Specifications Guide

Agilent Technologies
E4406A VSA Transmitter Tester

This manual provides documentation for the following instrument:

E4406A (7 MHz to 4 GHz)

Manufacturing Part Numbers: E4406-90266

Supersedes: E4406-90234
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Where to Find the Latest Information

Documentation is updated periodically. For the latest information about Agilent VSA transmitter tester, including firmware upgrades and application information, see:

http://www.agilent.com/find/vsa

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1 Transmitter Tester Specifications

Definitions and Requirements

The distinction among specifications, typical performance, and nominal values are described as follows.

Definitions

- Specifications describe the performance of parameters covered by the product warranty (temperature = 0 to 55 °C, unless otherwise noted).
- Typical describes additional product performance information that is not covered by the product warranty. It is performance beyond specification that 80 % of the units exhibit with a 95 % confidence level over the temperature range 20 to 30 °C. Typical performance does not include measurement uncertainty.
- Nominal values indicate expected performance, or describe product performance that is useful in the application of the product, but is not covered by the product warranty.

The following conditions must be met for the analyzer to meet its specifications.

Conditions Required to Meet Specifications

- The analyzer is within its calibration cycle.
- At least 2 hours of storage at a constant temperature, within the operating temperature range.
- At least 1 hour after the instrument is turned on.
- If Auto Align Alert is selected, an Align All Now must be run when the alignment error message occurs, or

  If Auto Align On is selected, it must have been turned on at least 5 minutes, or

  If Auto Align Off is selected, Align All Now must be run:

  – If more than 24 hours has expired, or
  – Any time the ambient temperature changes more than 3 °C.

CAUTION Changing the instrument mode clears any alignment error message. Align All Now must still be performed.

Certification

Agilent Technologies certifies that this product met its published specifications at the time of shipment from the factory. Agilent Technologies further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

Frequency

	Specifications	Supplemental Information
Frequency Range (RF Input)	7 MHz to 314 MHz 329 MHz to 4 GHz	
Frequency Range (Baseband IQ Inputs)	0 Hz to 5 MHz	

	Specifications	Supplemental Information
Frequency Spans (Baseband IQ Inputs)	5 Hz to 5 MHz	Baseband I or Q Inputs
	10 Hz to 10 MHz	Composite I/Q

	Specifications	Supplemental Information
Frequency Setting Resolution	1 Hz	

	Specifications	Supplemental Information
Frequency Reference		
Accuracy	±[(time since last adjustment x aging rate) + temperature stability + calibration accuracy][a]	
Initial calibration accuracy	±5 x 10-8	
Settability	±2 x 10-9	
Aging rate		
During any 24 hours, following 24-hour warmup		±5 x 10-10, (nominal)
Per year		±1 x 10-7, (nominal)
Temperature stability	±5 x 10-8 variation from frequency at +25 °C over the temperature range of 0 to +55 °C	
Warm-up time		1 hour, (nominal)
Within 10 minutes after turn-on		±1 x 10-7 (relative to measurement after 1 hour)
Within 20 minutes after turn-on		±1 x 10-8 (relative to measurement after 1 hour)
Within 15 minutes at ambient temperature of +25 ±3 °C		±5 x 10-8, relative to the frequency at the previous turn-off time (powered for at least 72 hours prior to removing power for 24 hours)

	Specifications		
Stability	7 to 678.59 MHz	678.6 to 1678.59 MHz	1678.60 to 4000 MHz
RMS residual FM 3.3 ms data acquisition time, 3 kHz pre-ADC bandwidth	≤4.0 Hz	≤8.0 Hz	≤16.0 Hz

a. Initial calibration accuracy depends on how accurately the frequency standard was adjusted to 10 MHz.

	Specifications	Supplemental Information
Noise Sidebands (RF Input) [a][b]		
673.6 MHz		
Offset 100 Hz	≤–85 dBc/Hz	
Offset 1 kHz	≤–92 dBc/Hz	
Offset 10 kHz	≤–102 dBc/Hz	
Offset 100 kHz	≤–131 dBc/Hz	
Offset 600 kHz	≤–138 dBc/Hz	
Offset 1.2 MHz	≤–141 dBc/Hz	
Offset 6.0 MHz	≤–145 dBc/Hz	
Offset 10.0 MHz	≤–145 dBc/Hz	
960 MHz		
Offset 100 Hz	≤–81 dBc/Hz	
Offset 1 kHz	≤–87 dBc/Hz	
Offset 10 kHz	≤–96 dBc/Hz	
Offset 100 kHz	≤–125 dBc/Hz	
Offset 600 kHz	≤–136 dBc/Hz	
Offset 1.2 MHz	≤–140 dBc/Hz	
Offset 6.0 MHz	≤–146 dBc/Hz	
Offset 10.0 MHz	≤–146 dBc/Hz	

a. Noise sidebands and spurious responses may be affected by the quality of the external reference when an external reference is used.
b. Offsets <1 MHz measured with RF Input ≥ –2 dBm; Offsets ≥ 1 MHz measured with RF Input >+12 dBm.

	Specifications	Supplemental Information
1990 MHz		
Offset 100 Hz	≤–75 dBc/Hz	
Offset 1 kHz	≤–82 dBc/Hz	
Offset 10 kHz	≤–86 dBc/Hz	
Offset 100 kHz	≤–118 dBc/Hz	
Offset 600 kHz	≤–132 dBc/Hz	
Offset 1.2 MHz	≤–137 dBc/Hz	
Offset 6.0 MHz	≤–141 dBc/Hz	
Offset 10.0 MHz	≤–141 dBc/Hz	
Noise Sidebands[a] (Baseband IQ Inputs)		
0 to 5 MHz		
Offset 1 kHz	≤–120 dBc/Hz	
Offset 10 kHz	≤–133 dBc/Hz	
Offset 100 kHz	≤–134 dBc/Hz	
Offset 1.0 MHz		≤–135 dBc/Hz (nominal)
Offset 5.0 MHz		≤–135 dBc/Hz (nominal)

a. No DC offset applied

	Specifications	Supplemental Information
Spurious Responses (RF Input)[a]		
–10 dBm at input mixer,[b] Manual ADC range		
Input CW frequency from 700 MHz to < 793 MHz 3kHz ≤ |offset| ≤ 50 MHz	≤–59 dBc	
Input CW frequency from 793 MHz to 1678.6 MHz 3kHz ≤ |offset| ≤ 150 MHz Except for 2 x input frequency – 964.2 MHz	≤–59 dBc	
Input CW frequency from > 1678.6 MHz to < 2200 MHz 3kHz ≤ |offset| ≤ 150 MHz	≤–53 dBc	
Input CW frequency from 2200 MHz to 3700 MHz 3kHz ≤ |offset| ≤ 1200 MHz Except for offsets of –160.7 MHz, –482.1 MHz, and –642.8 MHz	≤–53 dBc	
Input CW frequency from > 3700 MHz to 4000 MHz 3kHz ≤ |offset| ≤ 150 MHz	≤–53 dBc	
Spurious Responses[cd] **(Baseband IQ Inputs)**		
Full Scale input level, +13 dBm range	≤–80 dBc	

a. Noise sidebands and spurious responses may be affected by the quality of the external reference when an external reference is used.

b. Mixer power level (dBm) = input power (dBm) – input attenuation (dB).

c. Noise sidebands and spurious responses may be affected by the quality of the external reference when an external reference is used.

d. No DC offset applied

	Specifications	Supplemental Information
Residual Responses (RF Input)		
50 Ω Input terminated, 0 dB input attenuation, +18 dB ADC gain		
20 MHz to 2 GHz	≤–85 dBm	
2 GHz to 4 GHz	≤–80 dBm	
Residual Responses[a] (Baseband IQ Inputs)		
50 Ω Input terminated		
0 to 5 MHz	≤–90 dBm	

	Specifications	Supplemental Information
Spurious Sidebands[b] (Baseband IQ Inputs)		
> 1 kHz Offset	≤–80 dBc	

a. No DC offset applied
b. No DC offset applied

Amplitude

	Specifications	Supplemental Information
RF Input		
Maximum measurement power	+30 dBm (1 W)	
Maximum safe dc voltage	±26 Vdc	
Maximum safe input power	+35 dBm (3.16 W)	
Baseband IQ Inputs		
Input Ranges 50 Ω Input Z	−5 to +13 dBm in four ranges of 6 dB steps: −5 dBm, +1 dBm, +7 dBm, +13 dBm	
Input Ranges 600 Ω, 1 M Ω Input Z	−18 to 0 dBV in four ranges of 6 dB steps: −18 dBV, −12 dBV, −6 dBV, 0 dBV	
Maximum safe input voltage	±5 V (DC + AC)	

	Specifications	Supplemental Information
Input Attenuator (RF Input)		
Range	0 to +40 dB	
Step size	1 dB steps	
Accuracy at 50 MHz	±0.3 dB relative to 10 dB attenuation	

	Specifications	Supplemental Information
1st LO Emission from RF Input		
$f_{emission}$= Center Freq. ± 321.4 MHz		≤(−23 dBm – Input Attenuation), (nominal)

	Specifications		Supplemental Information
Third-order Intermodulation Distortion (RF Input)	Distortion[a]	TOI[b]	TOI
Input power ≤ +27 dBm Pre-ADC Filter ON			
Tone separation ≥ 5 MHz 50 MHz to 4 GHz	<–56 dBc	+18 dBm	+23 dBm (typical)
Tone separation ≥ 50 kHz 30 MHz to 4 GHz	<–54 dBc	+17 dBm	+21 dBm (typical)

	Specifications	Supplemental Information
Harmonic Distortion (Baseband IQ Inputs)		
For one CW input signal 0 to –10 dB below Range	≤–63 dBc	

	Specifications	Supplemental Information
1 dB Gain Compression Pre-ADC Filter ON Total power at input mixer[c]		
1 tone	0 dBm	
2 tones, separation ≥ 3 MHz	+2 dBm	+6 dBm, (typical)
2 tones, separation ≥ 40 MHz	+5 dBm	+10 dBm, (typical)

a. Computed from measured TOI, using the equation: Distortion (in dBc) = 2[mixer tone level (in dBm) – TOI]

b. TOI= third order intercept. The TOI is given by the mixer tone level (in dBm) minus (distortion/2) where distortion is the relative level of the distortion tones in dBc. The measurement is made with two -10 dBm tones at the input mixer.

c. Mixer power level (dBm) = input power (dBm) – input attenuation (dB).

	Specifications	Supplemental Information
Absolute Power Measurement Accuracy (RF Input)		
Excluding mismatch errors Excluding FFT scalloping errors Frequency tuned to the input CW frequency		
0 to 40 dB input attenuation (–2 dBm to –28 dBm) + attenuation, +18 °C to +30 °C		
810 MHz to 960 MHz	±0.60 dB	±0.4 dB, (typical)
1710 MHz to 2205 MHz	±0.60 dB	±0.4 dB, (typical)
1428 MHz to 1503 MHz	±0.60 dB	±0.5 dB, (typical)
10 dB input attenuation +8 dBm to –18 dBm 400 MHz to 2205 MHz		
+18 °C to +30 °C	±0.75 dB	
20 dB input attenuation +18 dBm to –8 dBm 400 MHz to 2205 MHz		
+18 °C to +30 °C	±0.80 dB	
0 to 20 dB input attenuation (–2 dBm to –28 dBm) + attenuation		
7 MHz to 1000 MHz	±1.0 dB	
1000 MHz to 2205 MHz	±1.3 dB	
2205 MHz to 4000 MHz	±1.8 dB	
21 to 30 dB input attenuation (–2 dBm to –28 dBm) + attenuation		
7 MHz to 1000 MHz	±1.1 dB	
1000 MHz to 2205 MHz	±1.5 dB	
2205 MHz to 4000 MHz	±2.0 dB	
31 to 40 dB input attenuation (–2 dBm to –28 dBm) + attenuation		
7 MHz to 1000 MHz	±1.1 dB	
1000 MHz to 2205 MHz	±1.6 dB	
2205 MHz to 4000 MHz	±2.6 dB	

	Specifications	Supplemental Information
Absolute Power Measurement Accuracy (Baseband IQ Inputs)		
Input Impedance = 50 Ω, all ranges	±0.6 dB	
Input Impedance = 600 Ω, all ranges		
0 to 1 MHz	±0.6 dB	
1 MHz to 5 MHz	±2.0 dB	
Input Impedance = 1 M Ω, all ranges		
Unbalanced		±0.7 dB, (nominal)
Balanced		
0 to 1 MHz		±0.6 dB, (nominal)
1 MHz to 5 MHz		±2.0 dB, (nominal)

	Specifications	Supplemental Information
Amplitude Accuracy (–2 dBm)		
Relative to –2 dBm at the Input Mixer[a] (RF Input)		ADC range is set to AUTO.
Power level at the mixer, no averaging		
–2 dBm to –78 dBm[b]	±0.25 dB	±0.15 dB, (typical)
–78 dBm to –88 dBm[c]	±0.70 dB	±0.40 dB, (typical)
–88 dBm to –98 dBm[c]	±1.20 dB	±0.80 dB, (typical)
Power level at the mixer, with 10 averages		
–78 dBm to –88 dBm[c]		±0.25 dB, (nominal)
–88 dBm to –98 dBm[c]		±0.35 dB, (nominal)

a. Mixer power level (dBm) = input power (dBm) – input attenuation (dB).
b. Uncertainty due to amplitude linearity. Does not include uncertainty due to noise.
c. Uncertainty due to amplitude linearity and noise (1 Hz resolution bandwidth)

	Specifications	Supplemental Information
Amplitude Accuracy (–12 dBm) Relative to –12 dBm at the Input Mixer[a] (RF Input) Power level at the mixer, no averaging –12 dBm to –62 dBm[b]	±0.15 dB	±0.10 dB, (typical)

	Specifications	Supplemental Information
Amplitude Linearity (Baseband IQ Inputs)		
0 to –35 dB below Range	±0.17 dB	
–35 to –55 dB below Range	±1.0 dB	

a. Mixer power level (dBm) = input power (dBm) – input attenuation (dB).
b. Uncertainty due to amplitude linearity. Does not include uncertainty due to noise.

	Specifications	Supplemental Information
Displayed Average Noise Level (RF Input) Input terminated in 50 Ω, 0 dB attenuation, 1 kHz RBW, 10 kHz span, +24 dB ADC gain		
7 MHz to 20 MHz	–103 dBm	–111 dBm, (typical)
20 MHz to 2000 MHz	–106 dBm	–111 dBm, (typical)
2000 MHz to 2700 MHz	–103 dBm	–108 dBm, (typical)
2700 MHz to 4000 MHz	–98 dBm	–104 dBm, (typical)
Displayed Average Noise Level[a] (Baseband IQ Inputs) Input terminated in 50 Ω, 50 Ω input impedance, 1 kHz RBW		
1 kHz to 5 MHz		
+13 dBm Range	–95 dBm	–100 dBm, (typical)
+7 dBm Range		–105 dBm, (typical)
+1 dBm Range		–108 dBm, (typical)
–5 dBm Range	–106 dBm	–110 dBm, (typical)

	Specifications	Supplemental Information
DC Offset (Baseband IQ Inputs)		
After Auto-Zero	< –40 dB below Range	–55 dB below Range, (typical)
Compensation for Customer DC Offset	≤ ±2.0 V DC	Offset Accuracy ±2.0% of Range, (nominal)

a. No DC offset applied

	Specifications	Supplemental Information
Channel Match (Baseband IQ Inputs)		
Amplitude match 0 to 5.0 MHz	±0.25 dB	
Phase match 0 to 5.0 MHz	±2.0 degrees	

	Specifications	Supplemental Information
Crosstalk (Baseband IQ Inputs)		
Input Impedance = 50 Ω	< –60 dB	
Input Impedance = 600 Ω	< –52 dB	

	Specifications	Supplemental Information
Common Mode Rejection (Baseband IQ Inputs)		
600 Ω Balanced Inputs		
0 to 0.5 MHz	< –50 dB	
> 0.5 MHz to 5.0 MHz	< –35 dB	

Measurements

These specifications apply to the measurements available in the Basic or Service Modes.

