Specifications

Agilent Technologies
E4406A VSA Series
Transmitter Tester

Manufacturing Part Number: E4406-90230
Supersedes E4406-90175

Printed in USA

December 2001

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1 Transmitter Tester 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.

Frequency

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

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

	Specifications	Supplemental Information
Frequency Setting Resolution	1 Hz	

	Specifications	Supplemental Information
Frequency Reference		
Accuracy	±[(time since last adjustment × aging rate) + temperature stability + calibration accuracy][a]	
Initial calibration accuracy	$\pm 5 \times 10^{-8}$	
Settability	$\pm 2 \times 10^{-9}$	
Aging rate		
During any 24 hours, following 24-hour warmup		$\pm 5 \times 10^{-10}$, characteristic
Per year		$\pm 1 \times 10^{-7}$, characteristic
Temperature stability	$\pm 5 \times 10^{-8}$ variation from frequency at +25 °C over the temperature range of 0 to +55 °C	
Warm-up time		1 hour, characteristic
Within 10 minutes after turn-on		$\pm 1 \times 10^{-7}$ (relative to measurement after 1 hour)

	Specifications	Supplemental Information
Within 20 minutes after turn-on Within 15 minutes at ambient temperature of +25 ±3 °C		$\pm 1 \times 10^{-8}$ (relative to measurement after 1 hour) $\pm 5 \times 10^{-8}$, relative to the frequency at the previous turn-off time (powered for at least 72 hours prior to removing power for 24 hours)

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

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

	Specifications	Supplemental Information
Noise Sidebands (RF Input) [a,b] 7 to 678.59 MHz Offset 100 Hz Offset 1 kHz Offset 10 kHz Offset 30 kHz Offset 100 kHz Offset 200 kHz Offset 250 kHz Offset 400 kHz Offset 600 kHz Offset 1.0 MHz Offset 1.2 MHz Offset 1.8 MHz Offset 6.0 MHz		 ≤–89 dBc/Hz, characteristic ≤–96 dBc/Hz, characteristic ≤–105 dBc/Hz, characteristic ≤–123 dBc/Hz, characteristic ≤–132 dBc/Hz, characteristic ≤–136 dBc/Hz, characteristic ≤–138 dBc/Hz, characteristic ≤–138 dBc/Hz, characteristic ≤–139 dBc/Hz, characteristic ≤–150 dBc/Hz, characteristic ≤–150 dBc/Hz, characteristic ≤–150 dBc/Hz, characteristic ≤–150 dBc/Hz, characteristic

	Specifications	Supplemental Information
678.60 to 1678.59 MHz		
Offset 100 Hz		≤–83 dBc/Hz, characteristic
Offset 1 kHz		≤–90 dBc/Hz, characteristic
Offset 10 kHz		≤–99 dBc/Hz, characteristic
Offset 30 kHz		≤–117 dBc/Hz, characteristic
Offset 100 kHz		≤–126 dBc/Hz, characteristic
Offset 200 kHz		≤–132 dBc/Hz, characteristic
Offset 250 kHz		≤–134 dBc/Hz, characteristic
Offset 400 kHz		≤–136 dBc/Hz, characteristic
Offset 600 kHz		≤–138 dBc/Hz, characteristic
Offset 1.0 MHz		≤–150 dBc/Hz, characteristic
Offset 1.2 MHz		≤–150 dBc/Hz, characteristic
Offset 1.8 MHz		≤–150 dBc/Hz, characteristic
Offset 6.0 MHz		≤–150 dBc/Hz, characteristic
1678.60 to 4000 MHz		
Offset 100 Hz		≤–77 dBc/Hz, characteristic
Offset 1 kHz		≤–84 dBc/Hz, characteristic
Offset 10 kHz		≤–93 dBc/Hz, characteristic
Offset 30 kHz		≤–111 dBc/Hz, characteristic
Offset 100 kHz		≤–120 dBc/Hz, characteristic
Offset 200 kHz		≤–126 dBc/Hz, characteristic
Offset 250 kHz		≤–128 dBc/Hz, characteristic
Offset 400 kHz		≤–131 dBc/Hz, characteristic
Offset 600 kHz		≤–134 dBc/Hz, characteristic
Offset 1.0 MHz		≤–146 dBc/Hz, characteristic
Offset 1.2 MHz		≤–146 dBc/Hz, characteristic
Offset 1.8 MHz		≤–146 dBc/Hz, characteristic
Offset 6.0 MHz		≤–146 dBc/Hz, characteristic
Noise Sidebands[c] (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, characteristic
Offset 5.0 MHz		≤–135 dBc/Hz, characteristic

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.
c. 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 × 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, +24 dB ADC gain		
20 MHz to 2 GHz 2 GHz to 4 GHz	≤–85 dBm ≤–80 dBm	
Residual Responses[a] (Baseband IQ Inputs)		
50 Ω Input terminated		
0 to 5 MHz	≤–90 dBm	

a. No DC offset applied

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

a. 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 50Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm	
Input Ranges 600Ω, 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), characteristic

	Specifications	Supplemental Information
Third-order Intermodulation Distortion (RF Input)		
Input power ≤ +27 dBm Pre-ADC Filter ON		
30 MHz to 800 MHz	≤–54 dBc for two –10 dBm tones at the input mixer[a] with greater than 5 MHz separation	+20 dBm third order intercept, characteristic
800 MHz to 4 GHz	≤–54 dBc for two –10 dBm tones at the input mixer[a] with greater than 5 MHz separation	+24 dBm third order intercept, characteristic
30 MHz to 4 GHz	≤–48 dBc for two –10 dBm tones at the input mixer[a] with greater than 50 kHz separation	+17 dBm third order intercept, characteristic
Third-order Intermodulation Distortion (Baseband IQ Inputs)		
For two CW input signals –6 to –10 dB below Range		
0° to +15° C		≤–50 dBc, typical
+15° to +55° C	≤–60 dBc	

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

	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[a]		
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. 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	

