Test Equipment Solutions Datasheet

Test Equipment Solutions Ltd specialise in the second user sale, rental and distribution of quality test & measurement (T&M) equipment. We stock all major equipment types such as spectrum analyzers, signal generators, oscilloscopes, power meters, logic analysers etc from all the major suppliers such as Agilent, Tektronix, Anritsu and Rohde & Schwarz.

We are focused at the professional end of the marketplace, primarily working with customers for whom high performance, quality and service are key, whilst realising the cost savings that second user equipment offers. As such, we fully test & refurbish equipment in our in-house, traceable Lab. Items are supplied with manuals, accessories and typically a full no-quibble 2 year warranty. Our staff have extensive backgrounds in T&M, totalling over 150 years of combined experience, which enables us to deliver industry-leading service and support. We endeavour to be customer focused in every way right down to the detail, such as offering free delivery on sales, covering the cost of warranty returns BOTH ways (plus supplying a loan unit, if available) and supplying a free business tool with every order.

As well as the headline benefit of cost saving, second user offers shorter lead times, higher reliability and multivendor solutions. Rental, of course, is ideal for shorter term needs and offers fast delivery, flexibility, try-before-you-buy, zero capital expenditure, lower risk and off balance sheet accounting. Both second user and rental improve the key business measure of Return On Capital Employed.

We are based near Heathrow Airport in the UK from where we supply test equipment worldwide. Our facility incorporates Sales, Support, Admin, Logistics and our own in-house Lab.

All products supplied by Test Equipment Solutions include:

- No-quibble parts & labour warranty (we provide transport for UK mainland addresses).
- Free loan equipment during warranty repair, if available.
- Full electrical, mechanical and safety refurbishment in our in-house Lab.
- Certificate of Conformance (calibration available on request).
- Manuals and accessories required for normal operation.
- Free insured delivery to your UK mainland address (sales).
- Support from our team of seasoned Test & Measurement engineers.
- ISO9001 quality assurance.

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Agilent PSA Series Spectrum Analyzers

Data Sheet

40/80 MHz Analysis Bandwidth Now Available On 50 GHz PSA!

Models	
E4443A	3 Hz to 6.7 GHz
E4445A	3 Hz to 13.2 GHz
E4440A	3 Hz to 26.5 GHz*
E4447A	3 Hz to 42.98 GHz
E4446A	3 Hz to 44 GHz*
E4448A	3 Hz to 50 GHz*

* 325 GHz with external mixing

The Agilent PSA Series offers high-performance spectrum analysis, up to 50 GHz, with powerful one-button measurements, a versatile feature set, and a leading-edge combination of flexibility, speed, accuracy, analysis bandwidth, and dynamic range. From millimeter wave and phase noise measurements to spur searches and modulation analysis, the PSA Series offers unique and comprehensive high-performance solutions to R&D and manufacturing engineers in cellular and emerging wireless communications, aerospace, and defense.

For more information regarding the PSA wide analysis bandwidth, see the 40/80 MHz BW digitizers, Option 140/122, technical overview at **www.agilent.com/find/psa**

Agilent Technologies

Table of Contents

Definitions and Conditions

Specifications describe the performance of parameters covered by the product warranty and apply over 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 specifications that 80 percent of the units exhibit with a 95 percent 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 analyzer will meet its specifications when:

- stored a minimum of two hours within the operating temperature range and turned on for at least 30 minutes with **Auto Align On** selected.
- the instrument is within its one year calibration cycle.
- **Align All Now** has been performed within the past 24 hours or when the temperature changes 3 °C.
- the instrument is under auto couple control, except that Auto Sweep Time = Accy.
- DC coupling applied if center frequency is < 20 MHz.

This PSA Series data sheet is a summary of the complete specifications and conditions, which are available in the *PSA Series Spectrum Analyzers Specification Guide*.

The PSA Series Spectrum Analyzers Specification Guide can be obtained on the web through:
www.agilent.com/find/psa

Then follow this selection process:

- Select "Technical Support" under Key Library Information
- Select "Manuals and Guides"
- Download specifications guide.

Frequency Specifications

Frequency range

E4443A	(DC coupled) 3 Hz to 6.7 GHz	(AC coupled) 20 MHz to 6.7 GHz
E4445A	(DC coupled) 3 Hz to 13.2 GHz	(AC coupled) 20 MHz to 13.2 GHz
E4440A	(DC coupled) 3 Hz to 26.5 GHz[1]	(AC coupled) 20 MHz to 26.5 GHz[1]
E4447A	(DC coupled) 3 Hz to 42.98 GHz	
E4446A	(DC coupled) 3 Hz to 44 GHz[1]	
E4448A	(DC coupled) 3 Hz to 50 GHz[1]	

1 325 GHz with external mixers

Band	Harmonic mixing mode (N)	
0	1–	3 Hz to 3 GHz
1	1–	2.85 GHz to 6.6 GHz
2	2–	6.2 GHz to 13.2 GHz
3	4–	12.8 GHz to 19.2 GHz
4	4–	18.7 GHz to 26.8 GHz
5	4+	26.4 GHz to 31.15 GHz
6	8–	31.0 GHz to 50.0 GHz

Frequency reference

Accuracy	±[(time since last adjustment x aging rate) + temperature stability + calibration accuracy]	
Aging rate	$\pm 1 \times 10^{-7}$ / year	
Temperature stability	20 °C to 30 °C $\pm 1 \times 10^{-8}$	0 °C to 55 °C $\pm 5 \times 10^{-8}$
Achievable initial calibration accuracy	$\pm 7 \times 10^{-8}$	
Example frequency reference accuracy 1 year after last adjustment	$= \pm(1 \times 1 \times 10^{-7} + 1 \times 10^{-8} + 7 \times 10^{-8})$ $= \pm 1.8 \times 10^{-7}$	