	Specifications	Supplemental Information
Spectrum Measurement		
Range at RF Input Maximum: Minimum:	 +30 dBm (1 W) Displayed Avg Noise Level	
Range at IQ Input Maximum (50 Ω Input): Maximum (600 Ω, 1 M Ω Input): Minimum:	 +13 dBm (20 mW) 0 dBV Displayed Avg Noise Level	
Span Range (RF Input)	10 Hz to 10 MHz	Maximum is 15 MHz in Service Mode 1, 1.5, 2, 3, 5, 7.5, 10 sequence or arbitrary user-definable
Span Range (Composite I/Q Input)	10 Hz to 10 MHz	1, 1.5, 2, 3, 5, 7.5, 10 sequence or arbitrary user-definable
Span Range (Baseband I or Q Only Inputs)	10 Hz to 5 MHz	1, 1.5, 2, 3, 5, 7.5, 10 sequence or arbitrary user-definable
Capture time		267 ns to 40 s 8 points to 65536 points Coupled to span and resolution bandwidth
Resolution BW ranges Overall (Manual):	 100 MHz to 3 MHz	 1, 1.5, 2, 3, 5, 7.5, 10 sequence or arbitrary user-definable
Pre-FFT filter Type: BW:	 Gaussian, Flat Auto, Manual 1 Hz to 10 MHz	
FFT window:	Flat Top; (high amplitude accuracy); Uniform: Hanning; Hamming; Gaussian; Blackman; Blackman-Harris; Kaiser-Bessel 70, 90, 110	
Averaging Avg number: Avg mode: Avg type:	 1 to 10,000 Exponential, Repeat Power Avg (RMS), Log-Power Avg (Video), Voltage Avg, Maximum, Minimum	

	Specifications	Supplemental Information
Spectrum Measurement		
Displays (RF Input)	Spectrum, Linear Spectrum, I/Q waveform, I/Q Polar, Spectrum & I/Q waveform, Adjacent Channel Power, Power Stat CCDF	Service Mode also has RF Envelope and Quad-View
Displays (Baseband IQ Inputs)	Spectrum, Linear Spectrum, I/Q waveform, I/Q Polar, Spectrum & I/Q waveform, Power Stat CCDF	
Y-axis display		
Dynamic range:	10 divisions × scale/div	
Log scale/div range:	0.1 to 20 dB	
Log scale/div increment:	0.01 dB	
Voltage scale/div range:	1 nV to 20 V	
Controls:	Scale/Div, Ref Value, and Ref Position	Allows expanded views of portions of the trace data
Markers	Normal, Delta, Band power, Noise	
Measurement resolution		
Displayed:	0.01 dB	
Remote query:	0.001 dB	
Trigger (RF Input)		
Source:	Free Run (immediate), Video (IF envelope), RF Burst (wideband), External Front Input, External Rear Input, Frame Timer, Line	
Delay, Holdoff, & Auto:		See Trigger Trigger Trigger on page 28.
Trigger (Baseband IQ Inputs)		
Source:	Free Run (immediate), Video (IQ envelope), External Front Input, External Rear Input, Frame Timer, Line	
Delay, Holdoff, & Auto:		See Trigger on page 28.

	Specifications	Supplemental Information
Waveform Measurement		
Range (RF Input)		
Maximum:	+30 dBm (1 W)	
Minimum:	Displayed average noise level	
Range (IQ Input)		
Maximum (50 Ω Input):	+13 dBm (20 mW)	
Maximum (600 Ω, 1 M Ω Input):	1 Volt	
Minimum:	Displayed Avg Noise Level	
Sweep time range		
RBW ≤ 7.5 MHz:	10 μs to 200 ms	Minimum with decimation = 1
RBW ≤ 1 MHz:	10 μs to 400 ms	Maximum with decimation = 4
RBW ≤ 100 kHz:	10 μs to 2 s	
RBW ≤ 10 kHz:	10 μs to 20 s	
Time record length		2 to >900 k points, (nominal)
Resolution bandwidth		1, 1.5, 2, 3, 5, 7.5, 10 sequence or arbitrary user-definable
Gaussian filter:	10 Hz to 8 MHz	
Flat filter:	10 Hz to 10 MHz	
Averaging		
Avg Number:	1 to 10,000	
Avg Mode:	Exponential, Repeat	
Avg Type:	Power Avg (RMS), Log-power Avg (Video), Maximum, Minimum	
Displays (RF Input)	Signal Envelope, I/Q waveform, I/Q Polar	
Displays (Baseband IQ Inputs)	Signal Envelope, Linear Envelope, I/Q waveform, I & Q waveform, I/Q Polar	
Y-axis display		
Dynamic range:	10 divisions x scale/div	
Log scale/div range:	0.1 to 20 dB	
Log scale/div increment:	0.01 dB	
Voltage scale/div range:	1 nV to 20 V	
Controls:	Scale/Div, Ref Value, and Ref Position	Allows expanded views of portions of the trace data.
X-axis display		
Range:	10 divisions x scale/div	
Controls:	Scale/Div, Ref Value, and Ref Position	Allows expanded views of portions of the trace data.
Polar Display		
Controls		
Voltage scale/div range:	1 nV to 20 V	
I and Q Origin	±250 V	

	Specifications	Supplemental Information
Waveform Measurement		
Markers	Normal, Delta, Band Power	
Measurement resolution Displayed: Remote query:	 0.01 dB 0.001 dB	
Trigger (RF Input) Source:	 Free Run (immediate), Video (IF envelope), RF Burst (wideband), External Front Input, External Rear Input, Frame Timer, Line	
Delay, Holdoff, & Auto:		See Trigger on page 28.
Trigger (Baseband IQ Inputs) Source:	 Free Run (immediate), Video (IQ envelope), External Front Input, External Rear Input, Frame Timer, Line	
Delay, Holdoff, & Auto:		See Trigger on page 28.

	Specifications	Supplemental Information
Trigger (RF Input)		
Trigger delay		For Video, Ext Front, Ext Rear
Range:	–500 ms to +500 ms	
Repeatability:	±33 ns	
Resolution:	33 ns	
Trigger slope	Positive, Negative	
Trigger holdoff		
Range:	0 to 500 ms	
Resolution:	1 µs	
Auto trigger	On, Off	
Time interval range:		0 to 1000 s, (nominal) Does an immediate trigger if no trigger occurs before the set time interval.
RF burst trigger		Wideband IF for repetitive burst signals.
Peak carrier power range at RF Input:	+30 dBm to –40 dBm	
Trigger level range:	0 to –25 dB	Rela tive to signal peak
Bandwidth:		>15 MHz, (nominal)
Video (IF envelope) trigger		
Range:	+50 dBm to –200 dBm	

	Specifications	Supplemental Information
Trigger (Baseband I/Q Inputs)		
Trigger delay Range: Repeatability: Resolution:	 –500 ms to +500 ms ±33 ns 33 ns	For Video, RF Burst, Ext Front, Ext Rear
Trigger slope	Positive, Negative	
Auto trigger Time interval range:	 On, Off	 0 to 1000 s, (nominal) Does an immediate trigger if no trigger occurs before the set time interval.
Trigger holdoff Range: Resolution:	 0 to 500 ms 1 µs	
IQ Envelope Trigger Range:	 +50 dBm to –200 dBm	

	Specifications	Supplemental Information
Measurement Control		Single, Continuous, Restart, Pause, Resume

Options

Option BAC:	cdmaOne Personality
Option BAE:	NADC, PDC Personalities
Option BAF:	W-CDMA Personality
Option BAH:	GSM Personality
Option B78:	cdma2000 Personality
Option B7C:	Baseband I/Q Inputs
Option 202:	EDGE (with GSM) Personality
Option 210	HSDPA Personality
Option 204:	1xEV-DO Personality
Option 214	1xEV-DV Personality
Option 300:	Provides a 321.4 MHz IF rear-panel output

General

	Specifications	Supplemental Information
Temperature Range		
Operating	0 °C to +55 °C	
Non-operating	–40 °C to +71 °C	

	Specifications	Supplemental Information
Display[a]		
Resolution	640 × 480	

	Specifications	Supplemental Information
EMI Compatibility	Conducted and radiated emission is in compliance with CISPR Pub. 11/1990 Group 1 Class A.	

a. The LCD display is manufactured using high precision technology. However, there may be up to six bright points (white, blue, red or green in color) that constantly appear on the LCD screen. These points are normal in the manufacturing process and do not affect the measurement integrity of the product in any way.

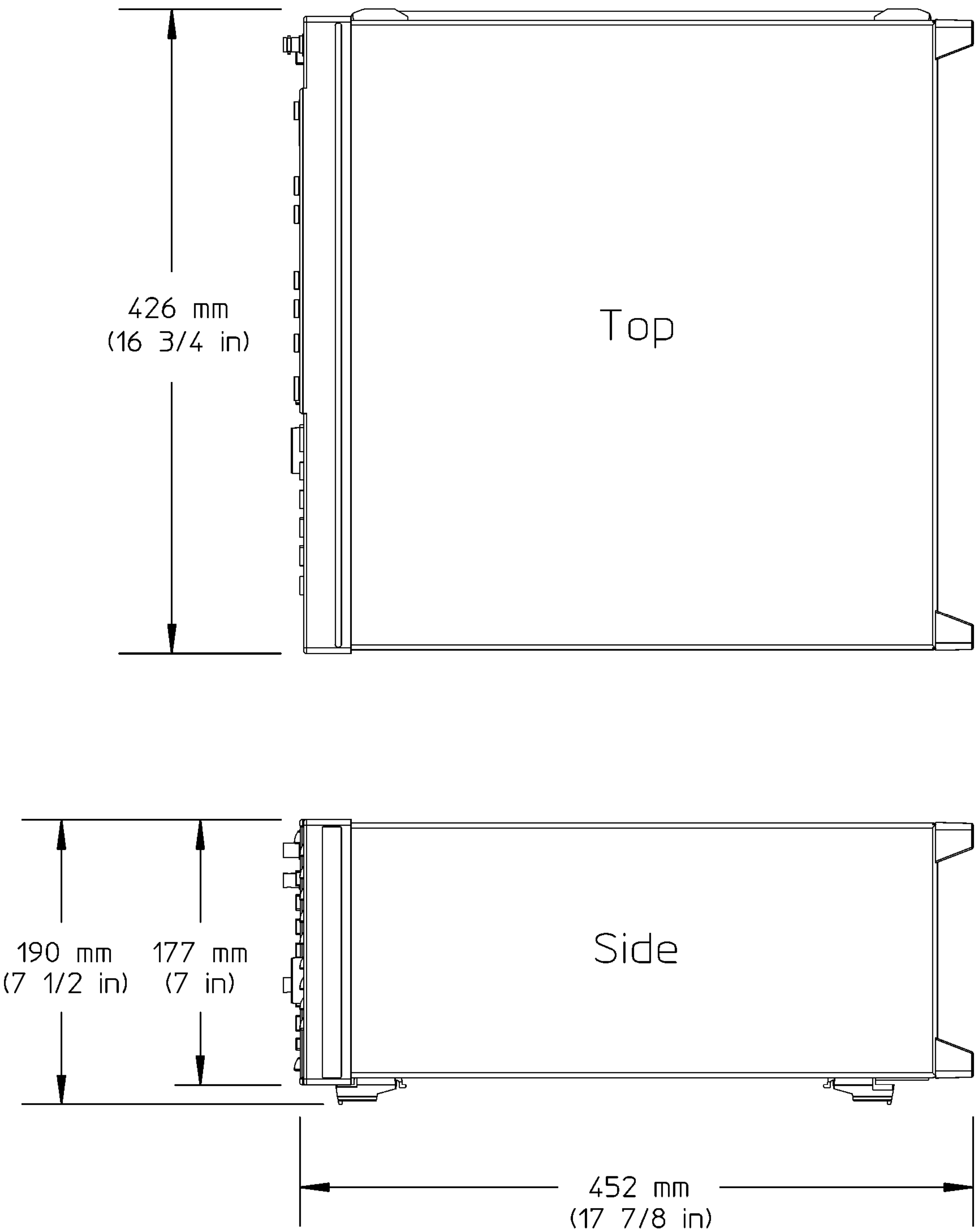
	Specifications	Supplemental Information
Immunity Testing (RF Input)		
Radiated Immunity		When tested at 3 V/m according to IEC 801-3/1984, the displayed average noise level will be within specifications over the full immunity test frequency range of 27 to 500 MHz, except that at immunity test frequencies of 278.6 MHz ± selected resolution bandwidth and 321.4 MHz ± selected resolution bandwidth, the displayed average noise level may be up to –90 dBm. When the analyzer tuned frequency is identical to the immunity test signal frequency there may be signals of up to –90 dBm displayed on the screen.
Electrostatic Discharge		In accordance with IEC 801-2/1991, an air discharge of up to 8 kV, or a contact discharge of up to 4 kV, will not cause any change of instrument state or measurement data. However, discharges to center pins of front or rear panel connectors may cause damage to the associated circuitry.

	Specifications	Supplemental Information
Immunity Testing (Baseband I/Q Inputs)		
Radiated Immunity		When tested at 3 V/m according to IEC 801-3/1984, the displayed average noise level will be within specifications over the full immunity test frequency range of 27 to 500 MHz.
Electrostatic Discharge		In accordance with IEC 801-2/1991, an air discharge of up to 8 kV, or a contact discharge of up to 4 kV, will not cause any change of instrument state or measurement data. However, discharges to center pins of front or rear panel connectors may cause damage to the associated circuitry.

	Specifications	Supplemental Information
Power Requirements		
Voltage, frequency	90 to 132 V rms, 47 to 440 Hz 195 to 250 V rms, 47 to 66 Hz	
Power consumption, ON	<350 W	
Power consumption, Standby	<20 W	

	Specifications	Supplemental Information
Weight		
Net		
Standard E4406A		19 kg (42 lb), (nominal)
E4406A Option B7C		20 kg (44 lb), (nominal)
Shipping		
Standard E4406A		39 kg (86 lb), (nominal)
E4406A Option B7C		40 kg (88 lb), (nominal)

Dimensions



Front Panel

	Specifications	Supplemental Information
RF INPUT		
Connector	Type N female	
Impedance		50 Ω, nominal
VSWR		
20 MHz to 2205 MHz 2205 MHz to 4 GHz 50 MHz	≤1.4 : 1 ≤1.6 : 1 ≤1.4 : 1	≤1.24 : 1, (typical) ≤1.4 : 1, (typical) ≤1.08 : 1, (typical)
Baseband I/Q INPUTS		
Connectors (4 each I, Q, I, Q)	BNC female	See Frequency and Amplitude sections for Baseband Input details
Balanced Input Impedance (4 connectors: I, Q, I, Q)		600 Ω, 1 M Ω, nominal (switchable)
Unbalanced Input Impedance (2 connectors: I, Q)		50 Ω, 1 M Ω, nominal (switchable)
VSWR		
50 Ω Impedance Only	≤1.4 : 1	≤1.08 : 1, (typical)
PROBE PWR		
Voltage/Current		+15 Vdc ±7% at 150 mA max. –12.6 Vdc ±10% at 150 mA max.
EXT TRIGGER INPUT		
Connector	BNC female	
Impedance		10 kΩ, nominal
Trigger level		–5 V to +5 V
Disk Device		Accepts 10-cm (3 1/2-inch) 1.44 megabyte flexible disk (MS-DOS≠ format)

Rear Panel

	Specifications	Supplemental Information
10 MHz OUT (SWITCHED)		
Connector	BNC female	
Impedance		50 Ω, nominal
Output amplitude		≥ 0 dBm, (nominal)

	Specifications	Supplemental Information
EXT REF IN		
Connector	BNC female	Note: Instrument noise sidebands and spurious responses may be affected by the quality of the external reference used.
Impedance		50 Ω, nominal
Input amplitude range		–5 to +10 dBm, (nominal)
Maximum dc level	±28 V dc	
Frequency		1 MHz to 30 MHz, selectable
Internal 10 MHz[a] error		
When EXT REF IN is an integer multiple of 500 kHz or 1.25 MHz		0 Hz
When EXT REF IN is not an integer multiple of 500 kHz or 1.25 MHz		≤0.533 nHz (≤1 degree phase error in 60 days)
Frequency lock range		±5 x 10–6 of the specified external reference input frequency

a. 100 MHz VCXO divided by 10.

