM, QPSK	8.784, 4.868
10/10A	QPSK, 16QAM	4.86, 8.774
11	64QAM, 16QAM	13.300, 8.774
12	QPSK	0.06

Note: For DC-HSDPA H-Sets 3A, 6A, 8A, 10A and 12, the nominal avg. inf. bit rate is for each of the serving cells. For HSDPA MIMO H-Sets 9 and 11, the nominal avg.inf. bit rate is for each of the transport blocks.

HSPA RB test mode

RB test mode uses signaling to establish a test control connection between the test set and UE, allowing you to test the parametric performance of your UE's transmitter and receiver. In RB test mode, the test set provides signaling to establish a connection between the UE and the test set. The test set can also signal the UE to change its configuration and alter the uplink signal. The test set measures the uplink signal to determine the UE's transmitter and receiver performance. RB test mode is operated on the downlink, simultaneously supporting a symmetrical RMC (reference measurement channel) of 12.2 kbps. This symmetrical RMC is typically used for transmitter testing and receiver testing using BER.

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_gen_bse_rbtest_setup.html

HSPA handovers

To support the HSPA tests and sub-test conditions specified in the 3GPP standards, the transport channel reconfiguration procedure allows you to change HSPA parameters while on a live connection. ßc, ßd, ΔACK, ΔNACK, ΔCQI, CQI feedback cycle (k), CQI repetition factor, Ack-Nack repetition factor, and default DPCH offset (DOFF) parameters can all be modified without dropping the HSPA connection. In addition, when using the user-defined DL configuration for HSDPA in RB test mode, the number of HARQ processes and UE IR buffer size can be changed on a live HSDPA connection to provide flexibility in testing multiple configurations.

The radio bearer reconfiguration allows handover from a CS domain or CS/PS domain HSDPA RB test mode connection or HSPA RB test mode connection to a (non-HSDPA/non-HSPA) symmetrical RMC. The radio bearer reconfiguration also allows you to change many other network parameters as part of the reconfiguration.

You can also handover between channels within a band and between bands using the physical channel reconfiguration procedure. This allows you to test channels in the low, middle, and high frequency portions of each UE-supported band without dropping the HSPA connection.

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_gen_call_handoffs.html

Inter-system handovers

Almost all UE supports multiple formats today. To speed the process of testing multiple formats with call processing, you can perform handovers from HSPA to GSM, and from HSPA to W-CDMA. If your test plan requires testing HSPA followed by GSM, GPRS, and/or EGPRS, you can hand over from an HSPA FRC to GSM test mode using the system handover. If your test plan requires testing W-CDMA as well, you can hand over from an HSPA FRC to a W-CDMA RMC, then use the existing W-CDMA RMC to GSM test mode system handover to test GSM, GPRS, and/or EGPRS.

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_gen_call_handoffs.html

HSDPA user-defined downlink

Verify your device's HSDPA throughput at the MAC-hs or MAC-ehs level with the user-defined downlink (DL) in E1963A Option 403, 405, 423, 433, and 435. Verify HS-DSCH category 15-20 HSDPA MIMO devices through to providing up to a 28 Mbps or 42 Mbps radio bearer (RB) test mode signal. Set the configuration's flexibly of HSDPA MIMO state, each antenna channel configuration, the number of transport blocks and active HS-PDSCHs, each transport block size index, modulation type of each transport block, inter-TTI, number of HARQ processes, and UE incremental redundancy (IR) buffer size. Configure the E5515C/E to provide up to a 42 Mbps RB test mode signal for testing HS-DSCH category 24 dual carrier or dual band dual carrier devices.

http://wireless.keysight.com/rfcomms/refdocs/wcdma/default.htm#wcdma_gen_bse_hsdpa_rbtest_setup.html

HSPA RF generator

W-CDMA channels active in HSPA mode

W-CDMA		
Channel (spread factor)	**Default assignment**	**Alternate choices**
CPICH (256)	0	–
P-CCPCH (256)	1	–
PICH (256)	16	channel code settable
DPCH, 12.2 kpbs RMC (128)	20	within available code range
HSDPA/DC-HSDPA /HSDPA MIMO		
HS-SCCH-1 (128)	2	channel code settable
HS-SCCH-2 (128)	6	within available code range
HS-SCCH-3 (128)	9	
HS-SCCH-4 (128)	10	
HS-PDSCH (16)	7	
OCNS HSDPA (128)	122, 123, 124, 125, 126, 127	
Antenna 2 S-CPICH (256)	2	
HSUPA		
E-AGCH (256)	42	channel code settable
E-HICH (128)	22	within available code range
E-RGCH (128)	22	

Common pilot channel relative level: –20 to 0 dB

Primary CCPCH relative level: –20 to 0 dB

PICH relative level: –20 to 0 dB

DPCH relative level: Settable from –30 to 0 dB with 0.01 dB resolution

HS-SCCH relative level of individual code channels:
HS-SCCH channel can be off but at least one channel is in presence. For 64QAM downlink, at least two channels are in presence. The channel level is settable from –20 to 0 dB

HS-PDSCH relative level of all active code channels: Settable from –20 to 0 dB

Primary sync channel relative level: Always the same as P-CCPCH

For DC-HSDPA the channel default assignment, code choices, and relative levels are the same for each of the serving cells, except that DPCH is only for the primary serving cell, and the maximum number of HS-SCCHs across both serving cells is 6.

For HSDPA MIMO, the pilot channel for each antenna can be configured. P-CPICH is configured on antenna 1 and P-CPICH or S-CPICH can be configured on antenna 2, and the relative level (power offsets from the cell power of the channels transmitted on antenna 1 or 2) is –20 to 0 dB.

When HSDPA MIMO is active, the same number of HS-PDSCHs is transmitted on both antennas with the same channelization codes. The existing power levels of HS-PDSCHs specified in the power offset parameters are the power offsets of all HS-PDSCHs transmitted on both antennas relative to the cell power. The power of each HS-PDSCH is split equally on both antennas.

RF IN/OUT composite signal absolute output level accuracy (DC-HSDPA)

AWGN off:
- < ±1.2 dB (typically < ±0.75 dB), at –109 to –15 dBm/3.84 MHz and < 2300 MHz
- < ±1.6 dB (typically < ±1.1 dB), at –109 to –15 dBm/3.84 MHz and ≥ 2300 MHz

Downlink CDMA modulation

Modulation type: QPSK, 16QAM, and 64QAM per 3GPP standard
- QPSK residual EVM: 10%, typically < 3%
- QPSK carrier feed through: < –25 dBc, typically < –35 dBc nominal ambient performance: < –45 dBc
- 16QAM residual EVM: Typically < 3%
- 16QAM carrier feed through: Typically < –35 dBc nominal ambient performance: < –45 dBc
- 64QAM residual EVM: Typically < 6%
- 64QAM carrier feedthrough: Typically < –35 dBc, nominal ambient performance: < –45 dBc

RF OUT ONLY composite signal absolute output level accuracy (DC-HSDPA)

AWGN off:
- < ±1.2 dB (typically < ±0.75 dB), at –109 to –15 dBm/3.84 MHz and < 2300 MHz
- < ±1.6 dB (typically < ±1.1 dB), at –109 to –15 dBm/3.84 MHz and ≥ 2300 MHz

OCNS – orthogonal channel noise source

Composed of 6 channels per Table E.5.5 in Annex E of 3GPP 34.121. OCNS channel can be off but at least 1 OCNS channel is in presence.