Frequency readout accuracy *(start, stop, center, marker)*

± (marker frequency x frequency reference accuracy + 0.25% x span + 5% x RBW + 2 Hz + 0.5 x horizontal resolution*)

* Horizontal resolution is span/(sweep points – 1)

Marker frequency counter

Accuracy	±(marker frequency x frequency reference accuracy + 0.100 Hz)
Delta counter accuracy	±(delta frequency x frequency reference accuracy + 0.141 Hz)
Counter resolution	0.001 Hz

Frequency span *(FFT and swept mode)*

Range	0 Hz (zero span), 10 Hz to maximum frequency of model
Resolution	2 Hz
Accuracy	±[0.2% x span + span / (sweep points – 1)]

Frequency Specifications (continued)

Sweep time and triggering		
Range	Span = 0 Hz Span ≥ 10 Hz	1 µs to 6000 s 1 ms to 2000 s
Accuracy	Span ≥ 10 Hz, sweep Span ≥ 10 Hz, FFT Span = 0 Hz	±0.01% nominal ±40% nominal ±0.01% nominal
Trigger	Free run, line, video, RF burst, external front, external rear, frame (basic mode)	
Trigger delay	Span = 0 Hz, or FFT Span ≥ 10 Hz, swept Resolution	–150 ms to +500 ms 1 µs to 500 ms 0.1 µs

Sweep (trace) point range	
Span = 0 Hz	2 to 8192
Span ≥ 10 Hz	101 to 8192

Gated sweep	
Gate length	10 µs to 500 ms
Gate delay range	0 to 500 ms
Gate delay jitter	33.3 ns p-p nominal

Gated FFT	
Delay range	–150 to +500 ms
Delay resolution	100 ns or 4 digits whichever is more
Gate duration	1.83/RBW ± 2% nominal

Resolution bandwidth (RBW)		
Range (–3.01 dB bandwidth)	1 Hz to 3 MHz (10% steps), 4, 5, 6, 8 MHz	
Bandwidth accuracy (power) RBW range	1 Hz to 51 kHz 56 kHz to 75 kHz 82 kHz to 330 kHz 360 kHz to 1.1 MHz (< 3 GHz CF) 1.2 MHz to 2.0 MHz (< 3 GHz CF) 2.2 MHz to 6.0 MHz (< 3 GHz CF)	±0.5% (± 0.022 dB) ±1.0% (± 0.044 dB) ±0.5% (± 0.022 dB) ±1.0% (± 0.044 dB) ±0.07 dB nominal ±0.2 dB nominal
Bandwidth accuracy (–3.01 dB) RBW range	1 Hz to 1.5 MHz	±2% nominal
Selectivity (–60 dB/–3 dB)	4.1:1 nominal	
EMI bandwidths (CISPR compliant)	200 Hz, 9 kHz, 120 kHz, 1 MHz	
EMI bandwidths (MIL STD 461E compliant)	10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz	

Frequency Specifications (continued)

Analysis bandwidth[1]

Maximum bandwidth				
with Option 140 [2]	40 MHz			
with Option 122 [2]	80 MHz			
with Option B7J	10 MHz			
321.4 MHz IF output [2]	–1 dB bandwidth	20 to 30 MHz nominal	Option 123 (> 2.85 GHz)	200 MHz nominal
	–3 dB bandwidth	30 to 60 MHz nominal		
70 MHz IF output[2] (Option E444xA-H70)	–1 dB bandwidth	20 to 30 MHz nominal		
	–3 dB bandwidth	30 to 60 MHz nominal		

1 Analysis bandwidth is the instantaneous bandwidth available around a center frequency over which the input signal can be digitized for further analysis or processing in the time, frequency, or modulation domain.

2 Not available for E4447A.

Video bandwidth (VBW)

Range	1 Hz to 3 MHz (10% steps), 4, 5, 6, 8 MHz and wide open
Accuracy	±6% nominal

Stability[3]

Noise sidebands	Offset	Specification	Typical
(20 °C to 30 °C, CF = 1 GHz)	100 Hz	–91 dBc/Hz	–96 dBc/Hz
	1 kHz	–103 dBc/Hz	–108 dBc/Hz
	10 kHz	–116 dBc/Hz	–118 dBc/Hz
	30 kHz	–116 dBc/Hz	–118 dBc/Hz
	100 kHz	–122 dBc/Hz	–124 dBc/Hz
	1 MHz	–145 dBc/Hz	–147 dBc/Hz, –148 dBc/Hz nominal
	6 MHz	–154 dBc/Hz	–156 dBc/Hz, –156.5 dBc/Hz nominal
	10 MHz	–156 dBc/Hz	–157.5 dBc/Hz, –158 dBc/Hz nominal
Residual FM	< (1 Hz X N) p-p in 1 s, typical, see frequency range for N (harmonic number)		