	Specifications	Supplemental Information
21 to 30 dB input attenuation (–2 dBm to –28 dBm) + attenuation		
7 MHz to 1000 MHz 1000 MHz to 2205 MHz 2205 MHz to 4000 MHz	±1.1 dB ±1.5 dB ±2.0 dB	
31 to 40 dB input attenuation (–2 dBm to –28 dBm) + attenuation		
7 MHz to 1000 MHz 1000 MHz to 2205 MHz 2205 MHz to 4000 MHz	±1.1 dB ±1.6 dB ±2.6 dB	
Absolute Power Measurement Accuracy (Baseband IQ Inputs)		
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, characteristic ±0.6 dB, characteristic ±2.0 dB, characteristic

	Specifications	Supplemental Information
Amplitude Accuracy 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, characteristic
–88 dBm to –98 dBm[c]		±0.35 dB, characteristic

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 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

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

	Specifications	Supplemental Information
Displayed Average Noise Level (RF Input) Input terminated in 50Ω, 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 50Ω, 50Ω 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

a. No DC offset applied

	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, characteristic

	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 = 50Ω	< –60 dB	
Input Impedance = 600Ω	< –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 (50Ω Input): Maximum (600Ω, 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: FFT window:	 Gaussian, Flat Auto, Manual 1 Hz to 10 MHz 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
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 Specifications
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 Specifications

	Specifications	Supplemental Information
Waveform Measurement		
Range (RF Input)		
Maximum:	+30 dBm (1 W)	
Minimum:	Displayed average noise level	
Range (IQ Input)		
Maximum (50Ω Input):	+13 dBm (20 mW)	
Maximum (600Ω, 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, characteristic
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 × 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 × scale/div	
Controls:	Scale/Div, Ref Value, and Ref Position	Allows expanded views of portions of the trace data.

	Specifications	Supplemental Information
Polar Display Controls Voltage scale/div range: I and Q Origin	 1 nV to 20 V ± 250 V	
Markers	Normal, Delta, Band Power	
Measurement resolution Displayed: Remote query:	 0.01 dB 0.001 dB	
Trigger (RF Input) Source: Delay, Holdoff, & Auto:	 Free Run (immediate), Video (IF envelope), RF Burst (wideband), External Front Input, External Rear Input, Frame Timer, Line	 See Trigger Specifications
Trigger (Baseband IQ Inputs) Source: Delay, Holdoff, & Auto:	 Free Run (immediate), Video (IQ envelope), External Front Input, External Rear Input, Frame Timer, Line	 See Trigger Specifications

	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, characteristic 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	Relative to signal peak
Bandwidth:		>15 MHz, characteristic
Video (IF envelope) trigger		
Range:	+50 dBm to –200 dBm	

	Specifications	Supplemental Information
Trigger (Baseband I/Q Inputs)		
Trigger delay		For Video, Ext Front, Ext Rear
Range:	–500 ms to +500 ms	
Repeatability:	±33 ns	
Resolution:	33 ns	
Trigger slope	Positive, Negative	
Auto trigger		
Time interval range:	On, Off	0 to 1000 s, characteristic Does an immediate trigger if no trigger occurs before the set time interval.
Trigger holdoff		
Range:	0 to 500 ms	
Resolution:	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 204:	1xEV-DO 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
EMI Compatibility	Conducted and radiated emission is in compliance with CISPR Pub. 11/1990 Group 1 Class A.	

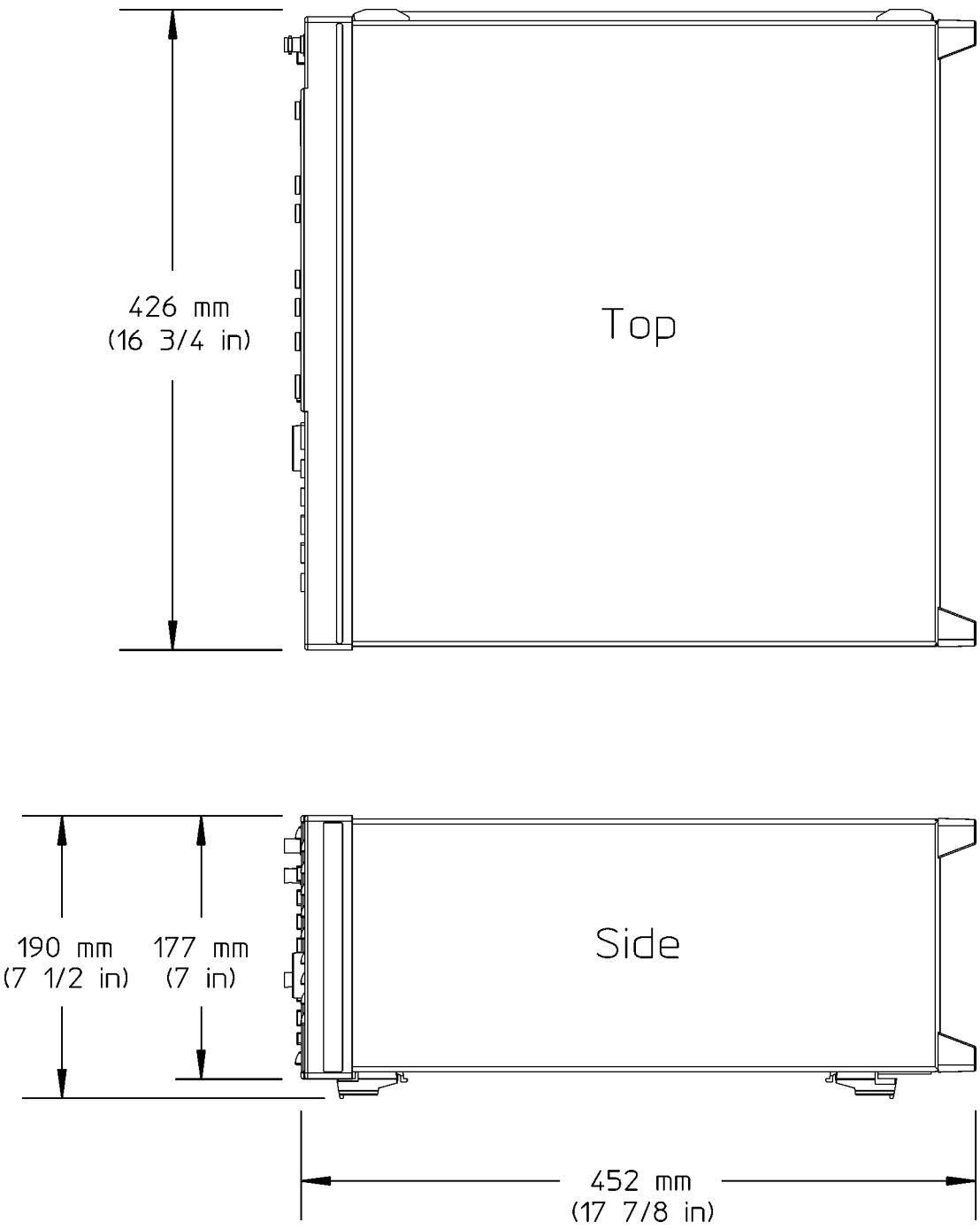
	Specifications	Supplemental Information
Immunity Testing (RF Input)		
Radiated Immunity		When tested at 3 V/m according to IEC 801-3/1984, the displayed average noise level will be within specifications over the full immunity test frequency range of 27 to 500 MHz, except that at immunity test frequencies 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), characteristic
E4406A Option B7C		20 kg (44 lb), characteristic
Shipping		
Standard E4406A		39 kg (86 lb), characteristic
E4406A Option B7C		40 kg (88 lb), characteristic