	Specifications	Supplemental Information
TRIGGER IN		
Connector	BNC female	
Impedance		10 kΩ, nominal
Trigger level		–5 V to +5 V
TRIGGER 1 OUT		
Connector	BNC female	
Impedance		50 Ω, nominal
Level		0 V to +5 V (No load)
TRIGGER 2 OUT		
Connector	BNC female	
Impedance		50 Ω, nominal
Level		0 V to +5 V (No load)

	Specifications	Supplemental Information
321.4 MHz OUT (Opt. 300)		
Connector	BNC female	
Impedance		50 Ω, nominal
Bandwidth		>300 MHz, (nominal)
Conversion Gain (Input Attenuator 0 dB)		
Tuned Frequency:		
50 MHz		–3.5 dB, (nominal)
400 MHz		–4.5 dB, (nominal)
600 MHz		–5.0 dB, (nominal)
800 MHz		–6.0 dB, (nominal)
1000 MHz		–5.5 dB, (nominal)
2000 MHz		–7.0 dB, (nominal)
2500 MHz		–7.5 dB, (nominal)
3000 MHz		–10.5 dB, (nominal)
4000 MHz		–13.0 dB, (nominal)

	Specifications	Supplemental Information
MONITOR Output		
Connector	VGA compatible, 15-pin mini D-SUB	
Format		VGA (31.5 kHz horizontal, 60 Hz vertical sync rates, non-interlaced)
Resolution	640 x 480	

	Specifications	Supplemental Information
PARALLEL Interface		Printer port only
Connector	25-pin D-SUB	
SERIAL Interface		RS 232 serial interface
Connector	9-pin D-SUB	Feature not implemented
LAN-TP		
Connector	RJ45 Ethertwist	
GP-IB Interface		
Connector	IEEE-488 bus connector	
GP-IB codes		SH1, AH1, T6, SR1, RL1, PP0, DC1, DT1, L4, C0
SCSI Interface		SCSI 2 (Slow narrow single-ended)
Connector	Mini D50, female	Feature not implemented
KYBD Connector	6-pin mini-DIN	Feature not implemented for operation; used for service only

2 Regulatory Information

Safety Warnings and Cautions

WARNING **Warning denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.**

CAUTION Caution denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

WARNING **This is a Safety Class 1 Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protected earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.**

WARNING **The power cord is connected to internal capacitors that may remain live for 5 seconds after disconnecting the plug from its power supply.**

International Regulatory Information

CAUTION — This product is designed for use in Installation Category II and Pollution Degree 2 per IEC 1010 and 664 respectively.

NOTE — This product has been designed and tested in accordance with IEC Publication 1010, Safety Requirements for Electronic Measuring Apparatus, and has been supplied in a safe condition. The instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

	The CE mark is a registered trademark of the European Community.
	The CSA mark is the Canadian Standards Association safety mark.
ISM 1-A	This is a symbol of an Industrial Scientific and Medical Group 1 Class A product (CISPR 11, Clause 4).

Compliance with German Noise Requirements

This is to declare that this instrument is in conformance with the German Regulation on Noise Declaration for Machines (Laermangabe nach der Maschinenlaermrerordnung - 3.GSGV Deutschland).

Acoustic Noise Emission/Geraeuschemission	
LpA <70 dB	LpA <70 dB
Operator position	am Arbeitsplatz
Normal position	normaler Betrieb
per ISO 7779	nach DIN 45635 t.19

Declaration of Conformity

DECLARATION OF CONFORMITY

According to ISO/IEC Guide 22 and CEN/CENELEC EN 45014

Manufacturer's Name: Agilent Technologies, Inc.

Manufacturer's Address: 1400 Fountaingrove Parkway
Santa Rosa, CA 95403-1799
USA

Declares that the product

Product Name: VSA Series Transmitter Tester

Model Number: E4406A

Product Options: This declaration covers all options of the above product.

Conforms to the following product specifications:

EMC: IEC 61326-1:1997+A1:1998 / EN 61326-1:1997+A1:1998

Standard	Limit
CISPR 11:1990 / EN 55011-1991	Group 1, Class A
IEC 61000-4-2:1995+A1998 / EN 61000-4-2:1995	4 kV CD, 8 kV AD
IEC 61000-4-3:1995 / EN 61000-4-3:1995	3 V/m, 80 - 1000 MHz
IEC 61000-4-4:1995 / EN 61000-4-4:1995	0.5 kV sig., 1 kV power
IEC 61000-4-5:1995 / EN 61000-4-5:1996	0.5 kV L-L, 1 kV L-G
IEC 61000-4-6:1996 / EN 61000-4-6:1998	3 V, 0.15 – 80 MHz
IEC 61000-4-11:1994 / EN 61000-4-11:1998	1 cycle, 100%

Safety: IEC 61010-1:1990 + A1:1992 + A2:1995 / EN 61010-1:1993 +A2:1995
CAN/CSA-C22.2 No. 1010.1-92

Supplementary Information:
The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC and carries the CE-marking accordingly.

Santa Rosa, CA, USA 26 April 2000

Greg Pfeiffer/Quality Engineering Manager

For further information, please contact your local Agilent Technologies sales office, agent or distributor.

3 cdmaOne Specifications

Measurements

Measurement specifications only apply over the cellular frequency bands supported by this option.

Measurement	Specifications	Supplemental Information
Channel Power Measurement (1.23 MHz Integration BW)		Integration BW range 1 kHz to 10 MHz
Range at UUT[a] Base station maximum: Mobile station maximum: Minimum:	 +47 dBm (50 W) +40 dBm (10 W) –70 dBm	 With ≥20 dB external attenuation With ≥13 dB external attenuation With ≤10 dB external attenuation
Range at RF Input Maximum: Minimum:	 +30 dBm (1 W) –80 dBm	
Absolute power accuracy for in-band signal (excluding mismatch error)		
+30 dBm to –28 dBm at RF Input: +18 °C to +30 °C: 0 °C to +55 °C:	 ±0.6 dB ±1.1 dB	 ±0.4 dB, (typical) ±0.7 dB, (typical)
–28 dBm to –50 dBm at RF Input: +18 °C to +30 °C: 0 °C to +55 °C:	 ±0.8 dB ±1.3 dB	 ±0.7 dB, (typical) ±0.9 dB, (typical)
–50 dBm to –80 dBm at RF Input[b]: +18 °C to +30 °C: 0 °C to +55 °C:	 ±1.0 dB ±1.2 dB	 ±0.9 dB, (typical)
Relative power accuracy (same channel, different Tx power, input attenuator fixed)[b]		
Input level change 0 to –76 dB[c]:	±0.2 dB	±0.1 dB, (typical)
Resolution Displayed: Remote query:	 0.01 dB 0.001 dB	
Instrument repeatability (over 30 days with daily internal self-alignment)		±0.05 dB, (nominal) Measurement repeatability = instrument repeatability + signal repeatability

a. UUT = Unit Under Test

b. Does not include uncertainty due to noise.

c. Minimum value is for RF Input ≥ –2 dBm and optimum input attenuation.

Measurement	Specifications	Supplemental Information
Code Domain (Base Station)		
Carrier power range at UUT[a] Base station Mobile station	 +47 dBm to –10 dBm +40 dBm to –17 dBm	 With 20 dB external attenuation With 13 dB external attenuation
Carrier power range at RF Input	+30 dBm to –30 dBm	
Measurement interval range	0.25 ms to 30 ms	
Code domain power Display dynamic range	 50 dB	
Accuracy (Walsh channel power within 20 dB of total power)	±0.3 dB	Measurement interval ≥ 1.25 ms.
Resolution	0.01 dB	
Other reported power parameters (dB referenced to total power)	Average active traffic Maximum inactive traffic Average inactive traffic Pilot, paging, sync channels	
Carrier frequency error measurement accuracy	±10 Hz	Excludes frequency reference. Measurement interval ≥ 1.25 ms.
Pilot time offset Range Accuracy Resolution	 –13.33 ms to +13.33 ms ±250 ns 10 ns	(From even second signal to start of PN sequence)
Code domain timing Range Accuracy Resolution	 ±200 ns ±10 ns 0.1 ns	(Pilot to code channel time tolerance) Measurement interval ≥ 1.25 ms.
Code domain phase Range Accuracy Resolution	 ±200 mrad ±20 mrad 0.1 mrad	(Pilot to code channel phase tolerance) Measurement interval ≥ 1.25 ms.
Displays		Power graph & metrics Power graph & 4 markers Power, timing, & phase graphs

a. UUT = Unit Under Test

Measurement	Specifications	Supplemental Information
Modulation Accuracy		
Carrier power range at UUT[a]		
Base station	+47 dBm to –20 dBm	With 20 dB external attenuation
Mobile station	+40 dBm to –27 dBm	With 13 dB external attenuation
Carrier power range at RF Input:	+30 dBm to –40 dBm	
Measurement interval range	0.25 ms to 30 ms	
Rho (waveform quality)		
Range	0.9 to 1.0	Usable range 0.5 to 1.0
Accuracy	±0.005	
Resolution	0.0001	
Frequency error		
Input frequency error range	±900 Hz	
Accuracy	±10 Hz + (transmitter frequency × frequency reference accuracy)	Measurement interval ≥1.25 ms.
Resolution	0.1 Hz	
Base station pilot time offset		(From even second signal to start of PN sequence)
Range	–13.33 ms to +13.33 ms	
Accuracy	±250 ns	
Resolution	10 ns	
EVM		
Floor	2.5%	1.8% (typical)
Accuracy	±0.5%	
Resolution	0.1%	
Carrier feedthrough		
Floor	–55 dBc	
Accuracy	±2.0 dB	
Resolution	0.1 dB	
Magnitude error		
Floor	2.5%	
Accuracy	±0.5%	
Resolution	±0.01%	
Phase error		
Accuracy	±1.0 degrees	
Resolution	0.1 degrees	
Displays	Metric summary Magnitude error graph Phase error graph EVM graph I/Q measured polar graph	

a. UUT = Unit Under Test

Measurement	Specifications	Supplemental Information
Adjacent Channel Power Ratio		
Carrier power range at UUT[a]	+47 to 0 dBm	With 20 dB external attenuation
Carrier power range at RF Input	+30 to –20 dBm	
Dynamic range		Referenced to average power of carrier in 1.23 MHz BW
Offset Freq. Integ. BW		
750 kHz 30 kHz	–82 dBc	
885 kHz 30 kHz	–82 dBc	
1.25625 MHz 12.5 kHz	–86 dBc	
1.98 MHz 30 kHz	–85 dBc	
2.75 MHz 1 MHz	–56 dBc	
Relative accuracy[b]	±0.9 dB	
Resolution	0.01 dB	

Measurement	Specifications	Supplemental Information
Spur Close		At Tx Max Power
Carrier power range at UUT[c] Base station: Mobile station:	 +47 dBm to +13 dBm +40 dBm to +6 dBm	 With 20 dB external attenuation With 13 dB external attenuation
Carrier power range at RF Input	+30 dBm to –30 dBm	
Minimum spurious emission power sensitivity at RF Input	–70 dBm	30 kHz BW
Absolute accuracy for in-band signal (excluding mismatch error)	±1.0 dB	
Relative accuracy[d]	±1.0 dB	
Resolution	0.01 dB	

a. UUT = Unit Under Test
b. Does not include uncertainty due to noise.
c. UUT = Unit Under Test
d. Does not include uncertainty due to noise.

Measurement	Specifications	Supplemental Information
Spectrum	See **Spectrum Measurement** on page 24.	

Measurement	Specifications	Supplemental Information
Waveform (Time Domain)	See **Waveform Measurement** on page 26.	

Frequency

	Specifications	Supplemental Information
In-Band Frequency Range	824 to 849 MHz 869 to 894 MHz	IS-95
	1850 to 1910 MHz 1930 to 1990 MHz	J-STD-008

General

	Specifications	Supplemental Information
Trigger		
Trigger source		RF burst (wideband), Video (IF envelope), Ext Front, Ext Rear. Actual available choices dependent on measurement.
Trigger delay, level, and slope		Each trigger source has a separate set of these parameters.
Trigger delay		
Range:	–500 to +500 ms	
Repeatability:	±33 ns	
Resolution:	33 ns	
External trigger inputs		
Level:		–5 V to +5 V, (nominal)
Impedance:		10 kΩ, nominal

	Specifications	Supplemental Information
Demod Sync		
Even second input		Level and impedance same as Ext Trigger
PN offset range	0 to 511 x 64[chips]	

4 GSM/EDGE Specifications

Measurement	Specifications	Supplemental Information
EDGE Error Vector Magnitude (EVM)		3π/8 shifted 8PSK modulation Specifications based on 3GPP essential conformance requirements, and are based on 200 bursts.
Carrier Power Range at RF Input		–45 dBm (nominal)
EVM		
Range[a]		0 to 25 % (nominal)
Floor (RMS)	0.5 %	0.3 % (typical)
Accuracy[b] (RMS) EVM range 1 % to 11 %	±0.5 %	Power range at RF input from +27 to –12 dBm
Frequency Error	±1 Hz + (transmitter frequency × frequency reference accuracy)	
IQ Origin Offset Range[a]	–20 to –45 dBc	

a. The range specification applies when the Burst Sync is set to Training Sequence.

b. The accuracy specification applies when the EVM to be measured is well above the measurement floor. When the EVM does not greatly exceed the floor, the errors due to the floor add to the accuracy errors. The errors due to the floor are noise-like and add incoherently with the UUT EVM. The errors depend on the EVM of the UUT and the floor as follows: floorerror = sqrt($EVMUUT^2 + EVMsa^2$) – EVMUUT, where EVMUUT is the EVM of the UUT in percent, and EVMsa is the EVM floor of the analyzer in percent. For example, if the EVM of the UUT is 3%, and the floor 0.5%, the error due to the floor is 0.04%. The total reading can be, at its maximum, EVMUUT + floorerror + accyerror, when the accyerror and floorerror are both at their maximums. The minimum reading that would be within the specifications would occur when the floor is near zero and the accuracy error is at its negative limit; in this case the reading could be as low as EVMUUT – accyerror.

Measurement	Specifications	Supplemental Information
Power vs. Time *and* **EDGE Power vs. Time**		GMSK modulation (GSM) 3π/8 shifted 8PSK modulation (EDGE)
		Measures mean transmitted RF carrier power during the useful part of the burst (GSM method) and the power vs. time ramping. 510 kHz RBW
Minimum carrier power at RF Input for GSM and EDGE		–30 dBm (nominal)
Absolute power accuracy for in-band signal (excluding mismatch error)[a]		
18 to 30°C	–0.11 ±0.60 dB	–0.11 ± 0.40 dB (typical)
0 to 55°C	–0.11 ±0.90 dB	
Power ramp relative accuracy		Referenced to mean transmitted power
RF Input Range = Auto[b] +6 dB to noise[bc]	±0.26 dB	
Mixer Level ≤–12 dBm[b] +6 dB to noise[bc]	±0.26 dB	
Measurement floor		–81 dBm + Input Attenuation (nominal)
Time resolution	200 ns	
Burst to mask uncertainty	±0.2 bit (approx ±0.7 μs)	
Trigger to T0 time offset Relative offset accuracy		±5.0 ns (nominal) (EDGE Power vs Time Only)

a. The power versus time measurement uses a resolution bandwidth of about 510 kHz. This is not wide enough to pass all the transmitter power unattenuated, leading the consistent error shown in addition to the uncertainty. A wider RBW would allow smaller errors in the carrier measurement, but would allow more noise to reduce the dynamic range of the low-level measurements. The measurement floor will change by $10 \times \log(\text{RBW}/510\text{kHz})$. The average amplitude error will be about $-0.11\text{dB} \times ((510\text{kHz}/\text{RBW})^2)$. Therefore, the consistent part of the amplitude error can be eliminated by using a wider RBW.

b. Using auto setting of RF Input range optimizes the dynamic range of analysis, but the scale fidelity is poorer at the relatively high mixer levels chosen. Because of this, manually setting the input attenuator so that the mixer level (RF Input power minus Input Attenuation) is lower can improve the relative accuracy of power ramp measurements as shown.

c. The relative error specification does not change as the levels approach the noise floor, except for the effect of the noise power itself. If the mixer level is not high enough to make the contribution of the measurement floor negligible, the noise of the analyzer will add power to the signal being measured, resulting in an error. That error is a function of the signal (carrier power) to noise (measurement floor) ratio (SN), in decibels. The function is error = $10 \times \log(1 + 10^{(-SN/10)})$. For example, if the mixer level is 26.4 dB above the measurement floor, the error due to adding the noise of the analyzer to the UUT is only 0.01 dB.