OCNS channel relative level range: Automatically calculated from other code channel relative levels to provide the composite W-CDMA cell power, but user-allocated channel level available

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_gen_bse_gen_info.html_BCGCBAHE

HSPA RF analyzer (measurements only)

Real-time demodulation of: Uplink – DPCH, HS-DPCCH, E-DCH

Tx measurements

Channel power measurement

Input signal modulation: QPSK and 16QAM

Measurement bandwidth
- RRC filter off: Measured with a bandwidth greater than (1 + a) x chip rate, where a = 0.22 and chip rate = 3.84 Mcps
- RRC filter on: Measured with a filter that has a root-raised cosine (RRC) filter response with roll-off a = 0.22 and a bandwidth equal to the chip rate 3.84 MHz centered on the active uplink channel)

Measurement range: –61 to +28 dBm/3.84 MHz

Measurement interval: Settable from 0.01 to 12 ms

Measurement accuracy (at ±10 °C from the calibration temperature):
- < ±1.0 dB (typically < ±0.5 dB) for measurement intervals of 333 µs to 12 ms over 698 to 1024 MHz, 1400 to 1500 MHz, and 1700 to 2000 MHz,
- < ±1.0 dB (typically < ±0.55 dB) for measurement intervals of 333 µs to 12 ms over 2480 to 2580 MHz,
- < ±1.0 dB (typically < ±0.6 dB) for measurement intervals of 67 to < 333 µs over 698 to 1024 MHz, 1400 to 1500 MHz, and 1700 to 2000 MHz

Measurement triggers: Auto, immediate, protocol, RF rise, external, and HS-DPCCH
http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_chanpow_desc.html

Phase discontinuity

Measurement method: The measured results include the phase discontinuity (defined as the phase difference of adjacent timeslots) as well as all waveform quality results for each timeslot

Input power level range:
- Phase discontinuity: –61 to +28 dBm/3.84 MHz
- Other measurements: –25 to +28 dBm/3.84 MHz

Input frequency ranges: 800 to 1000 MHz, 1700 to 1990 MHz

Phase discontinuity range: ±180°

EVM range: 0 to 35% rms

Phase discontinuity measurement accuracy:
- < ±2.4° (typically < ±1.7°) for input levels of –25 to +28 dBm/3.84 MHz
- < ±2.6° (typically < ±1.9°) for input levels of –51 to < –25 dBm/3.84 MHz

Phase discontinuity (continued)

Other reported parameters with phase discontinuity:
All measurements found in the waveform quality measurement are also available; the specifications are the same in both measurements, including the input power range of the waveform quality measurement

Measurement interval: 617 µs (= 1 timeslot (667 µs) – 25 µs
transient periods at either side of the nominal timeslot boundaries) or 283 µs (0.5 timeslot (333 µs) – 25 µs transient periods at either side of the nominal timeslot boundaries)

Measurement triggers: Protocol, external, and HS-DPCCH

Temperature range: +20 to +55 °C

Concurrency capabilities: Phase discontinuity measurements cannot be made concurrently with other measurements

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_wpdiscon_desc.html

Waveform quality measurement (HSDPA)

Waveform quality measurement: Composite EVM

Measurement format: HPSK

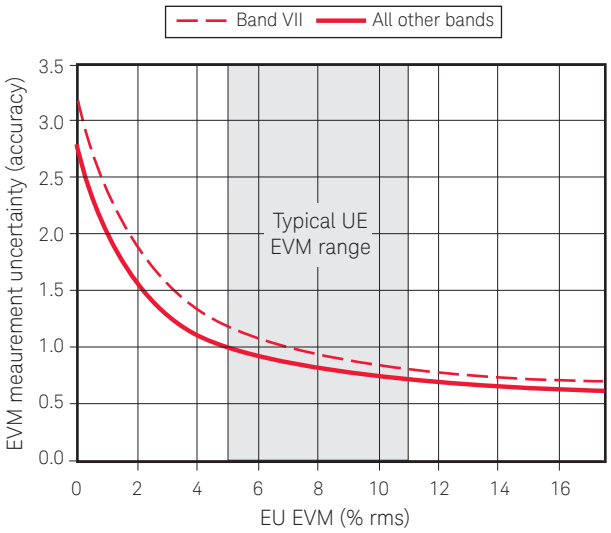
Measurement chip rate: 3.84 Mcps

Input level range: –25 to +28 dBm/3.84 MHz

Measurement range: ≤ 35% EVM

Measurement interval: 0.5 to 1.0 timeslot with choice to include or exclude 25 µs transient periods

EVM measurement accuracy (including the effects of residual EVM):



EVM measurement accuracy:
- < 2.8% rms (typically < 2.4% rms) for UE EVM ≥ 1% rms, ≤ 2200 MHz
- < 3.2% rms (typically < 2.8% rms) for UE EVM ≥ 1% rms, 2300 to 2580 MHz

Measurement triggers: Auto, protocol, immediate, external, and HS-DPCCH

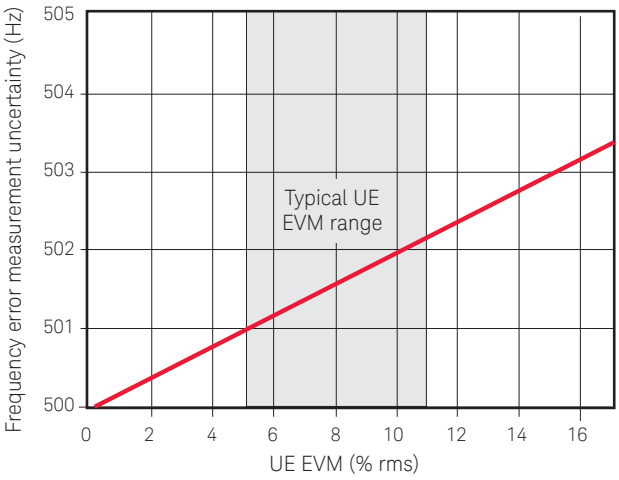
HS-DPCCH trigger alignment: Adjustable over
- Subframes: 0 to 5
- Timeslots: Ack, Nack or CQI
- Subslots: 0 to 0.5 timeslots

Other reported parameters with EVM:
- Frequency error
- Magnitude error
- Phase error
- Origin offset
- Timing error
- Peak code domain error

Frequency error measurement range: ±1 kHz

Residual frequency error:
< ±(5 Hz + timebase accuracy) for a measurement interval of 1 timeslot
< ±(7 Hz + timebase accuracy) for a measurement interval of 0.5 timeslot

Frequency error measurement accuracy:



Peak code domain error accuracy: < ±0.4 dB for code power levels > –25 dB

Timing error measurement range: ±10 µs

Timing error measurement accuracy: < ±0.5 chips (±130 ns)

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_wfrmqual_desc.html_CIHBBHDJ

IQ tuning

All measurements found in the waveform quality measurement are also available in the IQ tuning measurement; the specifications are the same in both measurements.

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_iqtuning_desc.html

HSPA code domain power

Code domain power accuracy: < ±0.4 dB for code power level > –25 dB

Relative code domain error (RCDE) accuracy: ≤ ±0.5 dB for RCDE level > –20 dB

Relative code domain power accuracy (RCDPA):
- ≤ ±0.2 dB for code power level from ≥ –10 to 0 dB
- ≤ ±0.3 dB for code power level from ≥ –15, –10 dB
- ≤ ±0.4 dB for code power level from ≥ –20, –15 dB

All measurements found in the waveform quality measurement are also available in the code domain measurement; the specifications are the same in both measurements.

Measurement triggers: Immediate, protocol, external, auto, HS-DPCCH, and even frame

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_cod_dom_desc.html

Adjacent channel leakage ratio (ACLR)

Measurement method: Ratio of the filtered mean transmitted power to the filtered mean power in an adjacent channel; both the transmitted and the adjacent channel powers are measured with a filter that has a RRC response with roll-off a = 0.22 and a band width equal to the chip rate

Input power level range: +5 to +28 dBm/3.84 MHz

Input frequency ranges: 698 to 1000 MHz, 1400 to 1500 MHz, 1700 to 2000 MHz, and 2480 to 2580 MHz

Measurement level ranging: Auto

Measurement accuracy: < ±0.8 dB (typically < ±0.5 dB), including the effects of the residual floor, for measurements at –33 dBc at ±5 MHz offsets and –43 dBc at ±10 MHz offsets, and ±10 °C from the calibration temperature

Residual ACLR floor: < –48 dBc for ±5 MHz offsets, < –58 dBc for ±10 MHz offsets

Measurement triggers: Auto, protocol, immediate, external, HS-DPCCH

Trigger alignment: Adjustable over subframes 0 to 5

Measurement interval: 1 timeslot

Measurement result: dBc relative to in-channel transmitted power

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_aclr_desc.html

Dynamic power analysis

Measurement method: Graphical display of the uplink power waveform including HS-DPCCH, DPCH versus time; by using the HS-DPCCH trigger source, results will be aligned to the HS-DPCCH