Dimensions



Inputs and Outputs

Front Panel

	Specifications	Supplemental Information
RF INPUT		
Connector	Type N female	
Impedance		50Ω, 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

	Specifications	Supplemental Information
Baseband I/Q INPUTS		
Connectors (4 each I, Q, $\overline{I}$, $\overline{Q}$)	BNC female	See Frequency and Amplitude sections for Baseband Input details
Balanced Input Impedance (4 connectors: I, Q, $\overline{I}$, and $\overline{Q}$)		600Ω, 1 M Ω, nominal (switchable)
Unbalanced Input Impedance (2 connectors: I and Q)		50Ω, 1 M Ω, nominal (switchable)
VSWR		
50Ω Impedance Only	≤1.4 : 1	≤1.08 : 1, typical

	Specifications	Supplemental Information
PROBE PWR		
Voltage/Current		+15 Vdc ±7% at 150 mA max. –12.6 Vdc ±10% at 150 mA max.

	Specifications	Supplemental Information
EXT TRIGGER INPUT		
Connector	BNC female	

	Specifications	Supplemental Information
Impedance		>10 k Ω, nominal
Trigger level		–5 V to +5 V

	Specifications	Supplemental Information
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		50Ω, nominal
Output amplitude		≥0 dBm, characteristic

	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		50Ω, nominal
Input amplitude range		–5 to +10 dBm, characteristic
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)

	Specifications	Supplemental Information
Frequency lock range		$\pm 5 \times 10^{-6}$ of the specified external reference input frequency

a. 100 MHz VCXO divided by 10.

	Specifications	Supplemental Information
TRIGGER IN		
Connector	BNC female	
Impedance		>10 k Ω, nominal
Trigger level		–5 V to +5 V

	Specifications	Supplemental Information
TRIGGER 1 OUT		
Connector	BNC female	
Impedance		50Ω, nominal
Level		0 V to +5 V (No load)

	Specifications	Supplemental Information
TRIGGER 2 OUT		
Connector	BNC female	
Impedance		50Ω, nominal
Level		0 V to +5 V (No load)

	Specifications	Supplemental Information
321.4 MHz OUT (Opt. 300)		
Connector	BNC female	
Impedance		50Ω, nominal
Bandwidth		>300 MHz, characteristic

	Specifications	Supplemental Information
Conversion Gain (Input Attenuator 0 dB) Tuned Frequency: 50 MHz 400 MHz 600 MHz 800 MHz 1000 MHz 2000 MHz 2500 MHz 3000 MHz 4000 MHz		 –3.5 dB, characteristic –4.5 dB, characteristic –5.0 dB, characteristic –6.0 dB, characteristic –5.5 dB, characteristic –7.0 dB, characteristic –7.5 dB, characteristic –10.5 dB, characteristic –13.0 dB, characteristic

	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 × 480	

	Specifications	Supplemental Information
PARALLEL Interface		Printer port only
Connector	25-pin D-SUB	

	Specifications	Supplemental Information
SERIAL Interface		RS 232 serial interface
Connector	9-pin D-SUB	Feature not implemented

	Specifications	Supplemental Information
LAN-TP		
Connector	RJ45 Ethertwist	

	Specifications	Supplemental Information
GP-IB Interface		
Connector	IEEE-488 bus connector	

	Specifications	Supplemental Information
GP-IB codes		SH1, AH1, T6, SR1, RL1, PP0, DC1, DT1, L4, C0

	Specifications	Supplemental Information
SCSI Interface		SCSI 2 (Slow narrow single-ended)
Connector	Mini D50, female	Feature not implemented

	Specifications	Supplemental Information
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.

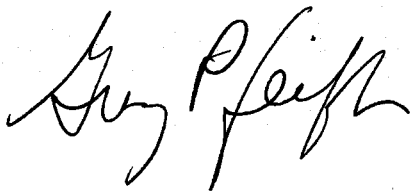
Conforms to the following product specifications:

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

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.

Measurements

Measurement specifications only apply over the cellular frequency bands supported by this option. Refer to "Frequency" on page 45 for specified frequency bands.