Measurement	Specifications	Supplemental Information
Phase and Frequency Error		GMSK modulation (GSM) Specifications based on 3GPP essential conformance requirements, and are based on 200 bursts.
Carrier power range at RF Input		+27 to –45 dBm (nominal)
Phase error		
Floor (RMS)	0.5°	
Accuracy (RMS)		
Phase error range 1° to 15°	±0.5°	
Peak phase error		
Floor	<1.5°	
Accuracy	±2.0°	
Phase error range 3° to 25°		
Frequency error		
Accuracy	±5 Hz + (transmitter frequency × frequency reference accuracy)	
I/Q offset		
Range		–15 dBc to –50 dBc (nominal)
Burst sync time uncertainty	±0.1 bit (approx ±0.4 μs)	
Trigger to T0 time offset		
Relative offset accuracy		±5.0 ns (nominal)

Measurement	Specifications		Supplemental Information
Output RF Spectrum *and* **EDGE Output RF Spectrum**			GMSK modulation (GSM) 3π/8 shifted 8PSK modulation (EDGE)
Minimum carrier power at RF Input			−15 dBm (nominal)
ORFS Relative RF Power Uncertainty[a]			
Due to modulation			
Offsets ≤1.2 MHz	±0.26 dB		
Offsets ≥ 1.8 MHz	±0.36 dB		
Due to switching			±0.27 dB (nominal)[b]
ORFS Absolute RF Power Accuracy 18 to 30°C	±0.60 dB		±0.40 dB (typical)
Dynamic Range, Spectrum due to modulation[c] 18 to 30°C			5-pole sync-tuned filters[d] Methods: Direct Time[e] and FFT[f]
Offset Frequency	**GSM**	**EDGE**	
100 kHz[g]	67.7 dB		
200 kHz[g]	73.3 dB		
250 kHz[g]	76.3 dB		
400 kHz	78.4 dB	77.9 dB	
600 kHz	81.1 dB	80.2 dB	
1.2 MHz	85.0 dB	83.3 dB	
1.8 MHz[h]	90.3 dB	82.4 dB	
6.0 MHz[h]	94.0 dB	85.3 dB	
Dynamic Range, Spectrum due to switching[c] 18 to 30°			5-pole sync-tuned filters[i]
Offset Frequency			
400 kHz[g]	68.7 dB		71.2 dB (95%)[j]
600 kHz	71.0 dB		73.1 dB (95%)[j]
1.2 MHz	74.1 dB		77.0 dB (95%)[j]
1.8 MHz	78.4 dB		80.4 dB (95%)[j]

a. The uncertainty in the RF power ratio reported by ORFS has many components. This specification does not include the effects of added power in the measurements due to dynamic range limitations, but does include the following errors: detection linearity, RF and IF flatness, uncertainty in the bandwidth of the RBW filter, and compression due to high drive levels in the front end.

b. ORFS due to switching has very small theoretical errors. But Agilent has been unable to verify this computed accuracy, therefore it is listed as nominal and is not warrented.

c. Maximum dynamic range requires RF input power above –2 dBm for offsets of 1.2 MHz and below. For offsets of 1.8 MHz and above, the required RF input power for maximum dynamic range is +6 dBm for GSM signals and +5 dBm for EDGE signals

d. ORFS standards call for the use of a 5-pole, sync-tuned filter; this and the following footnotes review the instrument's conformance to that standard. Offset frequencies can be measured by using either the FFT method or the direct time method. By default, the FFT method is used for offsets of 400 kHz and below, and the direct time method is used for offsets above 400 kHz. The FFT method is slower and has lower dynamic range than the direct time method.

e. The FFT method uses an exact 5-pole sync-tuned RBW filter, implemented in software.

f. The direct time method uses digital Gaussian RBW filters whose noise bandwidth (the measure of importance to “spectrum due to modulation”) is within ±0.5% of the noise bandwidth of an ideal 5-pole sync-tuned filter. However, the Gaussian filters do not match the 5-pole standard behavior at offsets of 400 kHz and less, because they have *lower* leakage of the carrier into the filter. The lower leakage of the Gaussian filters provides a superior measurement because the leakage of the carrier masks the ORFS due to the UUT, so that less masking lets the test be more sensitive to variations in the UUT spectral splatter. But this superior measurement gives a result that does not conform with ORFS standards. Therefore, the default method for offsets of 400 kHz and below is the FFT method.

g. The dynamic range for offsets at and below 400 kHz is not directly observable because the signal spectrum obscures the result. These dynamic range specifications are computed from phase noise observations.

h. Offsets of 1.8 MHz and higher use 100 kHz analysis bandwidths.

i. The impulse bandwidth (the measure of importance to “spectrum due to switching transients”) of the filter used in the direct time method is 0.8% less than the impulse bandwidth of an ideal 5-pole sync-tuned filter, with a tolerance of ±0.5%. Unlike the case with spectrum due to modulation, the shape of the filter response (Gaussian vs sync-tuned) does not affect the results due to carrier leakage, so the only parameter of the filter that matters to the results is the impulse bandwidth. There is a mean error of –0.07 dB due to the impulse bandwidth of the filter, which is compensated in the measurement of ORFS due to switching. By comparison, an analog RBW filter with a ±10% width tolerance would cause a maximum amplitude uncertainty of 0.9 dB.

j. Dynamic ranges for ORFS due to switching marked as “95%” are derived from 95^{th} percentile observations with 95% confidence during a pilot run whose size was statistically significant. A guardband is added to the results to account for measurement uncertainty in the measurement of the components of ORFS due to switching and environmental changes over the 18-30 °C temperature.

Frequency

Description	GSM Specifications	EDGE Specifications	Supplemental Information
In-Band Frequency Ranges[a]			
GSM 900, P-GSM	890 to 915 MHz 935 to 960 MHz	890 to 915 MHz 935 to 960 MHz	
GSM 900, E-GSM	880 to 915 MHz 925 to 960 MHz	880 to 915 MHz 925 to 960 MHz	
DCS1800	1710 to 1785 MHz 1805 to 1880 MHz	1710 to 1785 MHz 1805 to 1880 MHz	
PCS1900	1850 to 1910 MHz 1930 to 1990 MHz		
GSM850	824 to 849 MHz 869 to 894 MHz		

Description	GSM Specifications	EDGE Specifications	Supplemental Information
Alternative Frequency Ranges[b]			
Down Band GSM	400 to 500 MHz	400 to 500 MHz	
GSM450	450.4 to 457.6 MHz 460.4 to 467.6 MHz		
GSM480	478.8 to 486 MHz 488.8 to 496 MHz		
GSM700	447.2 to 761.8 MHz		

a. Frequency ranges over which all specifications apply.

b. Frequency ranges with tuning plans but degraded specifications for absolute power accuracy. The degradation should be nominally ±0.30 dB.

General

Description	Specifications	Supplemental Information
Trigger		
Trigger source		RF burst (wideband), Video (IF envelope), Ext Front, Ext Rear, Frame Timer. Actual available choices dependent on measurement.
Trigger delay, level, and slope		Each trigger source has a separate set of these parameters.
Trigger delay		
Range	–500 to +500 ms	
Repeatability	±33 ns	
Resolution	33 ns	
External trigger inputs		
Level		5V TTL (nominal)
Impedance		10 kΩ (nominal)
Burst Sync		
Source		Training sequence, RF amplitude, None. Actual available choices dependent on measurement.
Training sequence code		GSM defined 0 to 7 Auto (search) or Manual
Burst type		Normal (TCH & CCH) Sync (SCH) Access (RACH)
Range Control		RF Input Autorange[a] Manually set **Max Total Pwr** Manually set **Input Atten**

a. Autorange is *not* continuous with each measurement acquisition; it will run only once immediately following a measurement restart, initiated either by pressing the **Restart** hardkey, or by sending the GPIB command `INIT:IMM`. This behavior was chosen to maintain best measurement speed, but it requires caution when input power levels change. If the input signal power changes, the analyzer will not readjust the input attenuators for optimal dynamic range unless a measurement restart is initiated. For example, if a sequence of power measurements is made, beginning with a maximum power level that is large enough to require non-zero input attenuation, it is advisable to do a measurement restart to automatically set a lower input attenuator value to maintain optimal dynamic range for approximately every 3 dB the input signal power level is reduced, or smaller, depending upon how precisely dynamic range needs to be optimized. Conversely, if the input signal power increases to a high enough level, input overloading will occur if the input attenuators are not readjusted by doing a measurement restart.

5 NADC Specifications

Measurements

Measurement specifications only apply over the cellular frequency bands supported by this option.

Measurement	Specifications	Supplemental Information
Adjacent Channel Power Ratio		
Carrier Power Range at UUT[a]	+36 to –11 dBm	With 11 dB external atten.
Carrier Powr Range at RF Input	+27 to –20 dBm	
Adjacent Channel Power Ratio Range:		
At 30 KHz offset		0 to –35 dB, (nominal)
At 60 KHz offset	0 to –65 dB	
At 90 KHz offset	0 to –70 dB	
Accuracy	±1.0 dB	

Measurement	Specifications	Supplemental Information
Error Vector Magnitude (EVM)		
Carrier Power Range at UUT[b]	+36 to –11 dBm	With 11 dB external atten.
Carrier Power Range at RF Input	+27 to –20 dBm	
EVM		
Range	0 to 25 %	
Floor	1.0 %	
Accuracy	±0.6 %	±0.5 %, (typical)
Resolution	0.01 %	Display resolution
I/Q Origin offset		
Range	–10 to –50 dBc	
Resolution	0.01 dB	Display resolution
Carrier Frequency Error		
Frequency Resolution	0.01 Hz	Display resolution

a. UUT = Unit Under Test
b. UUT = Unit Under Test

Measurement	Specifications	Supplemental Information
Spectrum	See **Spectrum Measurement** on page 24.	
Waveform (Time Domain)	See **Waveform Measurement** on page 26.	

Frequency

	Specifications	Supplemental Information
In-Band Frequency Range		
800 MHz Band	824 to 849 MHz 869 to 894 MHz	
PCS Band	1850 to 1910 MHz 1930 to 1990MHz	

General

	Specifications	Supplemental Information
Trigger		
Trigger source		RF burst (wideband), Video (IF envelope), Ext Front, Ext Rear. Actual available choices dependent on measurement.
Trigger delay, level, and slope		Each trigger source has a separate set of these parameters.
Trigger delay		
Range	–500 to +500 ms	
Repeatability	±33 ns	
Resolution	33 ns	
External trigger inputs		
Level		–5 V to +5 V, (nominal)
Impedance		10 kΩ, nominal

6 PDC Specifications

Measurements

Measurement specifications only apply over the cellular frequency bands supported by this option.

Measurement	Specifications	Supplemental Information
Adjacent Channel Power Ratio		
Carrier Power Range at UUT[a]	+37 to –10 dBm	With 10 dB external atten.
Carrier Powr Range at RF Input	+27 to –20 dBm	
Adjacent Channel Power Ratio Range		
At 50 KHz offset	0 to –55 dB	
At 100 KHz offset	0 to –70 dB	
Accuracy	±1.0 dB	

Measurement	Specifications	Supplemental Information
Error Vector Magnitude (EVM)		
Carrier Power Range at UUT[b]	+37 to –10 dBm	With 10 dB external atten.
Carrier Power Range at RF Input	+27 to –20 dBm	
EVM		
Range	0 to 25 %	
Floor	1.0 %	
Accuracy	±0.6 %	±0.5 %, typical
Resolution	0.01 %	Display resolution
I/Q Origin offset		
Range	–10 to –50 dBc	
Resolution	0.01 dB	Display resolution
Carrier Frequency Error		
Frequency Resolution	0.01 Hz	Display resolution

a. UUT = Unit Under Test
b. UUT = Unit Under Test

Measurement	Specifications	Supplemental Information
Occupied Bandwidth		
Carrier power range at UUT[a]	+37 to –10 dBm	With 10 dB external atten.
Carrier power range at RF Input	+27 to –20 dBm	
Frequency		
Resolution	0.1 kHz	
Accuracy	+400 Hz, –100 Hz	

Measurement	Specifications	Supplemental Information
Spectrum	See **Spectrum Measurement** on page 24.	

Measurement	Specifications	Supplemental Information
Waveform (Time Domain)	See **Waveform Measurement** on page 26.	

Frequency

	Specifications	Supplemental Information
In-Band Frequency Range		
800MHz Band #1	810 to 828 MHz 940to 958 MHz	
800MHz Band #2	870 to 885 MHz 925 to 940 MHz	
800MHz Band #3	838 to 840 MHz 893 to 895 MHz	
1500 MHz Band	1477 to 1501 MHz 1429 to 1453 MHz	

a. UUT = Unit Under Test

General

	Specifications	Supplemental Information
Trigger		
Trigger source		RF burst (wideband), Video (IF envelope), Ext Front, Ext Rear, Frame Timer. Actual available choices dependent on measurement.
Trigger delay, level, and slope		Each trigger source has a separate set of these parameters.
Trigger delay		
Range	–500 to +500 ms	
Repeatability	±33 ns	
Resolution	33 ns	
External trigger inputs		
Level		–5 V to +5 V, (nominal)
Impedance		10 kΩ, nominal

7 W-CDMA Specifications

Conformance With 3GPP TS 25.141

Conformance With 3GPP TS 25.141 Base Station Requirements for a Manufacturing Environment

Sub-clause	Name	3GPP Required Test Instrument Tolerance (as of 2002-06)	Instrument Tolerance Interval[abc]	Supplemental Information
Conditions 25 to 35 °C[d] Derived tolerances[e] 95th percentile[a] 100 % limit tested[b] Calibration uncertainties included[c]				
6.2.1	**Maximum Output Power**	±0.7 dB (95 %)	±0.29 dB (95 %)	±0.63 dB (100 %)
6.2.2	**CPICH Power Accuracy**	±0.8 dB (95 %)	±0.30 dB (95 %)	–10 dB CDP[f]
6.3.4	**Frequency Error**	±12 Hz (95 %)	±10 Hz (100 %)	Freq Ref locked[g]
6.4.2	**Power Control Steps**[h]			
	1 dB step	±0.1 dB (95 %)	±0.03 dB (95 %)	Test Model 2
	0.5 dB step	±0.1 dB (95 %)	±0.03 dB (95 %)	Test Model 2
	Ten 1 dB steps	±0.1 dB (95 %)	±0.03 dB (95 %)	Test Model 2
	Ten 0.5 dB steps	±0.1 dB (95 %)	±0.03 dB (95 %)	Test Model 2
6.4.3	**Power Dynamic Range**	±1.1 dB (95 %)	±0.50 dB (95 %)	
6.4.4	**Total Power Dynamic Range**[h]	±0.3 dB (95 %)	±0.015 dB (95 %)	Ref –35 dBm at mixer[i]
6.5.1	**Occupied Bandwidth**	±100 kHz (95 %)	±38 kHz (95 %)	10 averages[j]
6.5.2.1	**Spectrum Emission Mask**	±1.5 dB (95 %)	±0.59 dB (95 %)	Absolute peak[k]
6.5.2.2	**ACLR**			
	5 MHz offset	±0.8	±0.34 dB (95 %)	±0.93 dB (100 %)
	10 MHz offset	±0.8	±0.40 dB (95 %)	±0.82 dB (100 %)
6.7.1	**EVM**	±2.5 % (95 %)	±1.0 % (95 %)	Range 15 to 20 %[l]
6.7.2	**Peak Code Domain Error**	±1.0 dB (95 %)	±1.0 dB (nominal)	

a. Those tolerances marked as 95 % are derived from 95th percentile observations with 95 % confidence.

b. Those tolerances marked as 100 % are derived from 100 % limit tested observations. Only the 100 % limit tested observations are covered by the product warranty.

c. The computation of the instrument tolerance intervals shown includes the uncertainty of the tracing of calibration references to national standards. It is added, in a root-sum-square fashion, to the observed performance of the instrument.

d. This table is intended for users in the manufacturing environment, and as such, the tolerance limits have been computed for temperatures of the ambient air near the analyzer of 25 to 35 °C.
e. Most of the tolerance limits in this table are derived from measurements made of standard instrument specifications, rather than direct observations.
f. Tolerance limits are computed for a CPICH code domain power of –10 dB relative to total signal power.
g. The frequency references of the DUT and the test equipment must be locked together to meet this tolerance interval.
h. These measurements are obtained by utilizing the code domain power function or general instrument capability. The tolerance limits given represent instrument capabilities.
i. The tolerance interval is based on the largest signal power being –35 dBm at the mixer.
j. The OBW measurement errors are dominated by the noise-like nature of the signal. The errors decline in proportion to the square root of the number of averages. The tolerance interval shown is for ten averages.
k. The tolerance interval shown is for the peak absolute power of a CW-like spurious signal. The standards for SEM measurements are ambiguous as of this writing; the tolerance interval shown is based on Agilent's interpretation of the current standards and is subject to change.
l. EVM tolerances apply with signals having EVMs within +/-2.5 % of the required 17.5 % EVM limit.