Input power level range: –61 to +28 dBm/3.84 MHz

Measurement level ranging: Auto

Data capture range: Combination of number of steps and step length cannot exceed 58.26 ms

Measurement bandwidth: Selectable RRC filter on or off

Measurement interval: Settable from 0.01 to 12 ms (must be less than or equal to the step length)

Measurement accuracy: (At ±10 °C from calibration temperature with measurement interval 333 µs to 12 ms):

Input level range	Measurement accuracy	Frequency range
≤ 25 dB	< ±1.0 dB, *typically* < *±0.5 dB* < ±1.0 dB, *typically* < *±0.55 dB*	800 to 1000 MHz 1700 to 2000 MHz 2480 to 2580 MHz
≤ 35 dB	< ±1.0 dB, *typically* < *±0.55 dB* < ±1.0 dB, *typically* < *±0.6 dB*	800 to 1000 MHz 1700 to 2000 MHz 2480 to 2580 MHz
≤ 40 dB with RRC filter on	< ±1.0 dB, *typically* < *±0.55 dB* < ±1.0 dB, *typically* < *±0.7 dB*	800 to 1000 MHz 1700 to 2000 MHz 2480 to 2580 MHz

Measurement triggers: RF rise, external, and HS-DPCCH

HS-DPCCH trigger alignment: Adjustable over subframes 0 to 5

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_wdpanalysis_desc.html

Spectrum emission mask (SEM)

Measurement method: Ratio of the transmitted power (3.84 MHz bandwidth RRC) to offset frequencies, which are between 2.5 and 12.5 MHz away from the UE center carrier frequency; the offset frequencies are measured in 30 kHz or 1 MHz bandwidths, depending on the offset

Input power level range: +5 to +28 dBm/3.84 MHz

Input frequency ranges: 698 to 1000 MHz, 1400 to 1500 MHz, 1700 to 2000 MHz, and 2480 to 2580 MHz

Measurement accuracy:
≤ ±1.5 dB (typically < ±0.8 dB) for the following offsets
(±10 °C from the calibration temperature)

Frequency offset	Levels (dBm)	Meas BW
2.5 to 3.5 MHz	$\left\{-35 - 15^{*}\left[\frac{\Delta f}{\text{MHz}} - 2.5\right]\right\}$	30 kHz
3.5 to 7.5 MHz	$\left\{-35 - 1^{*}\left[\frac{\Delta f}{\text{MHz}} - 3.5\right]\right\}$	1 MHz
7.5 to 8.5 MHz	$\left\{-39 - 10^{*}\left[\frac{\Delta f}{\text{MHz}} - 7.5\right]\right\}$	1 MHz
8.5 to 12.5 MHz	–49	1 MHz

Measurement accuracy for additional spectrum emission limits for bands II, IV, V, X, XII, XIII, and XIV: Typically < ±1.1 dB for the following offsets (±10 °C from the calibration temperature)

Frequency offset	Levels (dBm)	Meas BW
2.5 to 3.5 MHz	–15 dBm	30 kHz
3.5 to 12.5 MHz	–13 or –15 dBm	1 MHz or 100 kHz

Measurement triggers: Auto, protocol, immediate, external, and HS-DPCCH
HS-DPCCH trigger alignment: Adjustable over subframes 0 to 5

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_spec_em_mask_desc.html

Rx measurements

HSDPA/HSPA+ block error ratio

Measurement method: Test set counts the ACK/NACK/statDTX on UE HS-DPCCH and uses the results to calculate BLER

BLER measurement input level range: –50 to +28 dBm/3.84 MHz

Reported parameters: Measured BLER, number of blocks tested, throughput, number of ACKs, number of NACKs, number of stat DTXs, and median CQI. When DC-HSDPA is configured, three sets of these results are available: serving cell, secondary serving cell, and the combined cells

Concurrency capability: HSDPA BLER measurements cannot be made concurrently with phase discontinuity, PRACH Tx on/off, or inner loop power measurements, or while speech is provided on the downlink; HSDPA BLER measurements can be made concurrently with all other measurements, including W-CDMA loopback BER and BLER

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_hblerror_desc.html

HSDPA bit error ratio

Measurement method: The 8960 can be configured so that BER can be measured externally using the 8960 downlink and external UE monitoring software

W-CDMA Specifications

Call connection types

End-to-end video conferencing (Option 401)
Loop back video conferencing (Option 402)

The E1963A, when configured as a two-instrument system, provides true H324 call setup with live video and audio from both mobile devices. With only one E5515C, loop back video call can be setup with Option 402.

Validate compatibility by testing interoperability between your mobile and the competitor models offered for the same network.

- Complete call setup, mobile origination, and mobile release
- 64 k circuit-switched UDI channel
- H324 call setup

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_gen_call_video_call.html

AMR voice

Standard voice call with audio loopback for a quick check of voice functionality for 12.2 k rate; also many more AMR rates, such as 4.75, 5.15, 5.9, 6.7, 7.4, 7.95, 10.2, and 12.2 k

- UE and BS origination 12.2 k
- UE and BS release

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_gen_bse_amrvoice.html

FDD test mode

FDD test mode allows you to test the parametric performance of your UE's transmitter and receiver without call processing. In FDD test mode, the test set does not send signaling information on the downlink. Rather, it continuously generates a downlink signal and searches for a corresponding uplink signal. The UE must synchronize to the downlink signal and send an appropriate uplink signal, which the test set uses to measure the UE's transmitter and receiver performance. Any changes to the UE configuration must be accomplished by directly sending commands to the UE from a system controller through a proprietary digital interface.

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_gen_bse_fddtest.html

RB test mode

Fast conformance test calls with significant configuration control and testing capabilities

BS origination and release

Symmetrical configuration: W-CDMA modes support symmetrical RMCs at 12.2, 64, 144, and 384 k rates. These symmetrical RMCs are typically used for transmitter testing and receiver testing user BER (via loopback type 1) or BLER (via loopback type 2)

Asymmetric configuration: The asymmetrical RMCs use either a 12.2 or a 64 k channel on the uplink. The primary purpose of the symmetrical RMCs is to provide a way to make a BLER measurement by counting retransmission requests that the UE sends. There is no need for data loopback in this mode

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_gen_bse_rbtest_setup.html

Inter-system handover

Dual-mode functionality is required for most W-CDMA phones, as GSM is an integral part in the majority of devices shipping today. Inter-system handovers provide a means to validate dual-mode performance at your desk instead of roaming on a real network. When operated in conjunction with compressed mode, this feature can very closely emulate the basics of a real handover as made on the network.

- Blind handovers from W-CDMA to GSM
- Configurable landing GSM cell
- Test control to GSM voice
- W-CDMA AMR voice to GSM voice

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_gen_call_handoffs.html

W-CDMA RF generator

W-CDMA channels

Channel (spread factor)	Default assignment	Alternate choices
CPICH (256)	0	–
P-CCPCH (256)	1	–
S-CCPCH (64)	7	All these channel codes are settable within respective available code range
AICH (256)	10	
PICH (256)	16	
DPCH, 3.4 kbps SRB (256)	12	
DPCH, 12.2 kbps RMC (128)	9	
DPCH, 64 kbps RMC (32)	6	
DPCH, 144 kbps RMC (16)	12	
DPCH, 384 kbps RMC (8)	6	
OCNS (test model 1) (128)	Spreading factor of 128 at the fixed OVSF codes of 2, 11, 17, 23, 31, 38, 47, 55, 62, 69, 78, 85, 94, 113, 119, 125	Channel code is settable within available code range

RF generator level accuracy is derived from the 99th percentile observations with 95% confidence (corresponds to an expanded uncertainty with a 95% confidence (k=2)) at ambient conditions, then qualified to include the environmental effects of temperature and humidity.