3 For nominal values, refer to Figures 1.

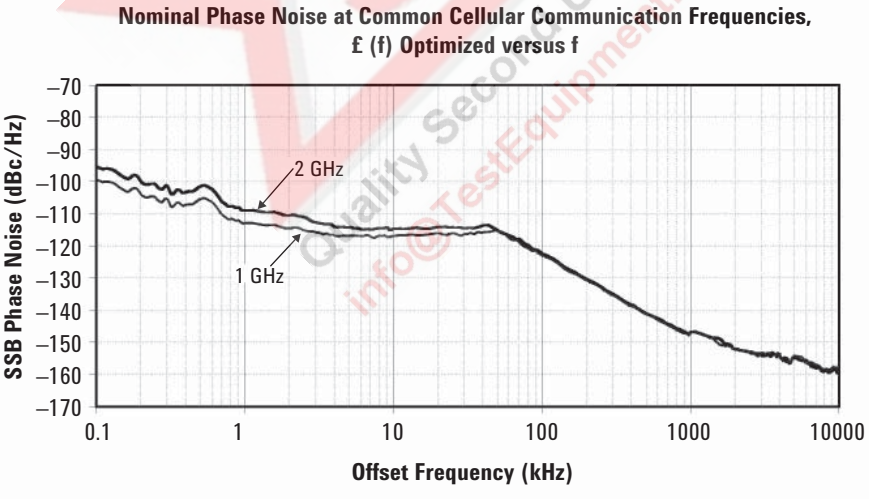

Figure 1. Nominal phase noise at common cellular frequencies

Amplitude Specifications

Amplitude range

Measurement range	Displayed average noise level (DANL) to maximum safe input level
Input attenuator range (3 Hz to 50 GHz)	0 to 70 dB in 2 dB steps

Maximum safe input level

Average total power	+30 dBm (1 W)		
Preamp (Option E444xA-1DS)	+30 dBm		
Preamp (Option E444xA-110)	+25 dBm		
Peak pulse power	< 10 µs pulse width, < 1% duty cycle and input attenuation ≥ 30 dB		+50 dBm (100 W)
DC volts	DC coupled < ±0.2 Vdc	AC coupled (E4443A, E4445A, E4440A only)	±100 Vdc

1 dB gain compression (two-tone)

		Total power at input mixer	
	20 MHz to 200 MHz	0 dBm	+3 dBm nominal
	200 MHz to 3 GHz	+3 dBm	+7 dBm nominal
	3 GHz to 6.6 GHz	+3 dBm	+4 dBm nominal
	6.6 GHz to 26.5 GHz	–2 dBm	0 dBm nominal
	26.5 GHz to 50 GHz		0 dBm nominal
Preamp on (Option E444xA-1DS)	10 MHz to 200 MHz		–30 dBm nominal
	200 MHz to 3 GHz		–25 dBm nominal
Preamp on (Option E444xA-110)	10 MHz to 200 MHz		–24 dBm nominal
	200 MHz to 3 GHz		–20 dBm nominal
	3.0 GHz to 6.6 GHz		–23 dBm nominal
	6.6 GHz to 30 GHz		–27 dBm nominal
	30 GHz to 50 GHz		–24 dBm nominal

Typical gain compression (two-tone)

		Mixer level	Compression
	20 MHz to 200 MHz	0 dBm	< 0.5 dB
	200 MHz to 6.6 GHz	+3 dBm	< 0.5 dB
	6.6 GHz to 26.5 GHz	–2 dBm	< 0.4 dB

Amplitude Specifications (continued)

Displayed Average Noise Level (DANL) (Input terminated, sample or average detector, averaging type = Log, 20 to 30 °C)

		Zero span and swept normalized to 1 Hz RBW and 0 dB attenuation	Zero span and swept normalized to 1 Hz RBW and 0 dB attenuation (typical)	FFT only actual 1 Hz RBW 0 dB attenuation
E4443A/E4445A/E4440A	3 Hz to 1 kHz	—	–110 dBm nominal	—
	1 kHz to 10 kHz	—	–130 dBm nominal	—
	10 kHz to 100 kHz	–137 dBm	–141 dBm	–137 dBm
	100 kHz to 1 MHz	–145 dBm	–149 dBm	–145 dBm
	1 MHz to 10 MHz	–150 dBm	–153 dBm	–150 dBm
	10 MHz to 1.2 GHz	–154 dBm	–155 dBm	–154 dBm
	1.2 GHz to 2.1 GHz	–153 dBm	–154 dBm	–153 dBm
	2.1 GHz to 3.0 GHz	–152 dBm	–153 dBm	–152 dBm
	3 GHz to 6.6 GHz	–152 dBm	–153 dBm	–151 dBm
	6.6 GHz to 13.2 GHz	–150 dBm	–152 dBm	–149 dBm
	13.2 GHz to 20 GHz	–147 dBm	–149 dBm	–146 dBm
	20 GHz to 26.5 GHz	–143 dBm	–145 dBm	–143 dBm
Preamp ON (Option 1DS)	100 kHz to 200 kHz	–159 dBm	–162 dBm	–158 dBm
	200 kHz to 500 kHz	–159 dBm	–162 dBm	–158 dBm
	500 kHz to 1 MHz	–163 dBm	–165 dBm	–162 dBm
	1 MHz to 10 MHz	–166 dBm	–168 dBm	–165 dBm
	10 MHz to 500 MHz	–169 dBm	–170 dBm	–168 dBm
	500 MHz to 1.1 GHz	–168 dBm	–169 dBm	–167 dBm
	1.1 GHz to 2.1 GHz	–167 dBm	–168 dBm	–166 dBm
	2.1 GHz to 3.0 GHz	–165 dBm	–166 dBm	–165 dBm
Preamp ON (Option 110)	10 to 50 MHz	–148 dBm	–154 dBm	–148 dBm
	50 to 500 MHz	–153 dBm	–164 dBm	–153 dBm
	500 MHz to 2.1 GHz	–166 dBm	–168 dBm	–166 dBm
	2.1 to 3 GHz	–166 dBm	–168 dBm	–166 dBm
	3 to 6.6 GHz	–165 dBm	–166 dBm	–165 dBm
	6.6 to 13.2 GHz	–163 dBm	–165 dBm	–163 dBm
	13.2 to 16 GHz	–162 dBm	–165 dBm	–162 dBm
	16 to 19 GHz	–162 dBm	–164 dBm	–162 dBm
	19 to 26.5 GHz	–159 dBm	–161 dBm	–159 dBm