Measurement	Specifications	Supplemental Information
Channel Power		
Minimum power at RF Input		–70 dBm (nominal)
Absolute power accuracy [a] 18 to 30°C	±0.63 dB	±0.41 dB (typical)
Measurement floor		–73 dBm (nominal)
Channel Power (Baseband IQ Inputs)		
Input Ranges		
50 Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm	
600 Ω, 1 MΩ, Input Z	–18 to 0 dBV in four ranges of 6 dB steps: –18 dBV, –12 dBV, –6 dBV, 0 dBV	
Absolute power accuracy for in-band signal (excluding mismatch error) 18 °C to 30 °C		
Input Impedance = 50 Ω, all ranges	±0.6 dB	
Input Impedance = 600 Ω, all ranges		
0 to 1 MHz 1 MHz to 5 MHz	±0.6 dB ±2.0 dB	
Input Impedance = 1 MΩ, all ranges Unbalanced		±0.7 dB (nominal)
Balanced 0 to 1 MHz 1 MHz to 5 MHz		 ±0.6 dB (nominal) ±2.0 dB (nominal)

a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that measurement floor contribution is negligible. If the mixer level is not high enough to make the contribution of the measurement floor negligible,the noise of the analyzer will add power to the signal being measured, resulting in an error. That error is a function of the signal (channel power) to noise (measurement floor) ratio, SN, in decibels. The function is error = 10*log(1 + 10^(-SN/10)). For example, if the mixer level is 26.4 dB above the measurement floor, the error due to adding the analyzer's noise to the UUT is only 0.01 dB.

Measurement		Specifications	Supplemental Information
Adjacent Channel Power Ratio (ACPR; ACLR)[a]			Specifications apply for Sweep Method = FFT or Swp
Minimum power at RF Input			–27 dBm (nominal)
ACPR Accuracy[b]			RRC weighted, 3.84 MHz noise bandwidth
Radio	Offset Freq.		
MS (UE)	5 MHz	±0.20 dB	At ACPR range of –30 to –36 dBc with optimum mixer level[c]
MS (UE)	10 MHz	±0.30 dB	At ACPR range of –40 to –46 dBc with auto-ranged[d]
BTS	5 MHz	±0.93 dB	At ACPR range of –42 to –48 dBc with optimum mixer level[e]
BTS	10 MHz	±0.82 dB	At ACPR range of –47 to –53 dBc with auto-ranged[d]
BTS	5 MHz	±0.39 dB	At –48 dBc non-coherent ACPR[f]
Dynamic Range			RRC weighted, 3.84 MHz noise bandwidth
Offset Frequency			
5 MHz			–68 dB (nominal)[g]
10 MHz			–72 dB (nominal)[g]

a. Most versions of adjacent channel power measurements use negative numbers, in units of dBc, to refer to the power in an adjacent channel relative to the power in a main channel, in accordance with ITU standards. The standards for W-CDMA analysis include ACLR, a positive number represented in dB units. In order to be consistent with other kinds of ACP measurements, this measurement and its specifications will use negative dBc results, and refer to them as ACPR, instead of positive dB results referred to as ACLR. The ACLR can be determined from the ACPR reported by merely reversing the sign.

b. The accuracy of the Adjacent Channel Power Ratio will depend on the mixer drive level and whether the distortion products from the analyzer are coherent with those in the UUT. Except for the “noncoherent case” described in footnote f, the specifications apply even in the worst case condition of coherent analyzer and UUT distortion products. For ACPR levels other than those in this specifications table, the optimum mixer drive level for accuracy is approximately –27 dBm - (ACPR/3), where the ACPR is given in (negative) decibels.

c. In order to meet this specified accuracy when measuring mobile station (MS) or user equipment (UE) within 3 dB of the required –33 dBc ACPR, the mixer level (ML) must be optimized for accuracy. This optimum mixer level is –15 dBm, so the input attenuation must be set as close as possible to the average input power - (–15 dBm). For example, if the average input power is –6 dBm, set the attenuation to 9 dB. This specification applies for the normal 3.5 dB peak-to-average ratio of a single code. Note that, if the mixer level is set to optimize dynamic range instead of accuracy, accuracy errors are nominally doubled.

d. ACPR accuracy at 10 MHz offset is warranted when RF Input Range is set to Auto.

e. To meet this specified accuracy, the mixer level must be optimized for accuracy when measuring Node-B of the Base Transmission Station (BTS) within 3 dB of the required –45 dBc ACPR. This optimum mixer level is –11 dBm, so the input attenuation must be set as close as possible to the average input power - (–11 dBm). For example, if the average input power is –6 dBm, set the attenuation to 5 dB. This specification applies for the normal 10 dB peak-to-average ratio (at 0.01 % probability) for Test Model 1. Note that, if the mixer level is set to optimize dynamic range instead of accuracy, accuracy errors are nominally doubled.

f. Accuracy can be excellent even at low ACPR levels assuming that the user sets the mixer level to optimize the dynamic range, and assuming that the analyzer and UUT distortions are incoherent. When the errors from the UUT and the analyzer are incoherent, optimizing dynamic range is equivalent to minimizing the contribution of analyzer noise and distortion to accuracy, though the higher mixer level increases the display scale fidelity errors. This incoherent addition case is commonly used in the industry and can be useful for comparison of analysis equipment, but this incoherent addition model is often not justified.

g. The average input power level should be at least 0 dBm and RF Input Range should be set to Auto

Measurement	Specifications	Supplemental Information
Multi-Carrier Power		
Minimum Carrier Power at RF Input		–15 dBm (nominal)
ACPR Dynamic Range, two carriers		RRC weighted, 3.84 MHz noise bandwidth
5 MHz offset		–64 dB (nominal)
10 MHz offset		–68 dB (nominal)
ACPR Accuracy, two carriers		
5 MHz offset, –48 dBc ACPR		±0.70 dB (nominal)

Measurement	Specifications	Supplemental Information
Power Statistics CCDF		
Minimum Power at RF Input		–40 dBm, average (nominal)
Histogram Resolution	0.01 dB[a]	
Power Statistics CCDF (Baseband IQ inputs)		
Input Ranges		
50 Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm	
Input Ranges		
600 Ω, 1 MΩ Input Z	–18 to 0 dBV in four ranges of 6 dB steps: –18 dBV, –12 dBV, –6 dBV, 0 dBV	
Absolute power accuracy for in-band signal (excluding mismatch error) 18 °C to 30 °C		
Input Impedance = 50 Ω, all ranges	±0.6 dB	
Input Impedance = 600 Ω, all ranges		
0 to 1 MHz	±0.6 dB	
1 MHz to 5 MHz	±2.0 dB	

a. The Complementary Cumulative Distribution Function (CCDF) is a reformatting of a histogram of the power envelope. The width of the amplitude bins used by the histogram is the histogram resolution. The resolution of the CCDF will be the same as the width of those bins.

Measurement	Specifications	Supplemental Information
Intermodulation		
Minimum Carrier Power at RF Input		–20 dBm (nominal)

Measurement	Specifications	Supplemental Information
Occupied Bandwidth		
Minimum carrier power at RF Input		–20 dBm (nominal)
Frequency Resolution	100 Hz	
Frequency Accuracy		$\frac{1.4\%}{\sqrt{N_{avg}}}$ (nominal)[a]

a. The errors in Occupied Bandwidth measurement are due mostly to the noisiness of any measurement of a noise-like signal, such as the W-CDMA signal. The observed standard deviation of the OBW measurement is 60 kHz, so with 1000 averages, the standard deviation should be about 2 kHz, or 0.05 %. The frequency errors due to the FFT processing are computed to be 0.028 % with the RBW (30 kHz) used.

Measurement	Specifications	Supplemental Information
Spectrum Emission Mask		
Minimum power at RF Input		–20 dBm (nominal)
Dynamic Range, relative[a]		
2.515 MHz offset[b]	–77.9 dB	–82.8 dB (typical)
1980 MHz region[c]	–72.2 dB	–77.2 dB (typical)
Sensitivity, absolute[d]		
2.515 MHz offset[e]	–88.9 dBm	–93.9 dBm (typical)
1980 MHz region[f]	–72.9 dBm	–77.9 dBm (typical)
Accuracy, relative		
Display = Abs Peak Pwr[g]	±0.60 dB	±0.40 dB (typical)
Display = Rel Peak Pwr[h]	±0.25 dB	

a. The dynamic range specification is the ratio of the channel power to the power in the offset and region specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. This specification is derived from other analyzer performance limitations such as third-order intermodulation, DANL and phase noise. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Mixer level is defined to be the input power minus the input attenuation.

b. Default measurement settings include 30 kHz RBW. This dynamic range specification applies for the optimum mixer level, which is about –9dBm.

c. Default measurement settings include 1200 kHz RBW. This dynamic range specification applies for a mixer level of 0dBm. Higher mixer levels can give up to 5 dB better dynamic range, but at the expense of compression in the input mixer, which reduces accuracy. The compression behavior of the input mixer is specified in the PSA Specifications Guide; the levels into the mixer are nominally 8 dB lower in this application when the center frequency is 2 GHz.

d. The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal.

e. The sensitivity at this offset is specified in the default 30 kHz RBW.

f. The sensitivity for this region is specified in the default 1200 kHz bandwidth.

g. The absolute accuracy is a measure of the total power at the offsets. It applies for spectrum emission levels in the regions that are well above the dynamic range limitation.

h. The relative accuracy is a measure of the ratio of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are well above the dynamic range limitation.

Measurement	Specifications	Supplemental Information
Code Domain		Specifications apply to BTS and where the mixer level (RF input power minus attenuation) is between –20 and –10 dBm [b]
25 to 35° C[a]		
Code domain power		
Minimum power at RF input		–70 dBm (nominal)[cd]
Relative accuracy[e]		
Test signal		
Test Model 2 Code domain power range		
0 to –10 dBc –10 to –30 dBc –30 to –40 dBc		±0.015 dB ±0.06 dB ±0.07 dB
Test Model 1 with 32 DPCH Code domain power range		
0 to –10 dBc –10 to –30 dBc –30 to –40 dBc		±0.015 dB ±0.08 dB ±0.15 dB
Symbol power vs. time[f]		
Minimum power at RF Input		–45 dBm (nominal)[cd]
Relative accuracy Test signal Test Model 1 with 32 DPCH signal Code domain power range		
0 to –25 dBc –25 to –40 dBc		±0.10 dB ±0.50 dB
Symbol error vector magnitude		
Minimum power at RF Input		–45 dBm (nominal)[cd]
Accuracy		
Test signal Test Model 1 with 32 DPCH signal Code domain power range 0 to –25 dBc		±1.0 %

a. This table is intended for users in the manufacturing environment, and as such, the tolerance limits have been computed for temperatures of the ambient air near the analyzer of 25 to 35 °C.

b. All specifications given are derived from 95th percentile observations with 95 % confidence.

c. Predefined test models under the Symbol Boundary menu are recommended for RF input power levels below –55 dBm. At low signal-to-noise ratios the auto channel ID algorithm may not correctly detect an active code channel as turned on. The predefined test model bypasses the auto channel ID algorithm.

d. Nominal operating range. Accuracy specification applies when mixer level (RF input power minus attenuation) is between –20 and –10 dBm.

e. A code channel power measurement made on a specific spreading code includes all power that projects onto that code. This power is primarily made up from the intended signal power that was spread using that code, but also includes that part of the SCH power (when present) that also projects onto the code being measured. The reason for this addition is that the SCH power is spread using a gold code, which is not orthogonal to the code being measured. The increase in decibels due to this SCH leakage effect is given by the following formula:

SCH leakage effect = $10 \log (10^{S/10}/(10F) + 10^{C/10}) - C$

Where:

S = Relative SCH power in dB (during the first 10 % of each timeslot)

F = Spreading factor of the code channel being measured

C = Ideal relative code channel power in dB (excluding SCH energy)

For example, consider a composite signal comprising the SCH set to –10 dB during the first 10 % of each slot, and a DPCH at spreading factor 128 set to –28 dB. Performing a code channel power measurement on the DPCH will return a nominal code channel power measurement of –27.79 dB. The SCH leakage effect of 0.21 dB should not be considered as a measurement error but rather the expected consequence of the non-orthogonal SCH projecting energy onto the code used by the DPCH.

In order to calculate the ideal code channel power C from a code channel power measurement M that includes SCH energy, the following formula can be used:

$C = 10 \log (10^{M/10} - 10^{S/10}/(10F))$

Therefore a code channel power measurement M = –27.79 dB at spreading factor 128 of a signal including a relative SCH power of –10 dB indicates an ideal code channel power of –28 dB

f. The SCH leakage effect due to its being spread by a gold code not orthogonal to the symbol power being measured will add additional power to the measured result during the portion of the slot where SCH power is present. When SCH power is present, the accuracy specification excludes the noise-like contribution of the SCH power.

Description	Specifications	Supplemental Information
QPSK EVM		
Minimum power at RF Input		–20 dBm (nominal)
QPSK Downlink		
EVM		
Operating range		0 to 25 % (nominal)
Floor		1.5 % (nominal)
Accuracy[a]		±1.0 % (nominal) at EVM of 10 %
I/Q origin offset		
Range		–10 to –50 dBc (nominal)
Frequency error		
Range		±300 kHz (nominal)
Accuracy		±10 Hz (nominal) + (transmitter frequency × frequency reference accuracy)
12.2 k RMC Uplink		
EVM		
Operating range		0 to 20 % (nominal)
Floor		1.5 % (nominal)
Accuracy[a]		±1.0 % (nominal) at EVM of 10 %
I/Q origin offset		
Range		–10 to –50 dBc (nominal)
Frequency error		
Range		±20 kHz (nominal)
Accuracy		±10 Hz (nominal) + (transmitter frequency × frequency reference accuracy)

a. The accuracy specification applies when the EVM to be measured is well above the measurement floor. When the EVM does not greatly exceed the floor, the errors due to the floor add to the accuracy errors. The errors due to the floor are noise-like and add incoherently with the UUT EVM. The errors depend on the EVM of the UUT and the floor as follows: error = sqrt($EVMUUT^2$ + $EVMsa^2$) – EVMUUT, where EVMUUT is the EVM of the UUT in percent, and EVMsa is the EVM floor of the analyzer in percent. For example, if the EVM of the UUT is 7 %, and the floor is 2.5 %, the error due to the floor is 0.43 %. The total error can cause a reading as high as EVMUUT + floorerror + accyerror, or as low as EVMUUT – accyerror, where floorerror is the result of the error computation due to the floor, and accyerror is the specified accuracy.

Measurement	Specifications	Supplemental Information
Power Control and **Power vs. Time**		
Absolute power measurement		Using 5 MHz resolution bandwidth
Accuracy		
0 to –20 dBm		±0.7 dB (nominal)
–20 to –60 dBm		±1.0 dB (nominal)
Relative power measurement		
Accuracy		
Step range ±1.5 dB		±0.1 dB (nominal)
Step range ±3.0 dB		±0.15 dB (nominal)
Step range ±4.5 dB		±0.2 dB (nominal)
Step range ±26.0 dB		±0.3 dB (nominal)

Measurement	Specifications	Supplemental Information
Modulation Accuracy (Composite EVM)		Specifications apply to BTS and where the mixer level (RF input power minus attenuation) is between –20 and –10 dBm. [b]
25 to 35° C[a]		
Minimum power at RF input		–75 dBm (nominal) [c]
Composite EVM		
Test Model 4		
Range	0 % to 25 %	
Floor	1.5 %	
Accuracy[d]		±1.0 %
Test Model 1 with 32 DPCH		
Range	0 % to 25 %	
Floor	1.5 %	
Accuracy		±1.0 %
Peak Code Domain Error Using Test Model 3 with 16 PCH signal, and a spreading code of 256		
Accuracy		±1.0 dB (nominal)
I/Q orgin offset		
Range		–10 to –50 dBc (nominal)
Frequency error Specified for CPICH power ≥ –15 dBc		
Range	±500 Hz	
Accuracy	±2 Hz + (transmitter frequency × frequency reference accuracy)	
Time Offset		
Absolute frame offset accuracy	±150 ns	
Relative frame offset accuracy		±5.0 ns (nominal)
Relative offset accuracy (for STTD diff mode)	±1.25 ns	

a. This table is intended for users in the manufacturing environment, and as such, the tolerance limits have been computed for temperatures of the ambient air near the analyzer of 25 to 35 °C.
b. All specifications given are derived from 95th percentile observations with 95 % confidence.
c. Predefined test models under the Symbol Boundary menu are recommended for RF input power levels below –55 dBm. At low signal-to-noise ratios the auto channel ID algorithm may not correctly detect an active code channel as turned on. The predefined test model bypasses the auto channel ID algorithm.
d. The accuracy specification applies when the EVM to be measured is well above the measurement floor. When the EVM does not greatly exceed the floor, the errors due to the floor add to the accuracy errors. The errors due to the floor are noise-like and add incoherently with the UUT EVM. The errors depend on the EVM of the UUT and the floor as follows: error = sqrt($EVMUUT^2$ + $EVMsa^2$) EVMUUT, where EVMUUT is the EVM of the UUT in percent, and EVMsa is the EVM floor of the analyzer in percent. For example, if the EVM of the UUT is 7 %, and the floor is 2.5 %, the error due to the floor is 0.43 %. The total error can cause a reading as high as EVMUUT + floorerror + accyerror, or as low as EVMUUT – accyerror, where floorerror is the result of the error computation due to the floor, and accyerror is the specified accuracy.