RF IN/OUT cell power absolute output level accuracy

AWGN off:

- < ±1.1 dB (typically < ±0.65 dB), at –109 to –15 dBm/3.84 MHz and
- < 2300 MHz
- < ±1.5 dB (typically < ±1.0 dB), at –109 to –15 dBm/3.84 MHz and ≥ 2300 MHz

RF IN/OUT composite signal absolute output level accuracy

AWGN on:

- < ±1.2 dB, at –80 to –20 dBm/3.84 MHz and < 2300 MHz,
  typically < ±0.75 dB, over –109 to –20 dBm/3.84 MHz and < 2300 MHz
- < ±1.6 dB, at –80 to –20 dBm/3.84 MHz and ≥ 2300 MHz
  typically < ±1.1 dB, at –109 to –20 dBm/3.84 MHz and ≥ 2300 MHz

RF OUT ONLY cell power absolute output level accuracy

AWGN off:

- < ±1.1 dB, at –109 to –7 dBm/3.84 MHz and < 2300 MHz
  typically < ±0.65 dB, –109 to –15 dBm/3.84 MHz
- < ±1.5 dB, typically < ±1.0 dB, at –109 to –15 dBm/3.84 MHz and ≥ 2300 MHz

RF OUT ONLY composite signal absolute output level accuracy

AWGN on:

- < ±1.2 dB, at –80 to –12 dBm/3.84 MHz and < 2300 MHz
  typically < ±0.75 dB, at –109 to –20 dBm/3.84 MHz and < 2300 MHz
- < ±1.6 dB, at –80 to –20 dBm/3.84 MHz and ≥ 2300 MHz
  typically < ±1.1 dB, at –109 to –20 dBm/3.84 MHz and ≥ 2300 MHz

Common pilot channel relative level: –20 to 0 dB

Primary sync channel relative level: Always the same as P-CCPCH

Secondary sync channel relative level: Always the same as P-CCPCH

Primary CCPCH relative level: –20 to 0 dB

DPCH relative level: Settable from –30 to 0 dB with 0.01 dB resolution

PICH relative level: –20 to 0 dB

Downlink CDMA modulation

Modulation type: QPSK per 3GPP standard

Residual EVM: < 10%, typically < 3%

Carrier feed through: < –25 dBc, typically < –35 dBc, nominal ambient performance: < –45 dBc

OCNS – orthogonal channel noise source

Composed of 16 channels per Table E.3.6 in Annex E of 3GPP 34.121

OCNS channel relative level range: Automatically calculated from other
code channel relative levels to provide the set CDMA cell power

Relative CDMA channel level accuracy: < ±0.2 dB

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_gen_bse_gen_info.html_BCGCBAHE

W-CDMA RF analyzer (measurements only)

Real-time demodulation of: Uplink DPCH

W-CDMA Tx measurements

Thermal power measurement

Measurement bandwidth: > 5 MHz; if other signals are present outside of this frequency range, reduced measurement accuracy will result

Measurement data capture period: 10 ms

Measurement range: –10 to +28 dBm; usable to –20 dBm with degraded accuracy

Measurement level ranging: Auto

Auto zero function: Measurement automatically zeros the thermal power meter (no user control)

Measurement accuracy: (With 10 internal averages)

- 375 to 500 MHz < ±6.6%, typically < ±3.0%
- 698 to 1000 MHz < ±6.0%, typically < ±3.0%
- 1400 to 1500 MHz < ±7.2%, typically < ±3.7%
- 1700 to 2000 MHz < ±7.2%, typically < ±3.7%
- 2480 to 2580 MHz < ±8.7%, typically < ±3.7%

Temperature range: +20 to +55 °C

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_thermalpow_desc.html

Channel power measurement

Measurement bandwidth

RRC filter off: Measured with a bandwidth greater than (1 + a) x chip rate, where a = 0.22 and chip rate = 3.84 Mcps

RRC filter on: Measured with a filter that has a root-raised cosine (RRC) filter response with roll-off a = 0.22 and a bandwidth equal to the chip rate (3.84 MHz bandwidth centered on the active uplink channel)

Measurement range: –61 to +28 dBm/3.84 MHz

Measurement interval: Settable from 0.01 to 12 ms

Measurement triggers: Auto, immediate, protocol, external, and RF rise

Measurement accuracy
(at +10 °C from the calibration temperature):

- < ±1.0 dB (typically < ±0.5 dB) for measurement intervals of 333 µs to 12 ms over 698 to 1024 MHz, 1400 to 1500 MHz, and 1700 to 2000 MHz
- < ±1.0 dB (typically < ±0.55 dB) for measurement intervals of 333 µs to 12 ms over 2480 to 2580 MHz
- < ±1.0 dB (typically < ±0.55 dB) for measurement intervals of 67 to < 333 µs over 698 to 1024 MHz, 1400 to 1500 MHz, and 1700 to 2000 MHz

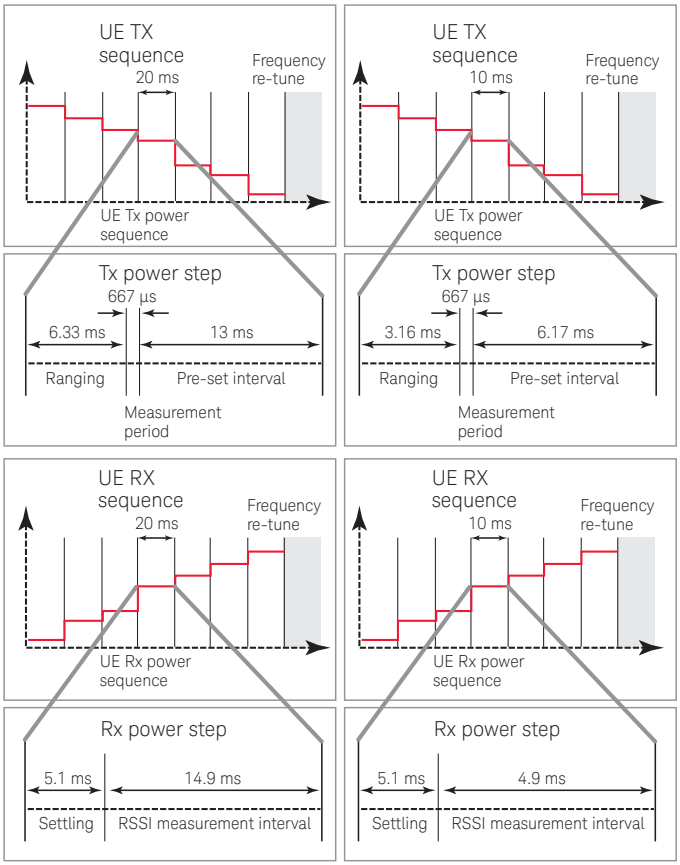
Temperature range: +20 to +55 °C

Temperature drift: Typically 0.1 dB per 10 °C temperature change

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_chanpow_desc.html

Fast device tune measurement

Description: Allows simultaneous calibration of a device's Tx output power and Rx input level across level and frequency in a single sweep (per frequency band). The device must operate in a test mode which forces it to transmit a predefined series of power steps at various uplink frequencies, and also forces it to simultaneously tune its receiver to perform measurements (such as RSSI) of the test set's signal at various downlink frequencies and power levels



Input frequency ranges: 698 to 1000 MHz, 1400 to 1500 MHz, 1700 to 1990 MHz, and 2480 to 2580 MHz

Tx power measurement input level range: –61 to +28 dBm/3.84 MHz

Tx power measurement level change between adjacent steps:

- < 20 dB for 20 ms step size
- < 10 dB for 10 ms step size

Tx power measurement accuracy (at +10 degrees from calibration temperature): < ±1.0 dB

Rx level output range at RF IN/OUT port: –109 to –15 dBm/3.84 MHz

Rx level output range at RF OUT ONLY port: –109 to –7 dBm/3.84 MHz

Rx level change between adjacent steps: < 20 dB

Rx level accuracy with W-CDMA modulation: < ±1.1 dB

Rx level setting: < 5.1 ms to be within 0.1 dB

Concurrency capabilities: Fast device tune measurements cannot be made concurrently with other measurements