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:	+47 dBm (50 W)	With ≥20 dB external attenuation
Mobile station maximum:	+40 dBm (10 W)	With ≥13 dB external attenuation
Minimum:	–70 dBm	With ≤10 dB external attenuation
Range at RF Input		
Maximum:	+30 dBm (1 W)	
Minimum:	–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:	±0.6 dB	±0.4 dB, typical
0 °C to +55 °C:	±1.1 dB	±0.7 dB, typical
–28 dBm to –50 dBm at RF Input:		
+18 °C to +30 °C:	±0.8 dB	±0.7 dB, typical
0 °C to +55 °C:	±1.3 dB	±0.9 dB, typical
–50 dBm to –80 dBm at RF Input[b]:		
+18 °C to +30 °C:	±1.0 dB	±0.9 dB, typical
0 °C to +55 °C:	±1.2 dB	
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:	0.01 dB	
Remote query:	0.001 dB	
Instrument repeatability (over 30 days with daily internal self-alignment)		±0.05 dB, characteristic 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: Accuracy (Walsh channel power within 20 dB of total power): Resolution:	 50 dB ±0.3 dB 0.01 dB	 Measurement interval ≥1.25 ms.
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		Frequency error excludes instrument time base error. Measurement interval ≥1.25 ms.
Input frequency error range:	±900 Hz	
Accuracy:	±10 Hz	
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	

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

Measurement	Specifications	Supplemental Information
Spur Close		At Tx Max Power
Carrier power range at UUT[a] 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[b]	±1.0 dB	
Resolution	0.01 dB	

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

Measurement	Specifications	Supplemental Information
Spectrum	"Spectrum Measurement" under Transmitter Tester Specifications. See "Measurements" on page 20.	

Measurement	Specifications	Supplemental Information
Waveform (Time Domain)	"Waveform Measurement" under Transmitter Tester Specifications. See "Measurements" on page 20.	

Frequency

	Specifications	Supplemental Information
In-Band Frequency Range	824 to 849 MHz 869 to 894 MHz 1850 to 1910 MHz 1930 to 1990 MHz	IS-95 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: Repeatability: Resolution:	 –500 to +500 ms ±33 ns 33 ns	
External trigger inputs Level: Impedance:		 –5 V to +5 V, characteristic > 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 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.

Measurements

Measurement specifications only apply over the cellular frequency bands supported by this option. Refer to "Frequency" on page 53 for specified frequency bands.

Measurement	Specifications	Supplemental Information
Transmit Power		GMSK modulation Measures mean transmitted RF carrier power during the whole burst using a power threshold method. RBW is 500 kHz.
Range at UUT[a] BTS maximum: MS maximum: Minimum:	 +50 dBm (100 W) +40 dBm (10 W) –40 dBm	 With ≥20 dB external attenuation With ≥10 dB external attenuation With ≤20 dB external attenuation
Range at RF Input Maximum: Minimum:	 +30 dBm (1 W) –60 dBm	
Absolute power accuracy for in-band signal (excluding mismatch error) +30 to –40 dBm at RF Input, 10 db or 20 dB attenuator +18 °C to +30 °C: 0 °C to +55 °C:	 ±0.6 dB ±0.9 dB	 ±0.4 dB typical
Relative power accuracy (same channel, different Tx power, input attenuator fixed)[b] Input level change 0 to –76 dB[c]:	 ±0.25 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, characteristic 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
Power vs. Time		GMSK modulation Measures mean transmitted RF carrier power during the useful part of the burst (GSM method) and the power vs. time ramping. 500 kHz RBW
Carrier power range at UUT[a] BTS maximum: MS maximum: Minimum:	 +50 dBm (100 W) +40 dBm (10 W) –40 dBm	 With >20 dB external attenuation With >10 dB external attenuation With <20 dB external attenuation
Carrier power range at RF Input Maximum: Minimum:	 +30 dBm (1 W) –50 dBm	 –40 dBm with training sequence burst sync
Transmit power Absolute accuracy: Relative power linearity: Instrument repeatability:	Same as Transmit power measurement	
Power ramp relative accuracy[b] 0 to +6 dB 0 to –70 dB[c]	 ±0.25 dB ±0.20 dB	Referenced to mean RF transmitted carrier power.
Resolution Displayed: Remote query:	 0.01 dB 0.001 dB	
Instrument repeatability (over 30 days with daily internal self-alignment)		±0.05 dB, characteristic Measurement repeatability = instrument repeatability + signal repeatability
Time resolution	≤0.2 µs	
Maximum record length	50 slots (29 ms)	145 k points, characteristic With default pre-trigger
Burst to mask uncertainty	±0.2 bit (approx ±0.7 µs)	

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
Phase and Frequency Error		GMSK modulation
Carrier power range at UUT[a]		
BTS:	+50 dBm to –20 dBm	With >20 dB external attenuation
MS:	+40 dBm to –30 dBm	With >10 dB external attenuation
Carrier power range at RF Input	+30 dBm to –40 dBm	
Phase error (phase trajectory)		
Range:	–180 ° to +180 °	
Resolution:	±0.01 °	
Peak measurement accuracy:	±2 °	
RMS measurement accuracy:	±1.0 °	±0.5 °, typical
Frequency error		Frequency error excludes instrument time base error.
Initial frequency error range:	±200 kHz	
Accuracy:	±5 Hz	
I/Q offset		
Range:	–80 dBc to –10 dBc	
Accuracy:	± 0.5 dB	
Burst sync time uncertainty	±0.1 bit (approx ±0.4 µs)	
Displays	I/Q error quad view Phase error vs. bit Phase error with frequency vs. bit RF envelope vs. bit Numeric summary I/Q measured polar vector Data bits	

a. UUT = Unit Under Test

Measurement	Specifications	Supplemental Information
Output RF Spectrum		GMSK modulation
Carrier power range at UUT[a]		
Offsets ≤1800 kHz, 30 kHz RBW		
BTS:	+50 dBm to +15 dBm	With >20 dB external attenuation
MS:	+40 dBm to +5 dBm	With >10 dB external attenuation
Carrier power range at RF Input		
Offsets ≤1800 kHz, 30 kHz RBW:	+30 dBm to –5 dBm	
Offsets >1800 kHz, 100 kHz RBW:	+30 dBm to +10 dBm	
Reference power accuracy	Same as Transmit Power measurement	
Relative accuracy[b]		
0 to –76 dB[c]	±0.25 dB	±0.1 dB, typical
–76 to –86 dB[c]	±0.70 dB	±0.4 dB, typical
Spectrum due to modulation displayed dynamic range[d]		Offset freq ≤400 kHz, RBW filter is an exact 5-pole sync-tuned filter. Offset freq > 400 kHz, RBW filter has noise BW and Impulse BW equivalent to 5-pole sync-tuned filter. 30 kHz RBW
100 kHz offset	30 dB	35 dB, typical
200 kHz offset	60 dB	65 dB, typical
250 kHz offset	60 dB	65 dB, typical
400 kHz offset	70 dB	75 dB, typical
600 kHz offset	80 dB	85 dB, typical
1200 kHz offset	80 dB	85 dB, typical
1.8 to 6.0 MHz offset	82 dB	87 dB, typical, (100 kHz RBW)
Spectrum due to switching transients displayed dynamic range[d]		
400 kHz offset	62 dB	65 dB typical
600 kHz offset	80 dB	85 dB typical
1200 kHz offset	85 dB	90 dB typical
1800 kHz offset	85 dB	90 dB typical

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.
d. Maximum dynamic range is for RF Input ≥Š+12 dBm.