Frequency

Measurement	Specifications	Supplemental Information
In-Band Frequency Range	2110 to 2170 MHz 1920 to 1980 MHz	

General

Measurement	Specifications	Supplemental Information
Trigger		
Trigger sources		RF burst (wideband), Video (IF envelope), Ext Front, Ext Rear. Actual choices are dependent on measurement.
Trigger delay, level, & slope		Each trigger source has separate set of these parameters.
Trigger delay Range Repeatability Resolution	 ±33 ns 33 ns	 –100 to +500 ms
External trigger inputs Level Impedance		 –5 V to +5 V (nominal) 10 kΩ (nominal)
Range Control		RF Input Autorange[a] Manually set **Max Total Pwr** Manually set **Input Atten**

a. Autorange is *not* continuous with each measurement acquisition; it will run only once immediately following a measurement restart, initiated either by pressing the **Restart** hardkey, or by sending the GPIB command `INIT:IMM`. This behavior was chosen to maintain best measurement speed, but it requires caution when input power levels change. If the input signal power changes, the analyzer will not readjust the input attenuators for optimal dynamic range unless a measurement restart is initiated. For example, if a sequence of power measurements is made, beginning with a maximum power level that is large enough to require non-zero input attenuation, it is advisable to do a measurement restart to automatically set a lower input attenuator value to maintain optimal dynamic range for approximately every 3 dB the input signal power level is reduced, or smaller, depending upon how precisely dynamic range needs to be optimized. Conversely, if the input signal power increases to a high enough level, input overloading will occur if the input attenuators are not readjusted by doing a measurement restart.

8 HSDPA Specifications

All specifications apply over 0 °C to +55 °C, except when otherwise specified. The instrument will meet its specifications after 2 hours of storage at a constant temperature, within the operating temperature range, 1 hour after the instrument is turned on and within 24 hours after “Align All Now” has been run. The specifications for each measurement apply for the measurement’s factory default setup.

Conformance With 3GPP TS 25.141

Conformance With 3GPP TS 25.141 Base Station Requirements for a Manufacturing Environment

Sub-clause	Name	3GPP Required Test Instrument Tolerance (as of 2002-06)	Instrument Tolerance Interval[abc]	Supplemental Information
Conditions 25 to 35 °C[d] Derived tolerances[e] 95th percentile[a] 100 % limit tested[b] Calibration uncertainties included[c]				
6.2.1	**Maximum Output Power**	±0.7 dB (95 %)	±0.29 dB (95 %)	±0.63 dB (100 %)
6.2.2	**CPICH Power Accuracy**	±0.8 dB (95 %)	±0.30 dB (95 %)	–10 dB CDP[f]
6.3.4	**Frequency Error**	±12 Hz (95 %)	±10 Hz (100 %)	Freq Ref locked[g]
6.4.2	**Power Control Steps**[h]			
	1 dB step	±0.1 dB (95 %)	±0.03 dB (95 %)	Test Model 2
	0.5 dB step	±0.1 dB (95 %)	±0.03 dB (95 %)	Test Model 2
	Ten 1 dB steps	±0.1 dB (95 %)	±0.03 dB (95 %)	Test Model 2
	Ten 0.5 dB steps	±0.1 dB (95 %)	±0.03 dB (95 %)	Test Model 2
6.4.3	**Power Dynamic Range**	±1.1 dB (95 %)	±0.50 dB (95 %)	
6.4.4	**Total Power Dynamic Range**[h]	±0.3 dB (95 %)	±0.015 dB (95 %)	Ref –35 dBm at mixer[i]
6.5.1	**Occupied Bandwidth**	±100 kHz (95 %)	±38 kHz (95 %)	10 averages[j]
6.5.2.1	**Spectrum Emission Mask**	±1.5 dB (95 %)	±0.59 dB (95 %)	Absolute peak[k]
6.5.2.2	**ACLR**			
	5 MHz offset	±0.8 (95 %)	±0.34 dB (95 %)	±0.93dB (100 %)
	10 MHz offset	±0.8 (95 %)	±0.40 dB (95 %)	±0.82dB (100 %)
6.7.1	**EVM**	±2.5 % (95 %)	±1.0 % (95 %)	Range 15 to 20 %[l]
6.7.2	**Peak Code Domain Error**	±1.0 dB (95 %)	±1.0 dB (nominal)	

a. Those tolerances marked as 95 % are derived from 95th percentile observations with 95 % confidence.

b. Those tolerances marked as 100 % are derived from 100 % limit tested observations. Only the 100 % limit tested observations are covered by the product warranty.

c. The computation of the instrument tolerance intervals shown includes the uncertainty of the tracing of calibration references to national standards. It is added, in a root-sum-square fashion, to the observed performance of the instrument.

d. This table is intended for users in the manufacturing environment, and as such, the tolerance limits have been computed for temperatures of the ambient air near the analyzer of 25 to 35 °C.
e. Most of the tolerance limits in this table are derived from measurements made of standard instrument specifications, rather than direct observations.
f. Tolerance limits are computed for a CPICH code domain power of –10 dB relative to total signal power.
g. The frequency references of the DUT and the test equipment must be locked together to meet this tolerance interval.
h. These measurements are obtained by utilizing the code domain power function or general instrument capability. The tolerance limits given represent instrument capabilities.
i. The tolerance interval is based on the largest signal power being –35 dBm at the mixer.
j. The OBW measurement errors are dominated by the noise-like nature of the signal. The errors decline in proportion to the square root of the number of averages. The tolerance interval shown is for ten averages.
k. The tolerance interval shown is for the peak absolute power of a CW-like spurious signal. The standards for SEM measurements are ambiguous as of this writing; the tolerance interval shown is based on Agilent’s interpretation of the current standards and is subject to change.
l. EVM tolerances apply with signals having EVMs within ±2.5 % of the required 17.5 % EVM limit.

Measurement	Specifications	Supplemental Information
Channel Power		
Minimum power at RF Input		–70 dBm (nominal)
Absolute power accuracy[a] 18 to 30°C	±0.63 dB	±0.41 dB (typical)
Measurement floor		–73 dBm (nominal)
Channel Power (Baseband IQ Inputs)		
Input Ranges		
50 Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm , +1 dBm, +7 dBm , +13 dBm	
600 Ω, 1 MΩ, Input Z	–18 to 0 dBV in four ranges of 6 dB steps: –18 dBV, –12 dBV, –6 dBV, 0 dBV	
Absolute power accuracy for in-band signal (excluding mismatch error) 18 °C to 30 °C		
Input Impedance = 50 Ω, all ranges	±0.6 dB	
Input Impedance = 600 Ω, all ranges		
0 to 1 MHz 1 MHz to 5 MHz	±0.6 dB ±2.0 dB	
Input Impedance = 1 MΩ, all ranges Unbalanced		±0.7 dB (nominal)
Balanced 0 to 1 MHz 1 MHz to 5 MHz		±0.6 dB (nominal) ±2.0 dB (nominal)

a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors and repeatability due to incomplete averaging. It applies when the mixer level is high enough that measurement floor contribution is negligible. If the mixer level is not high enough to make the contribution of the measurement floor negligible,the noise of the analyzer will add power to the signal being measured, resulting in an error. That error is a function of the signal (channel power) to noise (measurement floor) ratio, SN, in decibels. The function is error = 10*log(1 + 10^(-SN/10)). For example, if the mixer level is 26.4 dB above the measurement floor, the error due to adding the analyzer's noise to the UUT is only 0.01 dB.

Measurement		Specifications	Supplemental Information
Adjacent Channel Power Ratio (ACPR; ACLR)[a]			
Minimum power at RF Input			–27 dBm (nominal)
ACPR Accuracy[b]			RRC weighted, 3.84 MHz noise bandwidth
Radio	Offset Freq.		
MS (UE)	5 MHz	±0.20 dB	At ACPR range of –30 to –36 dBc with optimum mixer level[c]
MS (UE)	10 MHz	±0.30 dB	At ACPR range of –40 to –46 dBc with optimum mixer level[d]
BTS	5 MHz	±0.93 dB	At ACPR range of –42 to –48 dBc with optimum mixer level[e]
BTS	10 MHz	±0.82 dB	At ACPR range of –47 to –53 dBc with optimum mixer level[d]
BTS	5 MHz	±0.39 dB	At –48 dBc non-coherent ACPR[f]
Dynamic Range			RRC weighted, 3.84 MHz noise bandwidth
Offset Frequency			
5 MHz			–68 dB (nominal)[g]
10 MHz			–72 dB (nominal)[g]

a. Most versions of adjacent channel power measurements use negative numbers, in units of dBc, to refer to the power in an adjacent channel relative to the power in a main channel, in accordance with ITU standards. The standards for W-CDMA analysis include ACLR, a positive number represented in dB units. In order to be consistent with other kinds of ACP measurements, this measurement and its specifications will use negative dBc results, and refer to them as ACPR, instead of positive dB results referred to as ACLR. The ACLR can be determined from the ACPR reported by merely reversing the sign.

b. The accuracy of the Adjacent Channel Power Ratio will depend on the mixer drive level and whether the distortion products from the analyzer are coherent with those in the UUT. Except for the “noncoherent case” described in footnote f, the specifications apply even in the worst case condition of coherent analyzer and UUT distortion products. For ACPR levels other than those in this specifications table, the optimum mixer drive level for accuracy is approximately –29 dBm - (ACPR/3), where the ACPR is given in (negative) decibels.

c. In order to meet this specified accuracy when measuring mobile station (MS) or user equipment (UE) within 3 dB of the required –33 dBc ACPR, the mixer level (ML) must be optimized for accuracy. This optimum mixer level is –15 dBm, so the input attenuation must be set as close as possible to the average input power - (–15 dBm). For example, if the average input power is –6 dBm, set the attenuation to 9 dB. This specification applies for the normal 3.5 dB peak-to-average ratio of a single code. Note that, if the mixer level is set to optimize dynamic range instead of accuracy, accuracy errors are nominally doubled.

d. ACPR accuracy at 10 MHz offset is warranted when the input attenuator is set to give an average mixer level of –7 dBm.

e. To meet this specified accuracy, the mixer level must be optimized for accuracy when measuring node B of the Base Transmission Station (BTS) within 3 dB of the required –45 dBc ACPR. This optimum mixer level is –11 dBm, so the input attenuation must be set as close as possible to the average input power - (–11 dBm). For example, if the average input power is –6 dBm, set the attenuation to 5 dB. This specification applies for the normal 10 dB peak-to-average ratio (at 0.01 % probability) for Test Model 1. Note that, if the mixer level is set to optimize dynamic range instead of accuracy, accuracy errors are nominally doubled.

f. Accuracy can be excellent even at low ACPR levels assuming that the user sets the mixer level to optimize the dynamic range, and assuming that the analyzer and UUT distortions are incoherent. When the errors from the UUT and the analyzer are incoherent, optimizing dynamic range is equivalent to minimizing the contribution of analyzer noise and distortion to accuracy, though the higher mixer level increases the display scale fidelity errors. This incoherent addition case is commonly used in the industry and can be useful for comparison of analysis equipment, but this incoherent addition model is often not justified.

g. The optimum mixer drive level will be approximately –7 dBm.

Measurement	Specifications	Supplemental Information
Multi-Carrier Power		
Minimum Carrier Power at RF Input		–15 dBm (nominal)
ACPR Dynamic Range, two carriers		RRC weighted, 3.84 MHz noise bandwidth
5 MHz offset 10 MHz offset		–64 dB (nominal) –68 dB (nominal)
ACPR Accuracy, two carriers 5 MHz offset, –48 dBc ACPR		 ±0.70 dB (nominal)

Measurement	Specifications	Supplemental Information
Power Statistics CCDF		
Minimum Power at RF Input		–40 dBm, average (nominal)
Histogram Resolution	0.01 dB[a]	
Power Statistics CCDF (Baseband IQ Inputs)		
Input Ranges		
50 Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm	
Input Ranges		
600 Ω, 1 MΩ Input Z	–18 to 0 dBV in four ranges of 6 dB steps: –18 dBV, –12 dBV, –6 dBV, 0 dBV	
Absolute power accuracy for in-band signal (excluding mismatch error) 18 °C to 30 °C		
Input Impedance = 50 Ω, all ranges	±0.6 dB	
Input Impedance = 600 Ω, all ranges		
0 to 1 MHz	±0.6 dB	
1 MHz to 5 MHz	±2.0 dB	

a. The Complementary Cumulative Distribution Function (CCDF) is a reformatting of a histogram of the power envelope. The width of the amplitude bins used by the histogram is the histogram resolution. The resolution of the CCDF will be the same as the width of those bins.

Measurement	Specifications	Supplemental Information
Intermodulation		
Minimum Carrier Power at RF Input		–20 dBm (nominal)
Third-order Intercept		

Measurement	Specifications	Supplemental Information
Occupied Bandwidth		
Minimum carrier power at RF Input		–20 dBm (nominal)
Frequency Resolution	100 Hz	
Frequency Accuracy		$\frac{1.4\%}{\sqrt{N_{avg}}}$ (nominal)[a]

a. The errors in Occupied Bandwidth measurement are due mostly to the noisiness of any measurement of a noise-like signal, such as the W-CDMA signal. The observed standard deviation of the OBW measurement is 60 kHz, so with 1000 averages, the standard deviation should be about 2 kHz, or 0.05 %. The frequency errors due to the FFT processing are computed to be 0.028 % with the RBW (30 kHz) used.

Measurement	Specifications	Supplemental Information
Spectrum Emission Mask		
Minimum power at RF Input		–20 dBm (nominal)
Dynamic Range, relative[a]		
2.515 MHz offset[b]	–77.9 dB	–82.8 dB (typical)
1980 MHz region[c]	–72.2 dB	–77.2 dB (typical)
Sensitivity, absolute[d]		
2.515 MHz offset[e]	–88.9 dBm	–93.9 dBm (typical)
1980 MHz region[f]	–72.9 dBm	–77.9 dBm (typical)
Accuracy, relative		
Display = Abs Peak Pwr[g]	±0.60 dB	±0.40 dB (typical)
Display = Rel Peak Pwr[h]	±0.25 dB	

a. The dynamic range specification is the ratio of the channel power to the power in the offset and region specified. The dynamic range depends on the measurement settings, such as peak power or integrated power. This specification is derived from other analyzer performance limitations such as third-order intermodulation, DANL and phase noise. Dynamic range specifications are based on default measurement settings, with detector set to average, and depend on the mixer level. Mixer level is defined to be the input power minus the input attenuation.

b. Default measurement settings include 30 kHz RBW. This dynamic range specification applies for the optimum mixer level, which is about –9dBm.

c. Default measurement settings include 1200 kHz RBW. This dynamic range specification applies for a mixer level of 0dBm. Higher mixer levels can give up to 5 dB better dynamic range, but at the expense of compression in the input mixer, which reduces accuracy. The compression behavior of the input mixer is specified in the PSA Specifications Guide; the levels into the mixer are nominally 8 dB lower in this application when the center frequency is 2 GHz.

d. The sensitivity is specified with 0 dB input attenuation. It represents the noise limitations of the analyzer. It is tested without an input signal.

e. The sensitivity at this offset is specified in the default 30 kHz RBW.

f. The sensitivity for this region is specified in the default 1200 kHz bandwidth.

g. The absolute accuracy is a measure of the total power at the offsets. It applies for spectrum emission levels in the regions that are well above the dynamic range limitation.

h. The relative accuracy is a measure of the ratio of the power at the offset to the main channel power. It applies for spectrum emission levels in the offsets that are well above the dynamic range limitation.