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_cfdtune_desc.html

Waveform quality measurement

Waveform quality measurement: Composite EVM

Measurement format: HPSK

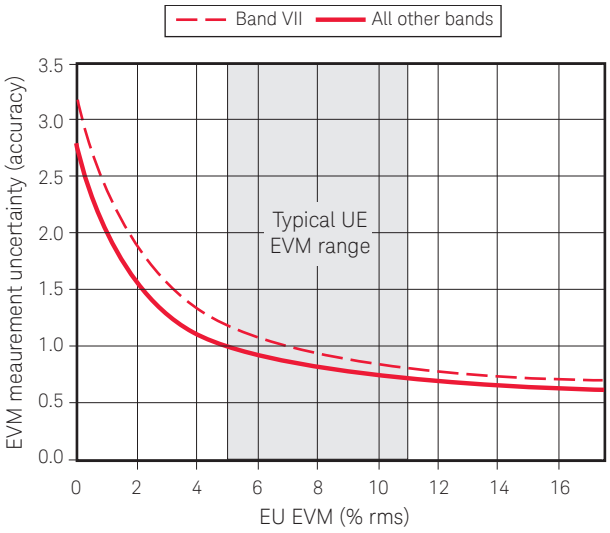
Measurement chip rate: 3.84 Mcps

Input level range: –25 to +28 dBm/3.84 MHz

Measurement range: ≤ 35% EVM

Measurement interval: 1 timeslot

Measurement accuracy (including the effects of residual EVM):



EVM measurement accuracy:

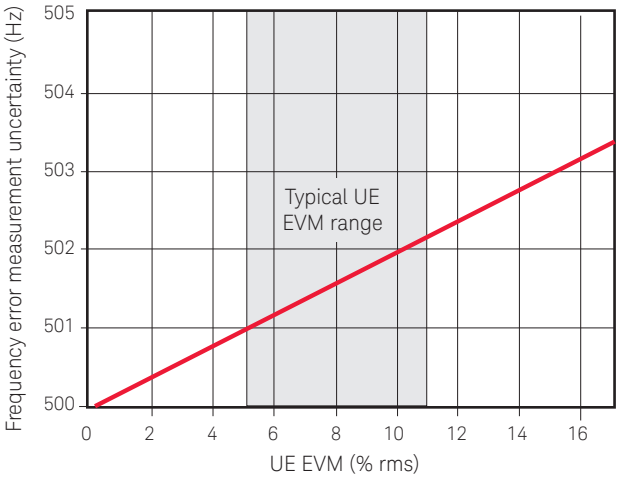
- < 2.8% rms (typically < 2.4% rms) for UE EVM ≥ 1% rms, ≤ 2200 MHz
- < 3.2% rms (typically < 2.8% rms) for UE EVM ≥ 1% rms, 2300 to 2580 MHz

Other reported parameters with EVM:

- Frequency error
- Magnitude error
- Phase error
- Origin offset
- Timing error
- Peak code domain error

Frequency error measurement range: ±1 kHz

Residual frequency error: < ± (5 Hz + timebase accuracy)



Peak code domain error accuracy: < ±0.3 dB for levels > –25 dB

Timing error measurement range: ± 10 µs

Timing error measurement accuracy: < ±0.5 chips (±130 ns)

Temperature range: +20 to +55 °C

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_wfrmqual_desc.html

IQ tuning

All measurements found in the waveform quality measurement are also available in the IQ tuning measurement; the specifications are the same in both measurements

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_iqtuning_desc.html

Adjacent channel leakage ratio (ACLR)

Measurement method: Ratio of the filtered mean transmitted power to the filtered mean power in an adjacent channel; both the transmitted and the adjacent channel powers are measured with a filter that has a RRC response with roll-off a = 0.22 and a band width equal to the chip rate

Input power level range: +5 to +28 dBm/3.84 MHz

Input frequency ranges: 698 to 1000 MHz, 1400 to 1500 MHz, 1700 to 2000 MHz, and 2480 to 2580 MHz

Measurement level ranging: Auto

Measurement triggers: Auto, protocol, immediate, and external

Measurement interval: 1 timeslot

Measurement result: dBc relative to in-channel transmitted power

Measurement accuracy: < ±0.8 dB (typically < ±0.5 dB), including the effects of the residual floor, for measurements at –33 dBc at ±5 MHz offsets and –43 dBc at ±10 MHz offsets, and ±10 °C from the calibration temperature

Residual ACLR floor: < –53 dBc for ±5 MHz offsets, < –63 dBc for ±10 MHz offsets

Temperature range: +20 to +55 °C

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_aclr_desc.html

Spectrum emission mask (SEM)

Measurement method: Ratio of the transmitted power (3.84 MHz bandwidth RRC) to offset frequencies, which are between 2.5 and 12.5 MHz away from the UE center carrier frequency; the offset frequencies are measured in 30 kHz or 1 MHz bandwidths, depending on the offset

Input power level range: +5 to +28 dBm/3.84 MHz

Input frequency ranges: 698 to 1000 MHz, 1400 to 1500 MHz, 1700 to 2000 MHz, and 2480 to 2580 MHz

Measurement accuracy[1]: ≤ ±1.5 dB (typically < ±0.8 dB) for the following offsets (±10 °C from the calibration temperature):

Frequency offset	Levels (dBm)	Meas BW
2.5 to 3.5 MHz	$\left\{-35 - 15 \times \left[\frac{\Delta f}{MHz} - 2.5\right]\right\}$	30 kHz
3.5 to 7.5 MHz	$\left\{-35 - 1 \times \left[\frac{\Delta f}{MHz} - 3.5\right]\right\}$	1 MHz
7.5 to 8.5 MHz	$\left\{-39 - 10 \times \left[\frac{\Delta f}{MHz} - 7.5\right]\right\}$	1 MHz
8.5 to 12.5 MHz	–49	1 MHz

Measurement triggers: Auto, protocol, immediate, and external

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_spec_em_mask_desc.html

Occupied bandwidth (OBW)

Measurement method: Bandwidth containing 99% of the total integrated power of the transmitted signal, centered on the channel frequency

Input power level range: +5 to +28 dBm

Input frequency ranges: 800 to 1000 MHz, 1700 to 1990 MHz

Measurement accuracy: < ±60 kHz

Measurement triggers: Auto, protocol, immediate, and external

Temperature range: +20 to +55 °C

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_occup_bw_desc.html

Code domain power

Code domain power accuracy: ≤ ±0.3 dB for code power level > –25 dB

All measurements found in the waveform quality measurement are also available in the code domain measurement; the specifications are the same in both measurements.

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_cod_dom_desc.html

1. Refer to HSPA SEM specification on page 9 for additional requirements

PRACH transmit on/off power

Measurement method: The measure of the ON power of the PRACH preamble burst, along with the OFF power preceding the burst and the OFF power following the burst

Input power level range:

- ON power: –40 to +28 dBm/3.84 MHz
- OFF power: –61 to –55 dBm/3.84 MHz

Input frequency ranges: 800 to 1000 MHz, 1700 to 1990 MHz

Measurement accuracy: < ±1.0 dB (typically < ±0.5 dB) within ±10 °C from the calibration temperature

Nominal trigger range: Expected power ±9 dB

Temperature range: +20 to +55 °C

Concurrency capabilities: PRACH Tx on/off measurements cannot be made concurrently with other measurements

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_oopow_desc.html

Phase discontinuity

Measurement method: The measured results include the phase discontinuity (defined as the phase difference of adjacent timeslots) as well as all waveform quality results for each timeslot

Input power level range:

- Phase discontinuity: –61 to +28 dBm/3.84 MHz
- Other measurements: –25 to +28 dBm/3.84 MHz

Input frequency ranges: 800 to 1000 MHz, 1700 to 1990 MHz

Phase discontinuity range: ±180°

EVM range: 0 to 35% rms

Phase discontinuity measurement accuracy:

- < ±2.4° (typically < ±1.7°) for input levels of –25 to +28 dBm/3.84 MHz
- < ±2.6° (typically < ±1.9°) for input levels of –51 to < –25 dBm/3.84 MHz

Other reported parameters with phase discontinuity: All measurements found in the waveform quality measurement are also available; the specifications are the same in both measurements, including the input power range of the waveform quality measurement

Measurement interval: 617 µs (= 1 timeslot (667 µs) – 25 µs transient periods at either side of the nominal timeslot boundaries)

Measurement triggers: Protocol and external

Temperature range: +20 to +55 °C

Concurrency capabilities: Phase discontinuity measurements cannot be made concurrently with other measurements