Amplitude Specifications (continued)

Displayed Average Noise Level (DANL) (Input terminated, sample or average detector, averaging type = Log, 20 to 30 °C) continued

		Zero span and swept normalized to 1 Hz RBW and 0 dB attenuation	Zero span and swept normalized to 1 Hz RBW and 0 dB attenuation (typical)	FFT only actual 1 Hz RBW 0 dB attenuation
E4447A/E4446A/E4448A	3 Hz to 1 kHz	—	–110 dBm nominal	—
	1 kHz to 10 kHz	—	–130 dBm nominal	—
	10 kHz to 100 kHz	–137 dBm	–141 dBm	–137 dBm
	100 kHz to 1 MHz	–145 dBm	–150 dBm	–145 dBm
	1 MHz to 10 MHz	–150 dBm	–155 dBm	–150 dBm
	10 MHz to 1.2 GHz	–153 dBm	–154 dBm	–152 dBm
	1.2 GHz to 2.1 GHz	–152 dBm	–153 dBm	–151 dBm
	2.1 GHz to 3 GHz	–151 dBm	–152 dBm	–150 dBm
	3 GHz to 6.6 GHz	–151 dBm	–152 dBm	–150 dBm
	6.6 GHz to 13.2 GHz	–146 dBm	–149 dBm	–146 dBm
	13.2 GHz to 20 GHz	–144 dBm	–146 dBm	–143 dBm
	20 GHz to 22.5 GHz	–143 dBm	–146 dBm	–143 dBm
	22.5 GHz to 26.8 GHz	–140 dBm	–144 dBm	–140 dBm
	26.8 GHz to 31.15 GHz	–142 dBm	–145 dBm	–141 dBm
	31.15 GHz to 35 GHz	–134 dBm	–136 dBm	–133 dBm
	35 GHz to 38 GHz	–129 dBm	–132 dBm	–129 dBm
	38 GHz to 44 GHz	–131 dBm	–134 dBm	–131 dBm
	44 GHz to 49 GHz	–128 dBm	–131 dBm	–127 dBm
	49 GHz to 50 GHz	–127 dBm	–130 dBm	–126 dBm
Preamp ON (Option 1DS)	100 kHz to 200 kHz	–158 dBm	–162 dBm	–157 dBm
	200 kHz to 500 kHz	–158 dBm	–162 dBm	–157 dBm
	500 kHz to 1 MHz	–161 dBm	–165 dBm	–160 dBm
	1 MHz to 10 MHz	–167 dBm	–169 dBm	–166 dBm
	10 MHz to 500 MHz	–167 dBm	–169 dBm	–167 dBm
	500 MHz to 1.2 GHz	–166 dBm	–168 dBm	–166 dBm
	1.2 GHz to 2.1 GHz	–165 dBm	–167 dBm	–165 dBm
	2.1 GHz to 3.0 GHz	–163 dBm	–165 dBm	–163 dBm
Preamp ON (Option 110)	10 to 50 MHz	–148 dBm	–158 dBm	–148 dBm
	50 to 500 MHz	–153 dBm	–164 dBm	–153 dBm
	500 MHz to 1.2 GHz	–165 dBm	–168 dBm	–165 dBm
	1.2 to 2.1 GHz	–165 dBm	–168 dBm	–165 dBm
	2.1 to 3 GHz	–165 dBm	–167 dBm	–165 dBm
	3 to 6.6 GHz	–165 dBm	–167 dBm	–165 dBm
	6.6 to 13.2 GHz	–162 dBm	–165 dBm	–162 dBm
	13.2 to 19 GHz	–161 dBm	–163 dBm	–161 dBm
	19 to 22.5 GHz	–161 dBm	–162 dBm	–161 dBm
	22.5 to 26.8 GHz	–155 dBm	–160 dBm	–155 dBm
	26.8 to 31.15 GHz	–157 dBm	–161 dBm	–157 dBm
	31.15 to 35 GHz	–152 dBm	–156 dBm	–152 dBm
	35 to 38 GHz	–146 dBm	–150 dBm	–146 dBm
	38 to 41 GHz	–146 dBm	–150 dBm	–146 dBm
	41 to 44 GHz	–146 dBm	–150 dBm	–146 dBm
	44 to 45 GHz	–143 dBm	–150 dBm	–143 dBm
	45 to 49 GHz	–143 dBm	–146 dBm	–143 dBm
	49 to 50 GHz	–140 dBm	–145 dBm	–140 dBm

Amplitude Specifications (continued)

Display range

Log scale	0.1 to 1 dB/division in 0.1 dB steps	1 to 20 dB/division in 1 dB steps (10 display divisions)
Linear scale	10 divisions	
Scale units	dBm, dBmV, dBµV, dBmA, dBµA, V, W, A, dBµV/m, dBµA/m, dBpT, dBG	

Frequency response ***(10 dB input attenuation, 20 to 30 °C, preselector centering applied)***