Measurement	Specifications	Supplemental Information
Code Domain	25 to 35° C[a] 95 %[b]	Specifications apply to BTS and where the mixer level (RF input power minus attenuation) is between –20 and –10 dBm
Code domain power		
Minimum power at RF input		–70 dBm (nominal)[cd]
Relative accuracy[e]		
Test signal		
Test Model 2 Code domain power range		
0 to –10 dBc –10 to –30 dBc –30 to –40 dBc	±0.015 dB ±0.06 dB ±0.07 dB	
Test Model 1 with 32 DPCH Code domain power range		
0 to –10 dBc –10 to –30 dBc –30 to –40 dBc	±0.015 dB ±0.08 dB ±0.15 dB	
Symbol power vs. time[f]		
Minimum power at RF Input		–45 dBm (nominal)[cd]
Relative accuracy Test signal Test Model 1 with 32 DPCH signal Code domain power range		
0 to –25 dBc –25 to –40 dBc	±0.10 dB ±0.50 dB	
Symbol error vector magnitude		
Minimum power at RF Input		–45 dBm (nominal)[cd]
Accuracy		
Test signal Test Model 1 with 32 DPCH signal Code domain power range 0 to –25 dBc	±1.0 %	

a. This table is intended for users in the manufacturing environment, and as such, the tolerance limits have been computed for temperatures of the ambient air near the analyzer of 25 to 35 °C.

b. All specifications given are derived from 95th percentile observations with 95 % confidence.

c. Predefined test models under the Symbol Boundary menu are recommended for RF input power levels below –55 dBm. At low signal-to-noise ratios the auto channel ID algorithm may not correctly detect an active code channel as turned on. The predefined test model bypasses the auto channel ID algorithm.

d. Nominal operating range. Accuracy specification applies when mixer level (RF input power minus attenuation) is between –20 and –10 dBm.

e. A code channel power measurement made on a specific spreading code includes all power that projects onto that code. This power is primarily made up from the intended signal power that was spread using that code, but also includes that part of the SCH power (when present) that also projects onto the code being measured. The reason for this addition is that the SCH power is spread using a gold code, which is not orthogonal to the code being measured. The increase in decibels due to this SCH leakage effect is given by the following formula:

SCH leakage effect = $10 \log (10^{S/10}/(10F) + 10^{C/10}) - C$

Where:

S = Relative SCH power in dB (during the first 10 % of each timeslot)

F = Spreading factor of the code channel being measured

C = Ideal relative code channel power in dB (excluding SCH energy)

For example, consider a composite signal comprising the SCH set to –10 dB during the first 10 % of each slot, and a DPCH at spreading factor 128 set to –28 dB. Performing a code channel power measurement on the DPCH will return a nominal code channel power measurement of –27.79 dB. The SCH leakage effect of 0.21 dB should not be considered as a measurement error but rather the expected consequence of the non-orthogonal SCH projecting energy onto the code used by the DPCH.

In order to calculate the ideal code channel power C from a code channel power measurement M that includes SCH energy, the following formula can be used:

$C = 10 \log (10^{M/10} - 10^{S/10}/(10F))$

Therefore a code channel power measurement M = –27.79 dB at spreading factor 128 of a signal including a relative SCH power of –10 dB indicates an ideal code channel power of –28 dB

f. The SCH leakage effect due to its being spread by a gold code not orthogonal to the symbol power being measured will add additional power to the measured result during the portion of the slot where SCH power is present. When SCH power is present, the accuracy specification excludes the noise-like contribution of the SCH power.

Description	Specifications	Supplemental Information
QPSK EVM		
Minimum power at RF Input		–20 dBm (nominal)
QPSK Downlink		
EVM		
Operating range		0 to 25 % (nominal)
Floor		1.5 % (nominal)
Accuracy[a]		±1.0 % (nominal) at EVM of 10 %
I/Q origin offset		
Range		–10 to –50 dBc (nominal)
Frequency error		
Range		±300 kHz (nominal)
Accuracy		±10 Hz (nominal) + (transmitter frequency × frequency reference accuracy)
12.2 k RMC Uplink		
EVM		
Operating range		0 to 20 % (nominal)
Floor		1.5 % (nominal)
Accuracy[a]		±1.0 % (nominal) at EVM of 10 %
I/Q origin offset		
Range		–10 to –50 dBc (nominal)
Frequency error		
Range		±20 kHz (nominal)
Accuracy		±10 Hz (nominal) + (transmitter frequency × frequency reference accuracy)

a. The accuracy specification applies when the EVM to be measured is well above the measurement floor. When the EVM does not greatly exceed the floor, the errors due to the floor add to the accuracy errors. The errors due to the floor are noise-like and add incoherently with the UUT EVM. The errors depend on the EVM of the UUT and the floor as follows: error = $\text{sqrt}(\text{EVMUUT}^2 + \text{EVMsa}^2) - \text{EVMUUT}$, where EVMUUT is the EVM of the UUT in percent, and EVMsa is the EVM floor of the analyzer in percent. For example, if the EVM of the UUT is 7 %, and the floor is 2.5 %, the error due to the floor is 0.43 %. The total error can cause a reading as high as EVMUUT + floorerror + accyerror, or as low as EVMUUT – accyerror, where floorerror is the result of the error computation due to the floor, and accyerror is the specified accuracy.

Measurement	Specifications	Supplemental Information
Power Control and Power vs. Time		
Absolute power measurement		Using 5 MHz resolution bandwidth
Accuracy		
0 to –20 dBm		±0.7 dB (nominal)
–20 to –60 dBm		±1.0 dB (nominal)
Relative power measurement		
Accuracy		
Step range ±1.5 dB		±0.1 dB (nominal)
Step range ±3.0 dB		±0.15 dB (nominal)
Step range ±4.5 dB		±0.2 dB (nominal)
Step range ±26.0 dB		±0.3 dB (nominal)

Measurement	Specifications	Supplemental Information
Modulation Accuracy (Composite EVM)		Specifications apply to BTS and where the mixer level (RF input power minus attenuation) is between –20 and –10 dBm.
Minimum power at RF input		–75 dBm (nominal)[a]
Composite EVM		
Test Model 4		
Range	0 % to 25 %	
Floor	1.5 %	
Accuracy[b]	±1.0 %	
Test Model 1 with 32 DPCH		
Range	0 % to 25 %	
Foor	1.5 %	
Accuracy	±1.0 %	
Peak Code Domain Error Using Test Model 3 with 16 PCH signal, and a spreading code of 256.		
Accuracy		±1.0 dB (nominal)
I/Q orgin offset		
Range		–10 to –50 dBc (nominal)
Frequency error Specified for CPICH power ≥ –15 dBc		
Range	±500 Hz	
Accuracy	±2 Hz + (transmitter frequency × frequency reference accuracy)	
Time Offset		
Frame offset accuracy	±150 ns	
Relative offset accuracy[c]	±1.25 ns	

a. Predefined test models under the Symbol Boundary menu are recommended for RF input power levels below –55 dBm. At low signal-to-noise ratios the auto channel ID algorithm may not correctly detect an active code channel as turned on. The predefined test model bypasses the auto channel ID algorithm.

b. The accuracy specification applies when the EVM to be measured is well above the measurement floor. When the EVM does not greatly exceed the floor, the errors due to the floor add to the accuracy errors. The errors due to the floor are noise-like and add incoherently with the UUT EVM. The errors depend on the EVM of the UUT and the floor as follows: error = $sqrt(EVMUUT^2 + EVMsa^2)$ EVMUUT, where EVMUUT is the EVM of the UUT in percent, and EVMsa is the EVM floor of the analyzer in percent. For example, if the EVM of the UUT is 7 %, and the floor is 2.5 %, the error due to the floor is 0.43 %. The total error can cause a reading as high as EVMUUT + floorerror + accyerror, or as low as EVMUUT – accyerror, where floorerror is the result of the error computation due to the floor, and accyerror is the specified accuracy.

c. The accuracy specification applies when the measured signal is the combination of CPICH (antenna-1) and CPICH (antenna-2), and where the power level of each CPICH is –3 dB relative to the total power of the combined signal. Further, the range of the measurement over which the accuracy specification applies is a maximum offset of ±0.5 chips.

Frequency

Measurement	Specifications	Supplemental Information
In-Band Frequency Range	2110 to 2170 MHz 1920 to 1980 MHz	

General

Measurement	Specifications	Supplemental Information
Trigger		
Trigger sources		RF burst (wideband), Video (IF envelope), Ext Front, Ext Rear. Actual choices are dependent on measurement.
Trigger delay, level, & slope		Each trigger source has separate set of these parameters.
Trigger delay		
Range		–100 to +500 ms
Repeatability	±33 ns	
Resolution	33 ns	
External trigger inputs		
Level		–5 V to +5 V (nominal)
Impedance		10 kΩ (nominal)
Range Control		RF Input Autorange[a] Manually set **Max Total Pwr** Manually set **Input Atten**

a. Autorange is *not* continuous with each measurement acquisition; it will run only once immediately following a measurement restart, initiated either by pressing the **Restart** hardkey, or by sending the GPIB command `INIT:IMM`. This behavior was chosen to maintain best measurement speed, but it requires caution when input power levels change. If the input signal power changes, the analyzer will not readjust the input attenuators for optimal dynamic range unless a measurement restart is initiated. For example, if a sequence of power measurements is made, beginning with a maximum power level that is large enough to require non-zero input attenuation, it is advisable to do a measurement restart to automatically set a lower input attenuator value to maintain optimal dynamic range for approximately every 3 dB the input signal power level is reduced, or smaller, depending upon how precisely dynamic range needs to be optimized. Conversely, if the input signal power increases to a high enough level, input overloading will occur if the input attenuators are not readjusted by doing a measurement restart.

9 cdma2000 Specifications

Measurements

Measurement specifications only apply over the cellular frequency bands supported by this option.

Measurement	Specifications	Supplemental Information
Channel Power (RF Input)		
Power range	+30 to –80 dBm	
Absolute power accuracy for in-band signal (excluding mismatch error) 18 °C to 30 °C		
+30 to –28 dBm	±0.6 dB	
–28 to –50 dBm	±0.8 dB	
–50 to –80 dBm	±1.0 dB	
Channel Power (Baseband IQ Inputs)		
Input Ranges 50 Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm	
Input Ranges 600 Ω, 1 M Ω Input Z	–18 to 0 dBV in four ranges of 6 dB steps: –18 dBV, –12 dBV, –6 dBV, 0 dBV	
Absolute power accuracy for in-band signal (excluding mismatch error) 18 °C to 30 °C		
Input Impedance = 50 Ω, all ranges	±0.6 dB	
Input Impedance = 600 Ω, all ranges 0 to 1 MHz 1 MHz to 5 MHz	 ±0.6 dB ±2.0 dB	
Input Impedance = 1 M Ω, all ranges Unbalanced Balanced 0 to 1 MHz 1 MHz to 5 MHz		 ±0.7 dB, (nominal) ±0.6 dB, (nominal) ±2.0 dB, (nominal)

Measurement		Specifications	Supplemental Information
Adjacent Channel Power Ratio			
Power range at RF input		+30 to –20 dBm	
Dynamic range			Referenced to average power of carrier in 1.25 MHz BW.
Offset Freq.	Integ. BW		
750 kHz	30 kHz	–82 dBc	
885 kHz	30 kHz	–82 dBc	
1.98 MHz	30 kHz	–85 dBc	
Relative accuracy		±0.9 dB	

Measurement	Specifications	Supplemental Information
Power Statistics CCDF (RF Input)		
Range Maximum:	+30 dBm (average) +40 dBm (peak)	
Minimum:	–40 dBm (average)	
Power Statistics CCDF (Baseband IQ Inputs)		
Input Ranges 50 Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm	
Input Ranges 600 Ω, 1 M Ω Input Z	–18 to 0 dBV in four ranges of 6 dB steps: –18 dBV, –12 dBV, –6 dBV, 0 dBV	
Absolute power accuracy for in-band signal (excluding mismatch error) 18 °C to 30 °C		
Input Impedance = 50 Ω, all ranges	±0.6 dB	
Input Impedance = 600 Ω, all ranges 0 to 1 MHz 1 MHz to 5 MHz	 ±0.6 dB ±2.0 dB	
Input Impedance = 1 M Ω, all ranges Unbalanced Balanced 0 to 1 MHz 1 MHz to 5 MHz		 ±0.7 dB, (nominal) ±0.6 dB, (nominal) ±2.0 dB, (nominal)

Measurement	Specifications	Supplemental Information
Inter-Modulation		
Carrier Power range at RF Input	+30 to –20 dBm	
Inter-modulation Power Range:	–20 to –65 dBc	
Relative Accuracy:	±1.5 dB	
Resolution:	0.01 dB	Display resolution

Measurement	Specifications	Supplemental Information
Occupied Bandwidth		
Carrier power range at RF Input	+30 to –20 dBm	
Frequency		
Resolution	1 kHz	
Accuracy	±3 kHz	

Measurement	Specifications	Supplemental Information
Spectrum Emission Mask		
Carrier Power range at RF Input	+30 to –20 dBm	
Spectrum Emission Power Range:		≤–136 dBc/Hz at 1 MHz offset, (nominal)
Relative Accuracy:	±1.0 dB	
Resolution:	0.01 dB	Display resolution

Measurement	Specifications	Supplemental Information
Code Domain (RF Input)		
Code domain power		
Power range	Mixer level (RF input power minus attenuation) is between –20 and –10 dBm.	
Accuracy		
Relative range		
0 to –10 dBc	±0.015 dB	
–10 to –30 dBc	±0.18 dB	
–30 to –40 dBc	±0.51 dB	
Symbol power vs. time		
Power range	+30 to –40 dBm	
Accuracy	±0.3 dB	Spread Channel Power is within 20 dB of Total Power. Averaged power over a slot.
Symbol error vector magnitude		
Power range	+30 to –20 dBm	
Pilot time offset		(From even second signal to start of PN sequence)
Range	–13.33 ms to +13.33 ms	
Accuracy	±300 ns	
Resolution	10 ns	
Code Domain (Baseband IQ Inputs)		
Input Ranges 50 Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm	
Input Ranges 600 Ω, 1 M Ω Input Z	–18 to 0 dBV in four ranges of 6 dB steps: –18 dBV, –12 dBV, –6 dBV, 0 dBV	
Absolute power accuracy for in-band signal (excluding mismatch error) 18 °C to 30 °C		
Input Impedance = 50Ω, all ranges	±0.6 dB	
Input Impedance = 600Ω, all ranges		
0 to 1 MHz	±0.6 dB	
1 MHz to 5 MHz	±2.0 dB	
Input Impedance = 1 M Ω, all ranges		
Unbalanced		±0.7 dB, (nominal)
Balanced		
0 to 1 MHz		±0.6 dB, (nominal)
1 MHz to 5 MHz		±2.0 dB, (nominal)

Measurement	Specifications	Supplemental Information
QPSK EVM (RF Input)		
Power range	+30 to –20 dBm	
EVM Range		0 to 25%, (nominal)
Floor		1.5%, (nominal)
Accuracy		±1.0%, (nominal)
I/Q origin offset Range		–10 to –50 dBc, (nominal)
Frequency Error Range		±500 Hz, (nominal)
Accuracy		±10 Hz (nominal) + (transmitter frequency × frequency reference accuracy)
QPSK EVM (Baseband IQ Inputs)		
Input Ranges 50 Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm	
Input Ranges 600 Ω, 1 M Ω Input Z	–18 to 0 dBV in four ranges of 6 dB steps: –18 dBV, –12 dBV, –6 dBV, 0 dBV	
Absolute power accuracy for in-band signal (excluding mismatch error) 18 °C to 30 °C		
Input Impedance = 50 Ω, all ranges	±0.6 dB	
Input Impedance = 600 Ω, all ranges 0 to 1 MHz 1 MHz to 5 MHz	 ±0.6 dB ±2.0 dB	
Input Impedance = 1 M Ω, all ranges Unbalanced Balanced 0 to 1 MHz 1 MHz to 5 MHz		 ±0.7 dB, (nominal) ±0.6 dB, (nominal) ±2.0 dB, (nominal)
Voltage range at I or Q inputs 50 Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm	
600 Ω, 1 M Ω Input Z	–18 to 0 dBV in four ranges of 6 dB steps: –18 dBV, –12 dBV, –6 dBV, 0 dBV	

Measurement	Specifications	Supplemental Information
Modulation Accuracy (Composite Rho) (RF Input)		
Carrier Power range	+30 to –50 dBm	
Global EVM		
Range	0 to 25%	
Floor	2.0% or less	Pilot only signal
	2.0% or less	9 active channels (defined by 3GPP2) RC3 at 9600 bps
Resolution	0.01%	Display resolution
I/Q Origin Offset		
Range	–10 to –50 dBc	
Resolution	0.02 dB	Display resolution
Frequency Error		
Range	±500 Hz	
Accuracy	±10 Hz + (transmitter frequency × frequency reference accuracy)	
Resolution	0.01 Hz	Display resolution
Pilot time offset		(From even second signal to start of PN sequence)
Range	–13.33 ms to +13.33 ms	
Accuracy	±300 ns	
Resolution	10 ns	
Code domain timing		Pilot to code channel time tolerance
Range	±200 ns	
Accuracy	±1.25 ns	
Resolution	±0.1 ns	
Code domain phase		Pilot to code channel phase tolerance
Range	±200 mrad	
Accuracy	±10 mrad	
Resolution	0.1 mrad	

Measurement	Specifications	Supplemental Information
Modulation Accuracy (Composite Rho) (Baseband IQ Inputs)		
Input Ranges 50 Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm	
Input Ranges 600 Ω, 1 M Ω Input Z	–18 to 0 dBV in four ranges of 6 dB steps: –18 dBV, –12 dBV, –6 dBV, 0 dBV	
Absolute power accuracy for in-band signal (excluding mismatch error) 18 °C to 30 °C		
Input Impedance = 50 Ω, all ranges	±0.6 dB	
Input Impedance = 600 Ω, all ranges 0 to 1 MHz 1 MHz to 5 MHz	 ±0.6 dB ±2.0 dB	
Input Impedance = 1 M Ω, all ranges Unbalanced Balanced 0 to 1 MHz 1 MHz to 5 MHz		 ±0.7 dB, (nominal) ±0.6 dB, (nominal) ±2.0 dB, (nominal)

Measurement	Specifications	Supplemental Information
Spectrum (Frequency Domain)	See **Spectrum Measurement** on page 24.	