Measurement	Specifications	Supplemental Information
Spectrum	"Spectrum Measurement" under Transmitter Tester Specifications See "Measurements" on page 20.	

Measurement	Specifications	Supplemental Information
Waveform (Time Domain)	"Waveform Measurement" under Transmitter Tester Specifications See "Measurements" on page 20.	

Frequency

	Specifications	Supplemental Information
In-Band Frequency Range		
Down Band GSM	400 to 500 MHz	
GSM 900, P-GSM	890 to 915 MHz 935 to 960 MHz	
GSM 900, E-GSM	880 to 915 MHz 925 to 960 MHz	
DCS1800	1710 to 1785 MHz 1805 to 1880 MHz	
PCS1900	1850 to 1910 MHz 1930 to 1990 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	
GSM850	824 to 849 MHz 869 to 894 MHz	

Amplitude

	Specifications	Supplemental Information
Range Control		RF Input Autorange Manually set **Max Total Pwr** Manually set **Input Atten**

	Specifications	Supplemental Information
External Loss Correction		BTS Ext Atten and MS Ext Atten (in dB)

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: Repeatability: Resolution:	 –500 to +500 ms ±33 ns 33 ns	
External trigger inputs Level: Impedance:		 –5 V to +5 V, characteristic >10 kΩ, nominal

	Specifications	Supplemental Information
Burst Sync		
Source		Training sequence, RF amplitude, Ext Rear, 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)

5 NADC 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.

Measurements

Measurement specifications only apply over the cellular frequency bands supported by this option. Refer to "Frequency" on page 60 for specified frequency bands.

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, characteristic
At 60 KHz offset	0 to –65 dB	
At 90 KHz offset	0 to –70 dB	
Accuracy	±1.0 dB	
Resolution	0.01 dB	Display resolution

a. UUT = Unit Under Test

Measurement	Specifications	Supplemental Information
Error Vector Magnitude (EVM)		
Carrier Power Range at UUT[a]	+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

Measurement	Specifications	Supplemental Information
Spectrum	"Spectrum Measurement" under Transmitter Tester Specifications. See "Measurements" on page 20.	

Measurement	Specifications	Supplemental Information
Waveform (Time Domain)	"Waveform Measurement" under Transmitter Tester Specifications. See "Measurements" on page 20.	

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, characteristic
Impedance:		> 10 kΩ, nominal

6 PDC 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.

Measurements

Measurement specifications only apply over the cellular frequency bands supported by this option. Refer to "Frequency" on page 66 for specified frequency bands.

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 At 100 KHz offset	 0 to –55 dB 0 to –70 dB	
Accuracy	±1.0 dB	
Resolutio:	0.01 dB	Display resolution

a. UUT = Unit Under Test

Measurement	Specifications	Supplemental Information
Error Vector Magnitude (EVM)		
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	
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

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 –20dBm	
Frequency		
Resolution	0.1 kHz	
Accuracy	+400 Hz, –100 Hz	

a. UUT = Unit Under Test

Measurement	Specifications	Supplemental Information
Spectrum	"Spectrum Measurement" under Transmitter Tester Specifications. See "Measurements" on page 20.	

Measurement	Specifications	Supplemental Information
Waveform (Time Domain)	"Waveform Measurement" under Transmitter Tester Specifications. See "Measurements" on page 20.	

Frequency

	Specifications	Supplemental Information
In-Band Frequency Range		
800MHz Band #1	810 to 828 MHz 940to 958MHz	
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 1501MHz 1429 to 1453 MHz	

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: Repeatability: Resolution:	 –500 to +500 ms ±33 ns 33 ns	
External trigger inputs Level: Impedance:		 –5 V to +5 V, characteristic >10 kΩ, nominal

7 W-CDMA Specifications

All specifications apply over 0 °C to +55 °C, excepting 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.

Measurements

Measurement specifications only apply over the cellular frequency bands supported by this option. Refer to "Frequency" on page 81 for specified frequency bands.

Measurement	Specifications	Supplemental Information
Channel Power (RF Inputs)		
Power range	+30 to –70 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 50Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm	
Input Ranges 600Ω, 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, characteristic ±0.6 dB, characteristic ±2.0 dB, characteristic

Measurement		Specifications	Supplemental Information
Adjacent Channel Power Ratio (ACPR; ACLR)[a]			
Power range at RF Input		+30 to –20 dBm	
ACPR accuracy[b]			RRC weighted, 3.84 MHz noise bandwidth
Radio	Offset Frequency		
MS (UE)	5 MHz	±0.31 dB	at ACPR range of –30 to –36 dBc with the optimum mixer level[c]
MS (UE)	10 MHz	±0.27 dB	at ACPR range of –40 to –46 dBc with the optimum mixer level[d]
BTS	5 MHz	±0.59 dB	at ACPR range of –42 to –48 dBc with the optimum mixer level[e]
BTS	10 MHz	±0.28 dB	at ACPR range of –47 to –53 dBc with the optimum mixer level[d]
BTS	5 MHz	±0.33 dB	at –48 dBc Non-Coherent ACPR[f]
Dynamic range			RRC weighted, 3.84 MHz noise bandwidth
Offset Frequency			
5 MHz			–68 dBc, characteristic[g]
10 MHz			–72 dBc, characteristic[d]