E4443A/E4445A/E4440A	3 Hz to 3 GHz	±0.38 dB	(±0.11 dB typical)
	3 GHz to 6.6 GHz	±1.50 dB	(±0.6 dB typical)
	6.6 GHz to 22 GHz	±2.00 dB	(±1.0 dB typical)
	22 GHz to 26.5 GHz	±2.50 dB	(±1.3 dB typical)
E4447A/E4446A/E4448A	3 Hz to 3 GHz	±0.38 dB	(±0.15 dB typical)
	3 GHz to 6.6 GHz	±1.50 dB	(±0.6 dB typical)
	6.6 GHz to 22 GHz	±2.00 dB	(±1.2 dB typical)
	22 GHz to 26.8 GHz	±2.50 dB	(±1.3 dB typical)
	26.4 GHz to 31.15 GHz	±1.75 dB	(±0.6 dB typical)
	31.15 GHz to 50 GHz	±2.50 dB	(±1.0 dB typical)
Frequency response at attenuation ≠ 10 dB (Atten = 20, 30, or 40 dB)	10 MHz to 2.2 GHz	±0.53 dB	
	2.2 GHz to 3 GHz	±0.69 dB	
Preamp on (Option E444xA-1DS), (for all models)	100 kHz to 3 GHz	±0.70 dB	< (±0.30 dB typical)
Preamp on (Option E444xA-110, 0 dB input attenuation) E4443A/E4445A/E4440A	10 MHz to 3.0 GHz	±1.0 dB	(±0.35 dB typical)
	3.0 to 6.6 GHz	±1.75 dB	(±0.8 dB typical)
	6.6 to 13.2 GHz	±3.0 dB	(±1.0 dB typical)
	13.2 to 19 GHz	±3.0 dB	(±1.2 dB typical)
	19 to 26.5 GHz	±4.0 dB	(±2.0 dB typical)
E4447A/E4446A/E4448A	10 MHz to 3.05 GHz	±1.3 dB	(±0.5 dB typical)
	3.0 to 6.6 GHz	±2.5 dB	(±1.0 dB typical)
	6.6 to 13.2 GHz	±2.5 dB	(±1.2 dB typical)
	13.2 to 19 GHz	±3.0 dB	(±1.5 dB typical)
	19 to 26.5 GHz	±4.0 dB	(±2.0 dB typical)
	26.5 to 31.15 GHz	±3.0 dB	(±1.2 dB typical)
	31.15 to 50 GHz	±3.5 dB	(±1.6 dB typical)

Input attenuation switching uncertainty ***(Attenuator setting ≥ 2 dB)***

	At 50 MHz	±0.18 dB	±0.053 dB typical
	3 Hz to 3 GHz		±0.3 dB nominal
	3 GHz to 13.2 GHz		±0.5 dB nominal
	13.2 GHz to 26.5 GHz		±0.7 dB nominal
	26.5 GHz to 50 GHz		±1.0 dB nominal

Total absolute amplitude accuracy ***(10 dB attenuation, 20 to 30 °C, 10 Hz ≤ RBW ≤ 1 MHz, input signal –10 to –50 dBm, all settings auto-coupled except Auto Swp Time = Accy, any reference level, any scale)***

	At 50 MHz	±0.24 dB (±0.06 dB typical)
	At all frequencies	±(0.24 dB + frequency response), ±(0.06 dB+ frequency response) typical
	3 Hz to 3 GHz (95% confidence)	±0.19 dB
Preamp on (Option E444xA-1DS)	± (0.36 dB + frequency response), ±(0.09 dB+ frequency response) typical	
Preamp on (Option E444xA-110)	± (0.40 dB + frequency response), ±(0.15dB + frequency response) typical	

Amplitude Specifications (continued)

Input voltage standing wave ratio (VSWR) ***(≥ 8 dB input attenuation)***

	50 MHz to 3 GHz	< 1.2:1 nominal
	3 GHz to 18 GHz	< 1.6:1 nominal
	18 GHz to 26.5 GHz	< 1.9:1 nominal
	26.5 GHz to 50 GHz	< 1.57:1 nominal
Preamp on (50 MHz to 3 GHz) (≥ 10 dB attenuation)	< 1.2:1 nominal	
Preamp on (Option E444xA-110) (> 10 dB input attenuation) E4443A/E4445A/E4440A	200 MHz to 6.6 GHz	< 1.4:1
	6.6 to 13.2 GHz	< 1.7:1
	13.2 to 19.2 GHz	< 1.5:1
	19.2 to 26.5 GHz	< 1.8:1
E4447A/E4446A/E4448A	200 MHz to 6.6 GHz	< 1.2:1
	6.6 to 13.2 GHz	< 1.4:1
	13.2 to 19.2 GHz	< 1.3:1
	19.2 to 31 GHz	< 1.5:1
	31 to 50 GHz	< 1.7:1

Resolution bandwidth switching uncertainty ***(referenced to 30 kHz RBW)***

1 Hz to 1 MHz RBW	±0.03 dB
1.1 MHz to 3 MHz RBW	±0.05 dB
4, 5, 6, 8 MHz RBW	±1.0 dB

Reference level

Range	Log scale	–170 dBm to +30 dBm in 0.01 dB steps
	Linear scale	707 pV to 7.07 V in 0.1% steps
Accuracy	0 dB	

Display scale switching uncertainty

Switching between linear and log	0 dB
Log scale/div switching	0 dB

Display scale fidelity

≤ –20 dBm input mixer level	±0.07 dB total
–20 dBm < mixer level ≤ –10 dBm	±0.13 dB total

Spurious response ***(mixer level = –40 dBm)***

General spurious	100 Hz ≤ f < 10 MHz from carrier	(–73 + 20 log N) dBc
	f ≥ 10 MHz from carier	(–80 + 20 log N) dBc, (–90 + 20 log N) dBc typical
See frequency range for N		

Amplitude Specifications (continued)

Second harmonic distortion (SHI)