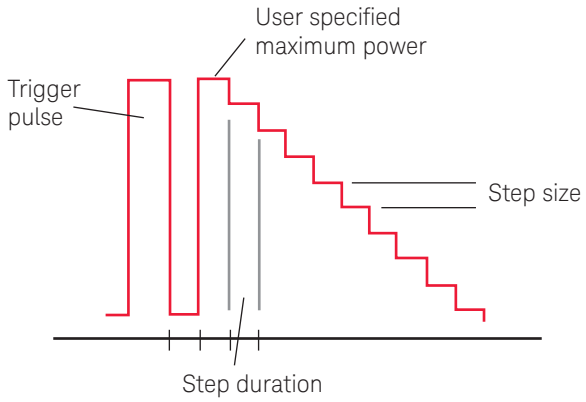
http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_wpdiscon_desc.html

Tx dynamic power measurement

Measurement method: Captures a user-defined trace consisting of 20, 40, or 80 ms duration power steps with user-defined step size produced by a test mode in the UE under test; measures the total power in a 3.84 MHz bandwidth centered on the active uplink center frequency in each step period

Measurement data capture period: 667 µs

Measurement trigger: Tx signal output by the mobile station must provide a pulse (off-on-off) followed by the stepped power burst beginning at the user specified output power



Measurement range: –61 to +28 dBm/3.84 MHz

Measurement level ranging: None; user must set the test set's receiver power control field to manual and set the receiver power to the expected full power of the power sweep produced by the UE

Measurement accuracy: (Calibrated against average power and within ±10 degrees of calibration temperature; calibration must occur between 20 to 55 °C);

- < ±1.0 dB (typically < ±0.5 dB) over 15 to 55 °C, 698 to 1000 MHz, 1400 to 1500 MHz and 1700 to 2000 MHz
- < ±1.0 dB (typically < ±0.55 dB) over 15 to 55 °C and 2480 to 2580 MHz

Measurement step duration (time): 20, 40, or 80 ms

Measurement step size: –90.00 to –0.01 dB

Measurement number of steps: 0 to 99

Measurement result: A graph displaying the discrete power at each power step along with numeric power results for each step

Measurement graphical controls: Marker on/off with position, trace start step, trace span, and return to default scale

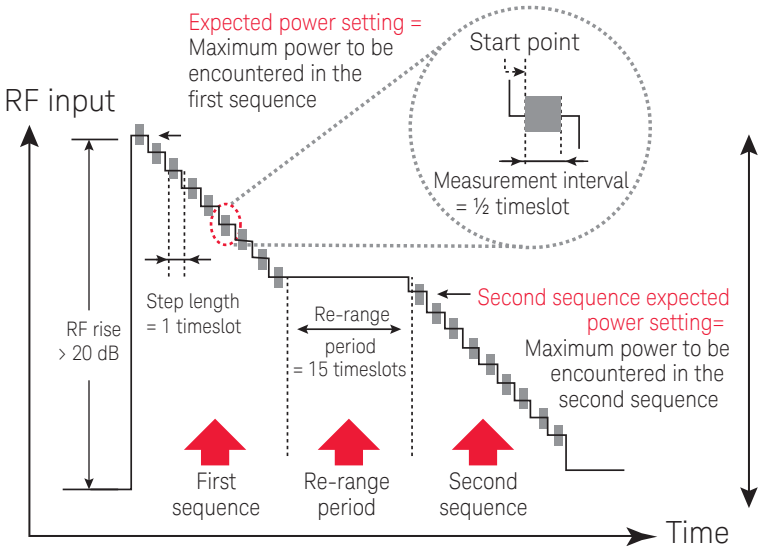
Concurrency capabilities: Tx dynamic power measurements cannot be made concurrently with other measurements

Calibrate function: Uses the channel power calibration function

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_wtdpower_desc.html

Extended range dynamic power measurement

Measurement method: Allows measurement of a UE's transmitter output power across its entire dynamic power (up to 90 dB) in one measurement cycle. This measurement requires the UE be put into a test mode which forces it to transmit up to two power sequences and analyzes the resulting UE output power using the test set



Measurement bandwidth: Selectable RRC filter on or off

Measurement range: –61 dBm to +28 dBm/3.84 MHz

Measurement accuracy:

- ±1.0 dB (typically ±0.5 dB), at top 25 dB of dynamic range
- ±1.0 dB (typically ±0.55 dB), at top 30 dB of dynamic range
- ±1.0 dB (typically ±0.55 dB), at top 35 dB of dynamic range with RRC filter on

Measurement trigger: RF rise, external

Temperature range: +20 to +55°C

Temperature drift: Typically < 0.1 dB per 10 °C temperature change

Inner loop power

Measurement method: Inner loop power control in the uplink is the ability of the UE transmitter to adjust its output power in accordance with one or more TPC commands received in the downlink; the absolute and relative power is reported for each power step

Measurement range: –61 to +28 dBm/3.84 MHz

Input frequency ranges: 800 to 1000 MHz, 1700 to 1990 MHz

Measurement accuracy:
Absolute power: < ±1.0 dB, typically < ±0.5 dB
Relative power:

- < ±0.1 dB for range ≤ 1.5 dB (–51 to +28 dBm/3.84 MHz)
  < ±0.184 dB for range ≤ 1.5 dB (–61 to –51 dBm/3.84 MHz)
- < ±0.15 dB for range ≤ 3 dB (–51 to +28 dBm/3.84 MHz)
- < ±0.174 dB for range ≤ 3 dB (–61 to –51 dBm/3.84 MHz)
- < ±0.3 dB for range ≤ 26 dB (–61 to +28 dBm/3.84 MHz)

Temperature range: +20 to +55 °C

Temperature drift: Typically < 0.1 dB per 10 °C temperature change for the absolute power measurements; typically < 0.025, 0.02, and 0.05 dB over +20 to +55 °C temperature range for relative power ranges of 1.5, 3, and 26 dB respectively

Concurrency capabilities: Inner loop power measurements cannot be made concurrently with other measurements

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_ilpow_desc.html

Dynamic power analysis

Measurement method: Graphical display of a series of channel power measurement for a user-defined number of steps and step lengths

Input level range: –61 to +28 dBm/3.84 MHz

Data capture range: Combination of number of steps and step length cannot exceed 58.26 ms

Measurement bandwidth: Selectable RRC filter on or off

Measurement interval: Settable from 0.01 to 12 ms (must be less than or equal to the step length)

Measurement accuracy: (At +10 °C from calibration temperature with measurement interval 333 µs to 12 ms):

Input level range	Measurement accuracy	Frequency range
≤ 25 dB	< ±1.0 dB, *typically* < *±0.5 dB* < ±1.0 dB, *typically* < *±0.55 dB*	800 to 1000 MHz 1700 to 2000 MHz 2480 to 2580 MHz
≤ 35 dB	< ±1.0 dB, *typically* < *±0.55 dB* < ±1.0 dB, *typically* < *±0.6 dB*	800 to 1000 MHz 1700 to 2000 MHz 2480 to 2580 MHz
≤ 40 dB with RRC filter on	< ±1.0 dB, *typically* < *±0.55 dB* < ±1.0 dB, *typically* < *±0.7 dB*	800 to 1000 MHz 1700 to 2000 MHz 2480 to 2580 MHz

Measurement triggers: External, RF rise

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_wdpanalysis_desc.html

Rx measurements

Loopback bit error ratio

Measurement method: Data loopback (mode 1 in 3GPP TS 34.109)

BER measurement input level range: –50 to +28 dBm/3.84 MHz

Reported parameters:

- Intermediate results: Measured bit error ratio, number of errors, number of bits tested, uplink missing blocks, uplink CRC errors, and loopback delay
- Final results: Measured BER, number of errors, number of bits tested, uplink missing blocks, CRC errors, and loopback delay

Concurrency capabilities: BER measurements cannot be made concurrently with BLER, phase discontinuity, PRACH Tx on/off, or inner loop power measurements, or while speech is provided on the downlink; loopback BER measurements can be made concurrently with all other measurements

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_loopber_desc.html

Block error ratio

Measurement method: The UE is configured to loop back the data bits and the CRC bits from the downlink transport blocks into the uplink transport blocks on the DPCH; a comparison is made in the test set by generating a CRC using the data bits received on the uplink and comparing the calculated CRC against the CRC received in the uplink transport block

BLER measurement input level range: –50 to +28 dBm/3.84 MHz

Reported parameters: Measured BLER, block error count, number of blocks tested, and uplink missing blocks