a. Most versions of adjacent channel power (ACP) 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 Adjacent Channel Leakage Power Ratio (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 ACPR 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 “non-coherent case” described in footnote f, the worst case condition of coherent analyzer and UUT distortion products is the condition specified.
c. The mixer level is optimized for accuracy for the measurement of mobile station (MS) or user equipment (UE) within 3 dB of the required –33 dBc ACPR. This optimum mixer level is –17.2 dBm, so the input attenuation must be set as close as possible to the “input power – (–17.2 dBm).” Note that, if the mixer level is set to optimize dynamic range instead of accuracy, accuracy errors are nominally doubled.
d. The optimum mixer level for alternate channel measurements is a peak level of 0 dBm at 2 GHz. These specifications apply for average mixer levels of –6.9 to –17.2 dBm, with peak levels that do not cause overloading.
e. The mixer level is optimized for accuracy for the measurement of base transmission station (BTS) within 3 dB of the required –45 dBc ACPR. This optimum mixer level is –14.3 dBm, so the input attenuation must be set as close as possible to the “input power – (–14.3 dBm).” 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 optimizing accuracy. This case is commonly used in the industry and can be useful for comparison of analysis equipment, but the incoherent addition model is rarely justified.
g. The dynamic range is specified with the mixer level optimized. The optimum mixer level for the dynamic range of ACPR measurements is an average level of –6.9 dBm at 2 GHz.

Measurement	Specifications	Supplemental Information
Multi-Carrier Power		
Carrier Power range at RF Input	+30 to –20 dBm	
Adjacent Channel Power Ratio Range: 5 MHz offset ≥10 MHz offset		 –65 dBc, characteristics –69 dBc, characteristics
Relative Accuracy:	±1.0 dB	At 0 dB to (minimum measurement + 10 dB).
Resolution:	0.01 dB	Display resolution

Measurement	Specifications	Supplemental Information
Power Statistics CCDF (RF Inputs)		
Power range Maximum:	 +30 dBm (average) +40 dBm (peak)	
Minimum:	–40 dBm (average)	
Power Statistics CCDF (Baseband IQ Inputs)		
Input Ranges 50Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm	
Input Ranges 600Ω, 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	

Measurement	Specifications	Supplemental Information
Input Impedance = 1 M Ω, all ranges Unbalanced Balanced 0 to 1 MHz 1 MHz to 5 MHz		 ±0.7 dB, characteristic ±0.6 dB, characteristic ±2.0 dB, characteristic

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	at 1 kHz resolution bandwidth

Measurement	Specifications	Supplemental Information
Spectrum Emission Mask		
Carrier Power range at RF Input	+30 to –20 dBm	
Frequency Range	329 MHz to 3.678 GHz	
Spectrum Emission Power Range:		≤–136 dBc/Hz at 1 MHz offset, characteristic
Relative Accuracy:	±1.0 dB	
Resolution:	0.01 dB	Display resolution

Measurement	Specifications	Supplemental Information
Code Domain (RF Inputs)		
Code domain power Power range at RF Input:	+30 to –50 dBm	
Accuracy:		±0.3 dB (characteristics) With 15 slot measurement interval and spread channel power of within –40 dB of total power. Averaged over a slot.
Symbol power vs. time Power range at RF Input:	+30 to –40 dBm	
Accuracy:	±0.3 dB	Spread Channel Power of within –20 dB of Total Power.
Symbol error vector magnitude Power range at RF Input:	+30 to –20 dBm	
Code Domain (Baseband IQ Inputs)		
Input Ranges 50Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm	
Input Ranges 600Ω, 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, characteristic ±0.6 dB, characteristic ±2.0 dB, characteristic

Measurement	Specifications	Supplemental Information
QPSK EVM (RF Inputs)		
Power range	+30 to –20 dBm	
EVM		
Range:	0 to 25%	
Floor:	3.0%	
Accuracy:	±1.0%	
QPSK EVM (Baseband IQ Inputs)		
Input Ranges 50Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm	
Input Ranges 600Ω, 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, characteristic
Balanced		
0 to 1 MHz		±0.6 dB, characteristic
1 MHz to 5 MHz		±2.0 dB, characteristic
I/Q origin offset		
Range:	–10 to –50 dBc	
Frequency error		
Range:	±500 Hz	
Accuracy:	±10 Hz + Reference Oscillator accuracy	

Measurement	Specifications	Supplemental Information
Modulation Accuracy (global EVM meas) (RF Inputs)		
Carrier Power range at RF Input	+30 to –50 dBm	
Global EVM Range:	0 to 25%	
Accuracy:		±1.0% for test model 3, characteristic (within the range of 2.0 to 25.0%)
Floor:	2.0% or less for Test Model 3	
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 + Reference oscillator accuracy)	
Resolution:	0.01 Hz	Display resolution
Peak Code Domain Error Accuracy:		±1.0 dB for Test Model 3, characteristic (within the range of 28 to 38 dB from total power)
Resolution:	±0.01 dB	
Modulation Accuracy (global EVM meas) (Baseband IQ Inputs)		
Input Ranges 50Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm	
Input Ranges 600Ω, 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
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, characteristic ±0.6 dB, characteristic ±2.0 dB, characteristic

Measurement	Specifications	Supplemental Information
Spectrum (Frequency Domain)	"Spectrum Measurement" under Transmitter Tester Specifications See "Measurements" on page 20.	

Measurement	Specifications	Supplemental Information
Waveform (Time Domain)	"Waveform Measurement" under Transmitter Tester Specifications See "Measurements" on page 20.	

Frequency

	Specifications	Supplemental Information
In-Band Frequency Range	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, characteristic > 10 kΩ, nominal

8 cdma2000 Specifications

All specifications apply over 0 °C to +55 °C, excepting 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.

Measurements

Measurement specifications only apply over the cellular frequency bands supported by this option. Refer to "Frequency" on page 93 for specified frequency bands.