		Distortion (dBc)	SHI (dBm)
E4443A/E4445A/E4440A	10 MHz to 460 MHz (–40 dBm mixer level)	–82	+42
	460 MHz to 1.18 GHz (–40 dBm mixer level)	–92	+52
	1.18 GHz to 1.5 GHz (–40 dBm mixer level)	–82	+42
	1.5 GHz to 2.0 GHz (–10 dBm mixer level)	–90	+80
	2.0 GHz to 13.25 GHz (–10 dBm mixer level)	–100	+90
E4447A/E4446A/E4448A	10 MHz to 460 MHz (–40 dBm mixer level)	–82	+42
	460 MHz to 1.18 GHz (–40 dBm mixer level)	–92	+52
	1.18 GHz to 1.5 GHz (–40 dBm mixer level)	–82	+42
	1.5 GHz to 2.0 GHz (–10 dBm mixer level)	–90	+80
	2.0 GHz to 3.25 GHz (–10 dBm mixer level)	–94	+84
	3.25 GHz to 13.25 GHz (–10 dBm mixer level)	–96	+86
	13.25 GHz to 25 GHz (–10 dBm mixer level)	–100 nominal	+90 nominal
Preamp on (Option E444xA-1DS), (for all models), (input preamp level = –45 dBm)	10 MHz to 1.5 GHz	–60 nominal	+15 nominal
Preamp on (Option E444xA-110), (for all models), (input preamp level = -45 dBm)	10 MHz to 25 GHz	–45 nominal	+10 nominal

Third-order intermodulation distortion (TOI) ***(two –30 dBm tones at input mixer with tone separation > 15 kHz, 20 to 30 °C)***

		Distortion (dBc)	TOI (dBm)
E4443A/E4445A/E4440A	10 MHz to 100 MHz	–88	+14 (+17 typical)
	100 MHz to 400 MHz	–90	+15 (+18 typical)
	400 MHz to 1.7 GHz	–92	+16 (+19 typical)
	1.7 GHz to 2.7 GHz	–94	+17 (+19 typical)
	2.7 GHz to 3.0 GHz	–94	+17 (+20 typical)
	3.0 GHz to 6.0 GHz	–90	+15 (+18 typical)
	6.0 GHz to 16 GHz	–76	+8 (+11 typical)
	16 GHz to 26.5 GHz	–84	+12 (+14 typical)
E4447A/E4446A/E4448A	10 MHz to 100 MHz	–90	+15 (+20 typical)
	100 MHz to 400 MHz	–92	+16 (+21 typical)
	400 MHz to 1.7 GHz	–94	+17 (+20 typical)
	1.7 GHz to 2.7 GHz	–96	+18 (+21 typical)
	2.7 GHz to 3.0 GHz	–96	+18 (+21 typical)
	3.0 GHz to 6.0 GHz	–92	+16 (+21 typical)
	6.0 GHz to 16 GHz	–84	+12 (+15 typical)
	16.0 GHz to 26.5 GHz	–84	+12 (+16 typical)
	26.5 GHz to 50 GHz	–85 nominal	+12.5 nominal
Preamp on (Option E444xA-1DS), (for all models, two –45 dBm tones at preamp input)	10 MHz to 500 MHz		–15 nominal
	500 MHz to 3 GHz		–13 nominal
Preamp on (Option E444x-110), (two –45 dBm tones at preamp input) E4443A/E4445A/E4440A	10 MHz to 3 GHz		–15 dBm nominal
	3 to 6.6 GHz		–21 dBm nominal
	6.6 to 13.2 GHz		–23 dBm nominal
	13.2 to 19 GHz		–23 dBm nominal
	19 to 26.5 GHz		–25 dBm nominal
E4447A/E4446A/E4448A	10 MHz to 3 GHz		–15 dBm nominal
	3 to 6.6 GHz		–21 dBm nominal
	6.6 to 13.2 GHz		–23 dBm nominal
	13.2 to 19 GHz		–23 dBm nominal
	19 to 26.5 GHz		–25 dBm nominal

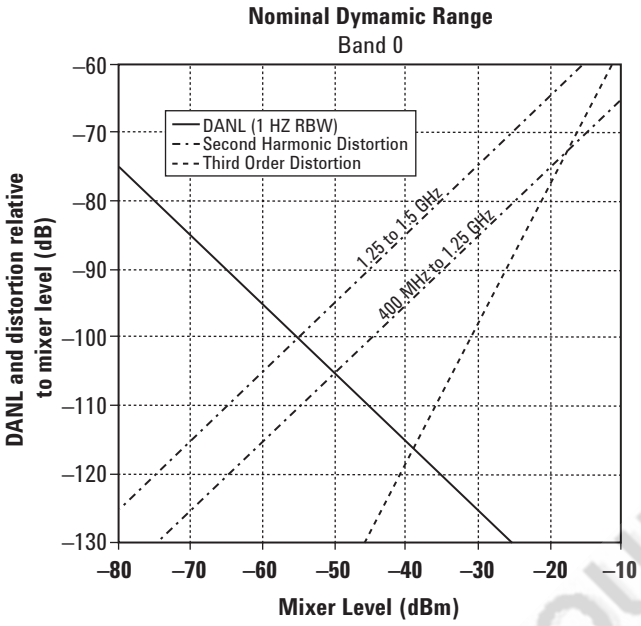

Figure 2. Nominal dynamic range - Band 0, for second and third order distortion, E4443A, E4445A, and E4440A - 3 Hz to 3 GHz