Concurrency capabilities: BLER measurements cannot be made concurrently with loopback BER, phase discontinuity, PRACH Tx on/off, or inner loop power measurements, or while speech is provided on the downlink; BLER measurements can be made concurrently with all other measurements

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_wblerror_desc.html

HSPA and W-CDMA Common Technical Specifications

RF generator

Downlink frequency

Frequency ranges (MHz)	
Band I (IMT-2000)	2112.4 to 2167.6
Band II (US PCS)	1932.4 to 1987.6
Band III (DCS/PCS)	1807.4 to 1877.6
Band IV	2112.4 to 2152.6
Band V (US Cellular)	871.5 to 887.5
Band VI (Japan 800)	877.4 to 882.6
Band VII (UMTS 2600)	2622.4 to 2687.6
Band VIII (UMTS 900)	927.4 to 957.6
Band IX (UMTS 1700)	1847.4 to 1877.4
Band X (UMTS Extended)	2112.4 to 2167.6
Band XI (UMTS 1500)	1478.4 to 1498.4
Band XII (UMTS 700)	728 to 746
Band XIII (UMTS 700)	746 to 756
Band XIV (UMTS 700)	758 to 768
Band XIX	877.4 to 887.6
Band XX	793.4 to 818.6
Band XXI	1498.4 to 1508.4

Frequency/channel setting: By channel number or MHz (test mode only)

Frequency accuracy: Same as timebase reference

Frequency setting resolution: 1 Hz

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_gen_bse_dl_chan_num.html

Downlink amplitude

Output port control: Control of RF source routing to either the RF IN/OUT port or the RF OUT ONLY port

Composite signal level: The sum of the user-set values of the cell power and the AWGN source measured in a root-raised cosine filter response with a roll off a = 0.22 and a 3.84 MHz BW; if the cell power is ON, the AWGN level must be set to within –20 dB to +10 dB of the cell power. Note: The composite signal level is not settable, however it is reported by the test set

RF IN/OUT cell power output range: –115 to –13 dBm/3.84 MHz

RF IN/OUT AWGN signal output level range: –115 to –20 dBm/3.84 MHz

RF IN/OUT VSWR:

- < 1.14:1, 400 to 500, 700 to 1000 MHz
- < 1.2:1, 1700 to 2000 MHz
- < 1.4:1, 2000 to 2700 MHz

RF IN/OUT reverse power: +37 dBm peak (5 W peak)

RF OUT ONLY cell power output range: –115 to –5 dBm/3.84 MHz

RF OUT ONLY reverse power: +24 dBm peak (250 mW peak)

Measurement calibrate function: Calibrates the channel power, ACLR, SEM, waveform quality, OBW, and code domain measurements over the specified frequency range of the test set against the thermal power measurement, no external cabling is required to perform this function

Measurement calibration time: < 180 seconds

Measurement calibration temperature range: Valid ±10 °C from previously calibrated temperature

AWGN channel relative level range: Settable to –20 dB to +10 dB relative to the user-set CDMA cell power with 0.01 dB resolution

RF analyzer

Measurement input frequency ranges
698 to 1000 MHz
1400 to 1500 MHz
1700 to 1990 MHz
2480 to 2580 MHz

Frequency ranges for uplink channels (MHz)	
Band I (IMT-2000)	1922.4 to 1977.6
Band II (US PCS)	1852.4 to 1907.6
Band III (DCS/PCS)	1712.4 to 1782.6
Band IV	1712.4 to 1752.6
Band V (US Cellular)	826.4 to 846.6
Band VI (Japan 800)	832.4 to 837.6
Band VII (UMTS 2600)	2502.4 to 2567.6
Band VIII (UMTS 900)	882.4 to 912.6
Band IX (UMTS 1700)	1752.4 to 1782.4
Band X (UMTS Extended)	1712.4 to 1767.6
Band XI (UMTS 1500)	1430.4 to 1450.4
Band XII (UMTS 700)	698 to 716
Band XIII (UMTS 700)	777 to 787
Band XIV (UMTS 700)	788 to 798
Band XIX	832.4 to 842.6
Band XX	834.4 to 859.6
Band XXI	1450.4 to 1460.4

Frequency/Channel setting: By channel number or MHz (test mode only)

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_gen_bse_ul_chan_num.html

Input level setting range: –70 to +30 dBm/3.84 MHz

Receiver ranging:

- Auto (Active closed loop power control): The test set uses TPC commands to the UE to adjust its transmit power as needed to achieve the “UE Target Power”
- Manual mode: User enters expected power; provides calibrated results if actual power is within ±9 dB of the user-entered level

Demodulation chip rate: 3.84 Mcps

Maximum input level: +37 dBm peak (5 W peak)

Amplitude scaling: Settable from 0.1 to 20 dB/division in 0.1 dB steps

Trigger source: Immediate, protocol, RF rise, external, auto

Trigger delay: Settable between ±50 ms

Peak threshold: Settable from –120 to +37 dBm

Peak excursion: Settable from 1.2 to 100 dB

Trace functions: Clear write, max hold, min hold

Detector type: Peak or sample

Tx measurements

Spectrum monitor

Operating modes: Active cell and test mode

Measurement modes: Swept mode or zero span

Frequency ranges: Although the spectrum monitor is available at any frequency supported by the test set, specifications apply only inside of the calibrated bands: 698 to 1000 MHz, 1400 to 1500 MHz, 1700 to 2000 MHz, and 2480 to 2580 MHz

Frequency spans, resolution bandwidth range:
Span and RBW can be independently set, except for zero span; zero span can only be set with the RBW combinations shown below

(Specifications only apply for span and RBW combinations shown in the following table):

Span	RBW	Displayed dynamic range
100 MHz	5 MHz	50 dB
80 MHz	1 MHz	55 dB
40 MHz	300 kHz	60 dB
20 MHz	100 kHz	65 dB
12 MHz	100 kHz	65 dB
10 MHz	100 kHz	65 dB
5 MHz	30 kHz	70 dB
4 MHz	30 kHz	70 dB
2.5 MHz	10 kHz	75 dB
1.25 MHz	3 kHz	80 dB
500 kHz	1 kHz	80 dB
125 kHz	300 Hz	80 dB
0	1 MHz	55 dB
0	300 kHz	60 dB
0	100 kHz	65 dB

RBW filter types: Flattop in swept mode, Gaussian in zero span

Zero span sweep time: Settable from 50 µs to 70 ms

Zero span offset time: Settable from 0 to 10 s

Reference level range: Settable from –50 to +37 dBm or automatically determined

Averaging capabilities: Settable between 1 and 999, or off

Marker functions: Three independent markers with modes of normal, delta, and off; operations are peak search, marker to expected power, and marker to expected frequency

Concurrency capabilities: Spectrum monitor analysis can be performed concurrently with all measurements

Supplemental characteristics

Typical level accuracy

- < ±2 dB for signals within 50 dB of a reference level > –10 dBm and RBW < 5 MHz
- < ±2 dB for signals within 30 dB of a reference level < –10 dBm and RBW = 5 MHz using 5 averages,
- < ±3.5 dB for signals > –70 dBm and within 50 dB of a reference level < –10 dBm with RBW < 5 MHz

Displayed average noise level: < –90 dBm for reference level of –40 dBm and 30 kHz bandwidth

Typical residual responses: < –70 dB with input terminated, reference level of –10 dBm and RF generator power < –80 dBm

Typical spurious responses: < –50 dBc with expected frequency tuned to carrier, carrier > 420 MHz, signal and reference level at –10 dBm and all spectral components within 100 MHz of carrier

Frequency resolution: 1 Hz

Marker amplitude resolution: 0.01 dB

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_smonitor_desc.html

Audio generator

Frequency

Operating range: 100 Hz to 20 kHz, typically 1 Hz to 20 kHz

Accuracy: Same as timebase reference

Frequency resolution: 0.1 Hz

Output level (from AUDIO OUTPUT connector)

Ranges: 0 to 1 V peak, 1 to 9 V peak (into > 600 ohms)

Accuracy: < ±(1.5% of setting + resolution) when output is DC coupled

Distortion: < 0.1% for 0.2 to 9 V peak into > 600 ohms

Coupling mode: Selectable as DC or AC (5 µF in series with output)