Measurement	Specifications	Supplemental Information
Waveform (Time Domain)	See **Waveform Measurement** on page 26.	

Frequency

	Specifications	Supplemental Information
In-Band Frequency Range		
Band Class 0 (North American Cellular)	869 to 894 MHz 824 to 849 MHz	
Band Class 1 (North American PCS)	1930 to 1990 MHz 1850 to 1910 MHz	
Band Class 2 (TACS)	917 to 960 MHz 872 to 915 MHz	
Band Class 3 (JTACS)	832 to 870 MHz 887 to 925 MHz	
Band Class 4 (Korean PCS)	1840 to 1870 MHz 1750 to 1780 MHz	
Band Class 6 (IMT–2000)	2110 to 2170 MHz 1920 to 1980 MHz	

General

	Specifications	Supplemental Information
Trigger		
Trigger source		RF burst (wideband), Video (IF envelope), Ext Front, Ext Rear. Actual available choices are dependent on measurement.
Trigger delay, level, and slope		Each trigger source has a separate set of these parameters.
Trigger delay Range: Repeatability: Resolution:	 –100 to +500 ms ±33 ns 33 ns	
External trigger inputs Level: Impedance:		 –5 V to +5 V, (nominal) 10 kΩ, nominal

10 1xEV-DV Specifications

Test model signal for 1xEV-DV

3GPP2 defines the test model signal as 9 active channels for a cdma2000 forward link. However, it doesn't cover 1xEV-DV requirements. This means that we need to define the test signal with an appropriate configuration for our specifications in Code Domain and Mod Accuracy. For the 1xEV-DV 8PSK/16QAM modulation code signal, we define the test model signal with the following table.

Table Test Model Definition for 1xEV-DV:

				Power	
	Walsh	**Code#**	**N**	**Linear**	**dB**
Pilot	64	0	1	0.200	-7.0
Paging	64	1	1	0.338	-4.7
Sync	64	32	1	0.085	-10.7
F-FCH	64	8	1	0.169	-7.7
F-PDCCH	64	9	1	0.039	-14.0
F-PDCH	32	31	1	0.039	-14.0
F-PDCH	32	15	1	0.039	-14.0
F-PDCH	32	23	1	0.039	-14.0
F-PDCH	32	7	1	0.039	-14.0
F-PDCH	32	27	1	0.039	-14.0
F-PDCH	32	11	1	0.039	-14.0
F-PDCH	32	19	1	0.039	-14.0
F-PDCH	32	3	1	0.039	-14.0
F-PDCH	32	30	1	0.039	-14.0
F-PDCH	32	14	1	0.039	-14.0
F-PDCH	32	22	1	0.039	-14.0
F-PDCH	32	6	1	0.039	-14.0
F-PDCH	32	26	1	0.039	-14.0
F-PDCH	32	10	1	0.039	-14.0
F-PDCH	32	18	1	0.039	-14.0

Measurements

Measurement specifications only apply over the cellular frequency bands supported by this option.

Measurement	Specifications	Supplemental Information
Code Domain (RF Input)		
Code domain power Power range	Mixer level (RF input power minus attenuation) is between –20 and –10 dBm.	
Accuracy QPSK modulation code signal Relative range 0 to –10 dBc –10 to –30 dBc –30 to –40 dBc	 ±0.015 dB ±0.18 dB ±0.51 dB	
8PSK/16QAM modulation code signal Relative range 0 to –10 dBc –10 to –30 dBc –30 to –40 dBc		See Table Test Model signal for 1xEV-DV ±0.015 dB (nominal) ±0.18 dB (nominal) ±0.51 dB (nominal)
Symbol power vs. time Power range	 +30 to –40 dBm	
QPSK modulation code signal Accuracy	 ±0.3 dB	Spread Channel Power is within 20 dB of Total Power. Averaged power over a slot.
8PSK/16QAM modulation code signal		See Table Test Model signal for 1xEV-DV ±0.3 dB (nominal)
Accuracy		Spread Channel Power is within 20 dB of Total Power. Averaged power over a slot.
Symbol error vector magnitude Power range	 +30 to –20 dBm	
Pilot time offset Range Accuracy Resolution	 –13.33 ms to +13.33 ms ±300 ns 10 ns	(From even second signal to start of PN sequence)

Measurement	Specifications	Supplemental Information
Code Domain (Baseband IQ Inputs)		
Input Ranges 50 Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm	
Input Ranges 600 Ω, 1 M Ω Input Z	–18 to 0 dBV in four ranges of 6 dB steps: –18 dBV, –12 dBV, –6 dBV, 0 dBV	
Absolute power accuracy for in-band signal (excluding mismatch error) 18 °C to 30 °C		
Input Impedance = 50Ω, all ranges	±0.6 dB	
Input Impedance = 600Ω, all ranges 0 to 1 MHz 1 MHz to 5 MHz	 ±0.6 dB ±2.0 dB	
Input Impedance = 1 M Ω, all ranges Unbalanced Balanced 0 to 1 MHz 1 MHz to 5 MHz		 ±0.7 dB, (nominal) ±0.6 dB, (nominal) ±2.0 dB, (nominal)

Measurement	Specifications	Supplemental Information
Modulation Accuracy (Composite Rho) (RF Input)		
Carrier Power range	+30 to –50 dBm	
Global EVM		
Range	0 to 25%	
Floor	2.0% or less	Pilot only signal
	2.0% or less	9 active channels defined by 3GPP2, RC3 at 9600 bps
		2.0% or less (nominal) 8PSK/16QAM 1xEV-DV signal. See Table Test model signal for 1xEV-DV
Resolution	0.01%	Display resolution
I/Q Origin Offset		
Range	–10 to –50 dBc	
Resolution	0.02 dB	Display resolution
Frequency Error		
Range	±500 Hz	
Accuracy	±10 Hz + (transmitter frequency × frequency reference accuracy)	
Resolution	0.01 Hz	Display resolution
Pilot time offset		(From even second signal to start of PN sequence)
Range	–13.33 ms to +13.33 ms	
Accuracy	±300 ns	
Resolution	10 ns	
Code domain timing		Pilot to code channel time tolerance
Range	±200 ns	
Accuracy	±1.25 ns	
Resolution	±0.1 ns	
Code domain phase		Pilot to code channel phase tolerance
Range	±200 mrad	
Accuracy	±10 mrad	
Resolution	0.1 mrad	

Measurement	Specifications	Supplemental Information
Modulation Accuracy (Composite Rho) (Baseband IQ Inputs)		
Input Ranges 50 Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm	
Input Ranges 600 Ω, 1 M Ω Input Z	–18 to 0 dBV in four ranges of 6 dB steps: –18 dBV, –12 dBV, –6 dBV, 0 dBV	
Absolute power accuracy for in-band signal (excluding mismatch error) 18 °C to 30 °C		
Input Impedance = 50 Ω, all ranges	±0.6 dB	
Input Impedance = 600 Ω, all ranges 0 to 1 MHz 1 MHz to 5 MHz	 ±0.6 dB ±2.0 dB	
Input Impedance = 1 M Ω, all ranges Unbalanced Balanced 0 to 1 MHz 1 MHz to 5 MHz		 ±0.7 dB, (nominal) ±0.6 dB, (nominal) ±2.0 dB, (nominal)

Measurement	Specifications	Supplemental Information
Spectrum (Frequency Domain)	See **Spectrum Measurement** on page 24.	

Measurement	Specifications	Supplemental Information
Waveform (Time Domain)	See **Waveform Measurement** on page 26.	

Frequency

	Specifications	Supplemental Information
In-Band Frequency Range		
Band Class 0 (North American Cellular)	869 to 894 MHz 824 to 849 MHz	
Band Class 1 (North American PCS)	1930 to 1990 MHz 1850 to 1910 MHz	
Band Class 2 (TACS)	917 to 960 MHz 872 to 915 MHz	
Band Class 3 (JTACS)	832 to 870 MHz 887 to 925 MHz	
Band Class 4 (Korean PCS)	1840 to 1870 MHz 1750 to 1780 MHz	
Band Class 6 (IMT–2000)	2110 to 2170 MHz 1920 to 1980 MHz	

General

	Specifications	Supplemental Information
Trigger		
Trigger source		RF burst (wideband), Video (IF envelope), Ext Front, Ext Rear. Actual available choices are dependent on measurement.
Trigger delay, level, and slope		Each trigger source has a separate set of these parameters.
Trigger delay Range: Repeatability: Resolution:	 –100 to +500 ms ±33 ns 33 ns	
External trigger inputs Level: Impedance:		 –5 V to +5 V, (nominal) 10 kΩ, nominal

11 1xEV-DO Specifications

Measurements

Measurement specifications only apply over the cellular frequency bands supported by this option.

Measurement	Specifications	Supplemental Information
Channel Power		
(1.23 MHz Integration Bandwidth)		
Carrier Power range at RF input	–80 to +30 dBm	
Power accuracy, absolute[a]		In-band signals for 18 °C to 30 °C
–28 to +30 dBm	±0.6 dB	
–50 to –28 dBm	±0.8 dB	
–80 to –50 dBm	±1.0 dB	

Measurement	Specifications	Supplemental Information
Power Statistics CCDF		
Carrier power range at RF input		
Maximum average	+30 dBm	
Maximum peak	+40 dBm	
Minimum average	–40 dBc	
Inter-Modulation		
Carrier power range at RF input	–20 to +30 dBm	
Inter-modulation power range	–65 to –20 dBm	
Accuracy, relative	±1.5 dB	
Resolution	0.01 dB	Display resolution

a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors.

Measurement	Specifications	Supplemental Information
Occupied Bandwidth		
Carrier power range at RF input	–20 to +30 dBm	
Frequency accuracy	±3 kHz	at 1 kHz resolution bandwidth
Frequency resolution	1 kHz	
Spurious Emissions & ACP		
Carrier power range at RF input	–20 to +30 dBm	
Spurious emissions power range		≤–136 dBc/Hz at 1 MHz offset, (nominal)
Accuracy, relative	±1.0 dB	
Resolution	0.01 dB	Display resolution

Measurement	Specifications	Supplemental Information
Code Domain		
Code domain power range at RF input	–50 to +30 dBm	
Accuracy[a] (for Pilot, MAC, QPSK Data, or 8PSK Data)	±0.3 dB	within 20 dB spread channel power relative to total power
QPSK EVM		
Carrier power range at RF input:	–20 to + 30 dBm	
EVM		
Range		0 to 25%, (nominal)
Floor		1.5%, (nominal)
Accuracy		±1.0%, (nominal)
I/Q origin offset range		–50 to –10 dBc, (nominal)
Frequency error		
Range		±500 Hz, (nominal)
Accuracy:		±10 Hz (nominal) + (transmitter frequency × frequency reference accuracy)

a. Based on EI test for Modulation Accuracy (Rho) measurements in cdma2000 of which floor is ≤2.0%, with compensated deviations by firmware design.

Measurement	Specifications	Supplemental Information
Modulation Accuracy (Composite Rho)		
Carrier power range at RF input	–50 to +30 dBm	
EVM (Pilot, MAC, QPSK Data, 8PSK Data)		
Range	0 to 25%	
Floor	2.5%	
Accuracy	±1.0%	at the range of 5% to 25%
Rho (Pilot, MAC, QPSK Data, 8PSK Data)		
Range	0.9 to 1.0	
Floor	0.99938	(0.99938 equals 2.5% EVM)
Accuracy	±0.0010 ±0.0044	at 0.99751 Rho (5% EVM) at 0.94118 Rho (25% EVM)
Frequency error (Pilot, MAC, QPSK Data, 8PSK Data)		
Range		±400 Hz (nominal)
Accuracy		±10 Hz (nominal) + (transmitter frequency × frequency reference accuracy)
Resolution	0.01 Hz	display resolution
I/Q origin offset		
Range	–10 to –50 dBc	
Resolution	0.02 dB	Display resolution
Power vs Time		
Carrier Power range at RF input		–80 to +30 dBm (nominal)
Power accuracy, absolute[a] In-band signals 18 °C to 30 °C		
–28 to +30 dBm		±0.6 dB (nominal)
–50 to –28 dBm		±0.8 dB (nominal)
–80 to –50 dBm		±1.0 dB (nominal)

a. Absolute power accuracy includes all error sources for in-band signals except mismatch errors.

Measurement	Specifications	Supplemental Information
Spectrum (Frequency Domain)	See **Spectrum Measurement** on page 24.	

Measurement	Specifications	Supplemental Information
Waveform (Time Domain)	See **Waveform Measurement** on page 26.	

Frequency

Measurement	Specifications	Supplemental Information
In-Band Frequency Range[a] (Access Network Only)		
Band Class 0	869 to 894 MHz	North American and Korean Cellular bands
Band Class 1	1930 to 1990 MHz	North American PCS band
Band Class 2	917 to 960 MHz	TACS band
Band Class 3	832 to 869 MHz	JTACS band
Band Class 4	1840 to 1870 MHz	Korean PCS band
Band Class 6	2110 to 2170 MHz	IMT–2000 band
Band Class 8	1805 to 1880 MHz	1800 MHz band
Band Class 9	925 to 960 MHz	900 MHz band

Measurement	Specifications	Supplemental Information
Alternative Frequency Ranges[b] (Access Network Only)		
Band Class 5	421 to 430 MHz 460 to 470 MHz 489 to 494 MHz	NMT-450 bands
Band Class 7	746 to 764 MHz	North American 700 MHz Cellular band

a. Frequency ranges over which all specifications apply.

b. Frequency ranges with tuning plans but degraded specifications for absolute power accuracy. The degradation should be nominally ±0.30 dB.

General

Measurement	Specifications	Supplemental Information
Trigger		
Trigger source		RF burst (wideband), Video (IF envelope), Ext Front, Ext Rear. Actual available choices are dependent on measurement.
Trigger delay, level, and slope		Each trigger source has a separate set of these parameters.
Trigger delay Range: Repeatability: Resolution:	 –100 to +500 ms ±33 ns 33 ns	
External trigger inputs Level: Impedance:		 –5 V to +5 V, (nominal) 10 kΩ, nominal
Range Control		RF Input Autorange[a] Manually set **Max Total Pwr** Manually set **Input Atten**

a. Autorange is *not* continuous with each measurement acquisition; it will run only once immediately following a measurement restart, initiated either by pressing the **Restart** hardkey, or by sending the GPIB command `INIT:IMM`. This behavior was chosen to maintain best measurement speed, but it requires caution when input power levels change.

If the input signal power changes, the analyzer will not readjust the input attenuators for optimal dynamic range unless a measurement restart is initiated. For example, if a sequence of power measurements is made, beginning with a maximum power level that is large enough to require non-zero input attenuation, it is advisable to do a measurement restart to automatically set a lower input attenuator value to maintain optimal dynamic range for approximately every 3 dB the input signal power level is reduced, or smaller, depending upon how precisely dynamic range needs to be optimized. Conversely, if the input signal power increases to a high enough level, input overloading will occur if the input attenuators are not readjusted by doing a measurement restart.