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 50Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm	
Input Ranges 600Ω, 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, characteristic ±0.6 dB, characteristic ±2.0 dB, characteristic

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 50Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm	
Input Ranges 600Ω, 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, characteristic
Balanced		
0 to 1 MHz		±0.6 dB, characteristic
1 MHz to 5 MHz		±2.0 dB, characteristic

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, characteristic
Relative Accuracy:	±1.0 dB	
Resolution:	0.01 dB	Display resolution

Measurement	Specifications	Supplemental Information
Code Domain (RF Input)		
Code domain power Power range:	+30 to –50 dBm	
Accuracy:	±0.3 dB	Spread channel power is within 20 dB of total power.
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 Range: Accuracy: Resolution:	 –13.33 ms to +13.3 ms ±250 ns 10 ns	(From even second signal to start of PN sequence)
Code Domain (Baseband IQ Inputs)		
Input Ranges 50Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm	

Measurement	Specifications	Supplemental Information
Input Ranges 600Ω, 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, characteristic ±0.6 dB, characteristic ±2.0 dB, characteristic

Measurement	Specifications	Supplemental Information
QPSK EVM (RF Input)		
Power range	+30 to –20 dBm	
EVM Range:	 0 to 25%	
Floor:	1.5%	
Accuracy:	±1.0%	
I/Q origin offset Range:	 –10 to –50 dBc	
Frequency Error Range:	 ±500 Hz	
Accuracy:	±10 Hz	
QPSK EVM (Baseband IQ Inputs)		
Input Ranges 50Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm	

Measurement	Specifications	Supplemental Information
Input Ranges 600Ω, 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, characteristic ±0.6 dB, characteristic ±2.0 dB, characteristic
Voltage range at I or Q inputs 50Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm	
600Ω, 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 (global EVM meas) (RF Input)		
Carrier Power range	+30 to –50 dBm	
Global EVM Range:	0 to 25%	
Floor:	2.0% or less for pilot only signal.	
	2.0% or less for pilot with 16 DPCH signal.	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	
Resolution:	0.01 Hz	Display resolution
Modulation Accuracy (global EVM meas) (Baseband IQ Inputs)		
Input Ranges 50Ω Input Z	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm	
Input Ranges 600Ω, 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	

Measurement	Specifications	Supplemental Information
Input Impedance = 1 M Ω, all ranges Unbalanced Balanced 0 to 1 MHz 1 MHz to 5 MHz		 ±0.7 dB, characteristic ±0.6 dB, characteristic ±2.0 dB, characteristic

Measurement	Specifications	Supplemental Information
Spectrum (Frequency Domain)	"Spectrum Measurement" under Transmitter Tester Specifications See "Measurements" on page 20.	

Measurement	Specifications	Supplemental Information
Waveform (Time Domain)	"Waveform Measurement" under Transmitter Tester Specifications See "Measurements" on page 20.	

Frequency

	Specifications	Supplemental Information
In-Band Frequency Range		
ITM-2000	2110 to 2170 MHz 1920 to 1980 MHz	
IS-95	869 to 894 MHz 824 to 849 MHz	
J-STD-008	1930 to 1990 MHz 1850 to 1910 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:	–100 to +500 ms	
Repeatability:	±33 ns	
Resolution:	33 ns	
External trigger inputs		
Level:		–5 V to +5 V, characteristic
Impedance:		> 10 kΩ, nominal

9 EDGE 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.

Measurements

Measurement specifications only apply over the cellular frequency bands supported by this option. Refer to "Frequency" on page 101 for specified frequency bands.

Measurement	Specifications	Supplemental Information
EDGE Error Vector Magnitude (EVM)		8PSK modulation
Carrier Power Range at UUT[a]	+37 to –10 dBm	With 10 dB external atten.
Carrier Power Range at RF Input	+27 to –31 dBm	
EVM		
Range	0 to 25 %	
Floor	0.6 %	0.5 %, typical
Accuracy		(With +27 to –12 dBm power range at the RF input.)
EVM range 1% to 10%	–1.0 % to +0.5 %	±0.55 %, typical
EVM range 10% to 20%	±1.75 %	±1.4 %, typical
Resolution	0.01 %	Display resolution
Frequency Error		±10 Hz, characteristic

a. UUT = Unit Under Test

Measurement	Specifications	Supplemental Information
EDGE Power vs. Time		8PSK modulation Measures mean transmitted RF carrier power during the useful part of the burst (GSM method) and the power vs. time ramping. 500 kHz RBW
Carrier power range at RF Input Maximum: Minimum:	 +30 dBm (1 W) –31 dBm	 –40 dBm with training sequence burst sync
Transmit power Absolute accuracy: Relative power linearity: Instrument repeatability:	Same as GSM transmit power measurement. See “Measurements” on page 48.	
Power ramp relative accuracy[a] 0 to +6 dB 0 to –70 dB[b]	 ±0.25 dB ±0.20 dB	Referenced to mean RF transmitted carrier power.
Resolution Displayed: Remote query:	 0.01 dB 0.001 dB	
Instrument repeatability (over 30 days with daily internal self-alignment)		±0.05 dB, characteristic Measurement repeatability = instrument repeatability + signal repeatability
Time resolution	≤0.2 µs	

a. Does not include uncertainty due to noise.
b. Minimum value is for RF Input ≥–2 dBm and optimum input attenuation.

Measurement	Specifications	Supplemental Information
EDGE Output RF Spectrum		8PSK modulation
Carrier power range at UUT[a] Offsets ≤1800 kHz, 30 kHz RBW BTS: MS:	 +50 dBm to +15 dBm +40 dBm to +5 dBm	 With >20 dB external attenuation With >10 dB external attenuation

Measurement	Specifications	Supplemental Information
Reference power accuracy	Same as GSM transmit power measurement. See "Measurements" on page 48.	
Relative accuracy[b]		
0 to –76 dB[c]	±0.25 dB	±0.1 dB, typical
–76 to –86 dB[c]	±0.70 dB	±0.4 dB, typical
Spectrum due to modulation displayed dynamic range[d]		30 kHz Res BW Offset freq ≤400 kHz, RBW filter is an exact 5-pole sync-tuned filter. Offset freq > 400 kHz, RBW filter has noise BW and impulse BW equivalent to 5-pole sync-tuned filter.
100 kHz offset	30 dB	35 dB, typical
200 kHz offset	60 dB	65 dB, typical
250 kHz offset	60 dB	65 dB, typical
400 kHz offset	70 dB	75 dB, typical
600 kHz offset	80 dB	85 dB, typical
1200 kHz offset	80 dB	85 dB, typical
1.8 to 6.0 MHz offset	82 dB	87 dB, typical, (100 kHz RBW)
Spectrum due to switching transients displayed dynamic range[d]		
400 kHz offset	62 dB	65 dB typical
600 kHz offset	80 dB	85 dB typical
1200 kHz offset	85 dB	90 dB typical
1800 kHz offset	85 dB	90 dB typical

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.
d. Maximum dynamic range is for RF Input ≥Š+12 dBm.