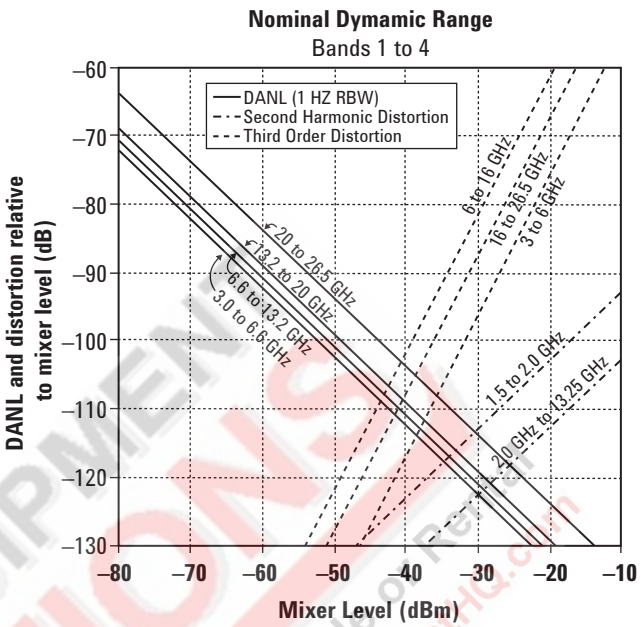

Figure 3. Nominal dynamic range - Bands 1 to 4, second and third order distortion, E4443A, E4445A, E4440A - 3 GHz to 26.5 GHz

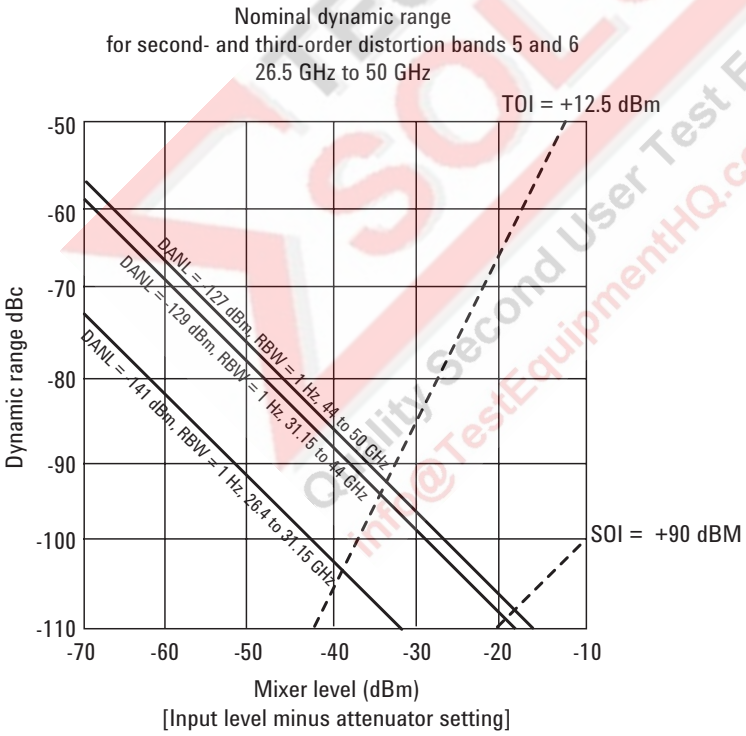

Figure 4. Nominal dynamic range - Bands 5 to 6, E4447A, E4446A, and E4448A 26.4 GHz to 50 GHz

Amplitude Specifications (continued)

Residual responses		
Input terminated and 0 dB attenuation	200 kHz to 6.6 GHz 6.6 GHz to 26.8 GHz 26.8 GHz to 50 GHz	–100 dBm –100 dBm nominal –90 dBm nominal

Trace detectors
Normal, peak, sample, negative peak, log power average, RMS average, and voltage average

EMI detectors	
CISPR	Peak, quasi-peak and average
MIL-STD	Peak

Option E444xA-1DS, preamplifier		
Frequency range	100 kHz to 3 GHz	
Gain	28 dB nominal	
Noise figure	7 dB nominal	

Option E444xA-110, preamplifier		
Frequency range	10 MHz to 50 GHz	
Gain	10 MHz to 30 GHz 30 to 50 GHz	27 dB (nominal) 24 dB (nominal)
Noise figure	10.0 MHz to 30 MHz 30 MHz to 3 GHz 3 to 30 GHz 30 to 50 GHz	12.5 dB (nominal) 7.8 dB (nominal) 10.3 dB (nominal) 21.8 dB (nominal)

Measurement speed		
Local measurement and display update rate	≥ 50/s nominal	
Remote measurement and GPIB transfer rate	101 sweep points 401 sweep points 601 sweep points	≥ 45/s nominal ≥ 30/s nominal ≥ 25/s nominal

Other Specifications

Option AYZ, external mixing

Frequency range	18 to 325 GHz (to 110 GHz with the Agilent unpreselected mixer)			
LO output				
Frequency range	3.05 GHz to 6.89 GHz			
Power output (20 to 30 °C)	E4440A		14.5 dBm min	18.5 dBm max
	E4446A and E4448A	3.05 to 3.2 GHz	14.5 dBm min	20 dBm max
		3.2 to 6.7 GHz	14.5 dBm min	18.8 dBm max
		6.7 to 6.89 GHz	14.5 dBm min	18.5 dBm max typical
VSWR	2.0:1 nominal			
IF input				
Frequency	321.4 MHz, ±30 MHz			
Maximum safe input range	10 dBm			
Absolute amplitude accuracy	± 1.2 dB (20 to 30 °C)			
VSWR	1.5:1 nominal			
Mixer bias current				
Range	± 10 mA			
Resolution	0.01 mA			
Accuracy	± 0.02 mA nominal			
Output impedance	477 Ω nominal			
Mixer bias voltage				
Range	± 3.7 V (open circuit)			
Preselector tune voltage	1.5 V/GHz of LO nominal			

Option 123, preselector bypass[1]

Frequency range	
E4440A	3.05 to 26.5 GHz
E4443A	3.05 to 6.7 GHz
E4445A	3.05 to 13.2 GHz
E4446A	3.05 to 44 GHz
E4447A	3.05 to 42.98 GHz
E4448A	3.05 to 50 GHz

1. When the preselector bypass option is installed and enabled, some aspects of the analyzer performance change. Please refer to the PSA specification guide for more details.