Typical maximum output current: 100 mA peak into 8 ohms

Typical output impedance: < 1.5 ohms at 1 kHz when output is DC coupled

Typical DC offset (when output is DC coupled):

- < 1 mV peak for 0 to 1 V peak
- < 10 mV peak for 1 to 9 V peak

Output level resolution: < 0.5 mV for 0 to 1 V peak output, < 5.0 mV for 1 to 9 V peak output

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_conf_audio_out.html_BJFBAIEH

Audio analyzer

(All specifications for the audio analyzer apply to signals present at test set's AUDIO IN ports)

Audio analyzer de-emphasis: 750 µs, de-emphasis settable as off or on

Audio analyzer expandor: Settable as off or on with reference level setting of 10 mV to 10 V

Audio analyzer filters: Settable choices of none, C-message, 50 Hz to 15 kHz band pass, 300 Hz to 15 kHz band pass, or 100 Hz band width tunable band pass tunable over 300 Hz to 15 kHz

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_afan_desc.html_BJFBAIEH

Audio level measurement

Types of signals measured: Sinusoidal audio signals

Measurement frequency range: 100 Hz to 15 kHz

AUDIO IN level range: 7.1 mV to 20 V peak (5 mV to 14.1 Vrms)

Measurement accuracy: < ± (2% of reading + resolution) for 100 Hz to 8 KHz,
< ±(3% of reading + resolution) for > 8 to 10 kHz

Measurement THD plus noise: < 200 µV rms

Measurement detector: Selectable choices of rms and peak

Measurement trigger source: Immediate

Available result: Audio level

Multi-measurement capabilities: 1 to 999 measurements, average, minimum, maximum, and standard deviation results

Concurrency capabilities: Audio level measurements can be made concurrently with all other measurements

Typical external input impedance: 100 k ohms in parallel with 105 pF

Measurement resolution: 0.3% of expected level setting or 0.2 mV, whichever is greater

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_aaudio_lev_desc.html

SINAD measurement

Types of signals measured: Sinusoidal audio signals

Measurement frequency range: 100 Hz to 10 kHz

AUDIO IN level range: 42.4 mV to 20 V peak (30 mV to 14.1 V rms)

Measurement accuracy: < ±1.0 dB for SINAD < 44 dB

Residual THD plus noise: < –60 dB or 200 µV rms, whichever is greater

Measurement trigger source: Immediate

Available result: SINAD ratio

Multi-measurement capabilities: 1 to 999 measurements, minimum, maximum, average, and standard deviation results

Concurrency capabilities: SINAD measurements can be made concurrently with all analog and audio measurements

Measurement resolution: 0.01 dB

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_sinad_desc.html

Distortion measurement

Types of signals measured: Sinusoidal audio signals

Measurement frequency range: 100 Hz to 10 kHz

AUDIO IN level range: 42.4 mV to 20 V peak (30 mV to 14.1 V rms)

Measurement accuracy: < ±12% of reading (±1.0 dB) for distortion > 0.67%

Residual THD plus noise: < –60 dB or 200 µV rms, whichever is greater

Measurement trigger source: Immediate

Available result: Audio distortion

Multi-measurement capabilities: 1 to 999 measurements, minimum, maximum, average, and standard deviation results

Concurrency capabilities: Distortion measurements can be made concurrently with all analog and audio measurements

Measurement resolution: 0.1%

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_distortion_desc.html

Audio frequency measurement

Types of signals measured: Sinusoidal audio signals

Measurement frequency range: 100 Hz to 15 kHz

AUDIO IN level range: 7.1 mV to 20 V peak (5 mV to 14.1 Vrms)

AUDIO IN signal conditions: Signal at test set's AUDIO IN must have signal-to-noise ratio > 30 dB

Measurement accuracy: < 0.1 Hz averaged over 10 measurements, < 1.0 Hz for a single measurement

Measurement THD plus noise: < 200 µV rms

Measurement trigger source: Immediate

Available result: Audio frequency

Multi-measurement capabilities: 1 to 999 measurements, minimum, maximum, average, and standard deviation results

Concurrency capabilities: Frequency measurements can be made concurrently with all other measurements

Measurement resolution: 0.1 Hz

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_afan_freq_desc.html

Frequency stability measurement

Types of signals measured: Analog and AMPS signals with or without SAT and with frequency modulation index ß < 3.0 radians

Frequency capture range: Signal must be within ±200 kHz of test set's expected frequency

Measurement rate range: 100 Hz to 15 kHz

Minimum input level: Signal at test set's RF IN/OUT must have analog Tx power > –30 dBm

Frequency and frequency error measurement accuracy:

Measurement accuracy	Input signal modulation	Input signal frequency range
< ±(1 Hz + timebase accuracy)	None	800 to 960 MHz
< ±(10 Hz + timebase accuracy)	Frequency modulation with ß < 3.0 radians	800 to 960 MHz

Measurement accuracy: Typically < +(1 Hz + timebase accuracy) for an input signal with SAT, < +(3.3 Hz + timebase accuracy) for an input signal with ß = 1 radian

Measurement trigger source: Immediate

Available result: RF frequency and RF frequency error

Multi-measurement capabilities: 1 to 999 measurements, minimum, maximum, average, and standard deviation in Hz for all results and worst case RF frequency error in ppm result

Concurrency capabilities: Frequency stability measurements can be made concurrently with all analog and audio measurements

Measurement resolution for frequency and frequency error measurement results in Hz: Typically 1 Hz

Measurement resolution for frequency error measurement result in ppm: Typically 0.01 ppm

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_fstab_desc.html

Single channel GPS source (E1999A-206)

With the option E1999A-206 and hardware Option 003, E5515C can generate a single channel GPS signal with C/A code to simulate one satellite. Some key parameters such as Satellite ID and signal level are settable.

GPS signal output: RF IN/OUT or RF OUTPUT ONLY

GPS signal frequency: 1.57542 GHz

GPS signal output level: –70 to –125 dBm

GPS signal output accuracy: < ±1.0 dB, –70 to –116 dBm; < ±1.5 dB, –116 to –125 dBm

Satellite ID: 1 to 37

Chip rate: 1.023 Mcps

Code supported: C/A code

Perceptual evaluation of speech quality (PESQ) measurement (E1999A-301)

The PESQ measurement provides an objective method for prediction of vocoder speech quality using the industry standard PESQ algorithm.

Supported service options: AMR voice, WB-AMR

Measurement mode: Downlink audio, uplink audio, or downlink and uplink simultaneously

Speech Source: Male or female

Expected audio input peak voltage (downlink mode): 1 mV to 2.000 V

Maximum audio output peak voltage (downlink mode): 0 to 5.0000 V

Uplink PESQ score: –0.50 to +4.50

Downlink PESQ score: –0.50 to +4.50

PESQ uplink headroom: 0 to 100.0 dB

PESQ downlink headroom: 0 to 100.0 dB

Timebase specifications

Internal high stability 10 MHz oven-controlled crystal oscillator (OCXO)

Aging rates: < ±0.1 ppm per year, < ±0.005 ppm peak-to-peak per day during any 24-hour period starting 24 hours or more after a cold start

Temperature stability: < +0.01 ppm frequency variation from 25 °C over the temperature range 0 to 55 °C

Warm-up times: Five minutes to be within ±0.1 ppm of frequency at one hour, 15 minutes to be within ±0.01 ppm of frequency at one hour

Typical accuracy after a 30-minute warm-up period of continuous operation is derived from: ±(time since last calibration) x (aging rate) + (temperature stability) +(accuracy of calibration)

Typical initial adjustment: ±0.03 ppm

External reference

Input frequency: 10 MHz

Input frequency range: Typically < ±5 ppm of nominal reference frequency

Input level range: Typically 0 to +13 dBm

Input impedance: Typically 50 ohms

External reference output

Output frequency: Same as timebase (internal 10 MHz OCXO or external reference input)

Typical output level: Typically > 0.5 V rms

Output impedance: Typically 50 ohms

Remote programming

GPIB: IEEE Standard 488.2

Remote front panel lockout: Allows remote user to disable the front panel display to improve GPIB measurement speed

Implemented functions: T6, TE0, L4, LE0, SH1, AH1, RL1, SR1, PP0, DC1, DT0, C0, and E2

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_hpib_navigation.html

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