Measurement	Specifications	Supplemental Information
Transmit Power	"Transmit Power Measurement" under GSM Specifications See "Measurements" on page 48.	GMSK modulation

Measurement	Specifications	Supplemental Information
Power vs. Time	"Power vs. Time Measurement" under GSM Specifications See "Measurements" on page 48.	GMSK modulation

Measurement	Specifications	Supplemental Information
Phase and Frequency Error	"Phase and Frequency Error Measurement" under GSM Specifications See "Measurements" on page 48.	GMSK modulation

Measurement	Specifications	Supplemental Information
Output RF Spectrum	"Output RF Spectrum Measurement" under GSM Specifications See "Measurements" on page 48.	GMSK modulation

Measurement	Specifications	Supplemental Information
Spectrum	"Spectrum Measurement" under Transmitter Tester Specifications See "Measurements" on page 20.	

Measurement	Specifications	Supplemental Information

Measurement	Specifications	Supplemental Information
Waveform (Time Domain)	"Waveform Measurement" under Transmitter Tester Specifications See "Measurements" on page 20.	

Frequency

	Specifications	Supplemental Information
In-Band Frequency Range		
Down Band GSM	400 to 500 MHz	
GSM 900, P-GSM	890 to 915 MHz 935 to 960 MHz	
GSM 900, E-GSM	880 to 915 MHz 925 to 960 MHz	
DCS1800	1710 to 1785 MHz 1805 to 1880 MHz	
PCS1900	1850 to 1910 MHz 1930 to 1990 MHz	

Amplitude

	Specifications	Supplemental Information
Range Control		RF Input Autorange Manually set **Max Total Pwr** Manually set **Input Atten**

	Specifications	Supplemental Information
External Loss Correction		BTS Ext Atten and MS Ext Atten (in dB)

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: Repeatability: Resolution:	 –500 to +500 ms ±33 ns 33 ns	
External trigger inputs Level: Impedance:		 –5 V to +5 V, characteristic >10 kΩ, nominal

10 1xEV-DO Specifications

All specifications apply over 0 °C to +55 °C, excepting 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.

Measurements

Measurement specifications only apply over the cellular frequency bands supported by this option. Refer to "Frequency" on page 110 for specified frequency bands.

Measurement	Specifications	Supplemental Information
Channel Power		Input signal must not be bursted
(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	

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

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		Input signal must not be bursted
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

Measurement	Specifications	Supplemental Information
Occupied Bandwidth		Input signal must not be bursted
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, characteristic
Accuracy, relative:	±1.0 dB	
Resolution:	0.01 dB	display resolution

Measurement	Specifications	Supplemental Information
Code Domain		For Pilot, 2 MAC channels, 16 channels of QPSK data.
Code domain power range at RF input:	–50 to +30 dBm	
Accuracy:	±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, characteristic
EVM		
Range:		0 to 25%, characteristic
Floor:		1.5%, characteristic
Accuracy:		±1.0%, characteristic
I/Q origin offset range:		–50 to –10 dBc, characteristic
Frequency error		
Range:		±500 Hz, characteristic
Accuracy:		± 10 Hz (nominal) + (transmitter frequency × frequency reference accuracy)

Measurement	Specifications	Supplemental Information
Modulation Accuracy (Composite Rho)		For Pilot, 2 MAC channels, 16 channels of QPSK data.
Carrier power range at RF input:		–45 to +30 dBm, characteristic
EVM		
Range:		0 to 25%,characteristic
Floor:		2.5%, characteristic
Rho		
Range:		0.94 to 1.0, characteristic
Floor:		0.99938 (2.5% EVM), characteristic
Frequency error		
Range:		±400 Hz, characteristic
Accuracy:	±1 Hz + (transmitter frequency × freq. ref. accuracy)	
Resolution:		0.01 Hz display resolution, characteristic
I/Q origin offset		
Range:		–50 to –10 dBc, characteristic
Resolution:		0.02 dB display resolution, characteristic

Measurement	Specifications	Supplemental Information
Power vs Time		
Carrier Power range at RF input		–80 to +30 dBm, characteristic
Power accuracy, absolute[a] In-band signals 18°C to 30°C		
–28 to +30 dBm:		±0.6 dB, characteristic
–50 to –28 dBm:		±0.8 dB, characteristic
–80 to –50 dBm:		±1.0 dB, characteristic

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

Measurement	Specifications	Supplemental Information
Spectrum (Frequency Domain)	"Spectrum Measurement" under Transmitter Tester Specifications. See "Measurements" on page 20.	

Measurement	Specifications	Supplemental Information
Waveform (Time Domain)	"Waveform Measurement" under Transmitter Tester Specifications. See "Measurements" on page 20.	

Frequency

Band Range	Specifications	Supplemental Information
In-Band Frequency Range (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 960MHz	900-MHz Band

Band Range	Specifications	Supplemental Information
Alternative Frequency Ranges[a] (Access Network Only)		
Band Class 5	421 to 430 MHz 460 to 470 MHz 489 to 194 MHz	NMT–450 Band
Band Class 7	746 to 764 MHz	North American 700-MHz Cellular Band

a. Frequency ranges with tuning plans but degraded specifications for absolute power accuracy. The degradation should be nominally ±0.30 dB; see Absolute Power Measurement Accuracy (RF Input) on page 15 for more details on amplitude accuracies of different bands.

General

Measurement	Specifications	Supplemental Information
Trigger		
Trigger source		RF burst (wideband), Video (IF envelope), Ext Front, Ext Rear. Actual choices available depend on measurement selection.
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, characteristic >10 kΩ, characteristic
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.