Power Suite Measurement Specifications

Channel power	
Amplitude accuracy, W-CDMA or IS95 (20 to 30 °C, mixer level < –20 dBm)	±0.68 dB (±0.18 dB typical)

Occupied bandwidth	
Frequency accuracy	±[span/600] nominal

Adjacent channel power		
Accuracy, W-CDMA (ACLR) (at specific mixer levels and ACLR ranges)	Adjacent	Alternate
MS	±0.12 dB	±0.17 dB
BTS	±0.22 dB	±0.22 dB
Dynamic range (typical)		
Without noise correction	–74.5 dB	–82 dB
With noise correction	–81 dB	–88 dB
Offset channel pairs measured	1 to 6	
ACP speed (fast method). Data measurement and transfer time	30 ms nominal (0.2 dB standard deviation)	

Multi-carrier power and ACP	
ACPR dynamic range, W-CDMA (5 MHz offset, RRC weighted, 3.84 MHz noise bandwidth)	
Two carriers	–70 dB nominal
Four carriers	–66 dB nominal
With noise correction	–76 dB nominal
ACPR accuracy (two carriers, 5 MHz offset, –48 dBc ACPR)	±0.38 dB nominal
Multiple number of carriers measured	Up to 12

Power statistics CCDF	
Histogram resolution	0.1 dB

Harmonic distortion	
Maximum harmonic number	10th
Results	Fundamental power (dBm), relative harmonics power (dBc), total harmonic distortion in %

Intermod (TOI)
Measure the third-order products and intercepts from two tones

Burst power	
Methods	Power above threshold, power within burst width
Results	Single burst output power, average output power, maximum power, minimum power within burst, burst width

Power Suite Measurement Specifications (continued)

Spurious emission	
W-CDMA (1980 MHz region, 1.2 MHz RBW)	
Table driven spurious signals; search across regions.	
Relative dynamic range	80.6 dB (82.4 dB typical)
Absolute sensitivity	–89.7 dBm (–91.7 dBm typical)

Spectrum emission mask (SEM)	
cdma2000 (750 kHz offset)	
Relative dynamic range (30 kHz RBW)	85.3 dB (88.3 dB typical)
Absolute sensitivity	–105.7 dBm (–107 dBm typical)
Relative accuracy	±0.09 dB
3GPP W-CDMA (2.515 MHz offset)	
Relative dynamic range (30 kHz RBW)	87.3 dB (89.5 dB typical)
Absolute sensitivity	–105.7 dBm (–107.7 dBm typical)
Relative accuracy	±0.10 dB

General Specifications

Temperature range	
Operating	0 °C to +55 °C
Storage	–40 °C to +70 °C

EMI compatibility
Radiated and conducted emission is in compliance with CISPR Pub 11/1996 Class B

Radiated immunity
Complies with the radiated electromagnetic field immunity requirements in IEC/EM 61326 using performance criteria B.

Audio noise	
ISO 7779 sound pressure	Lp < 55 dBA

Environmental conditions
Samples of this product have been type tested in accordance with the Agilent Environmental Test manual and veified to be robust against the environmental stresses of storage, transportation and end-use, those stresses include but are not limited to temperature, humidity, shock, vibration, altitude and power line conditions. Test methods are aligned with IEC 60068-2 and levels are similar to MIL-PRF-28800F Class 3.

Power requirements	
Voltage and frequency (nominal)	100 to 120 V, 50/60/400 Hz
	200 to 240 V, 50/60 Hz
Power consumption	
On	< 260 watts, no options, (< 450 watts, all options)
Standby	< 20 watts

Data storage	
Internal	512 MB (nominal)
Floppy drive (10 to 40 °C)	3.5" 1.44 MB (nominal)

Weight (without options)		
E4443A/E4445A/E4440A	Net	23 kg (50 lbs) nominal
	Shipping	33 kg (73 lbs) nominal
E4447A/E4446A/E4448A	Net	24 kg (53 lbs) nominal
	Shipping	33 kg (73 lbs) nominal

Dimensions	
Height	177 mm (7.0 in)
Width	426 mm (16.8 in)
Length	483 mm (19 in)

Warranty
The E4440A, E4443A, E4445A, E4446A, E4447A, and E4448A are supplied with a one-year warranty.

Input and Outputs

Front panel

RF input	
Connector	
E4443A/E4445A	Type-N female, 50 Ω
E4440A	Type-N female, 50 Ω
Option E4440A-BAB	APC 3.5 male
E4447A/E4446A/E4448A	2.4 mm male, 50 Ω
Probe power	
Voltage/current (nominal)	+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 range	–5 to +5 V
1st LO output (Option AYZ)	
Connector	SMA female
Frequency range	3 to 7 GHz
IF input (Option AYZ)	
Connector	SMA female
Frequency	321.4 MHz

Input and Outputs (continued)

Rear panel

10 MHz OUT (switched)	
Connector	BNC female, 50 Ω
Output amplitude	≥ 0 dBm nominal
Frequency accuracy	10 MHz ± (10 MHz x frequency reference accuracy)
Ext Ref In	
Connector	BNC female, 50 Ω
Input amplitude range	–5 to +10 dBm nominal
Input frequency	1 to 30 MHz nominal
Frequency lock range	± 5 x 10-6 of specified external reference input frequency
Trigger in	
Connector	BNC female
External trigger input	Impedance > 10 kΩ nominal
	Trigger level range –5 to +5 V
Trigger 1 and Trigger 2 outputs	
Connector	BNC female
Trigger 1 output	HSWP (high = sweeping)
	Impedance 50 Ω nominal
	Level 5 V TTL
Trigger 2 output	Gate
Monitor output	
Connector	VGA compatible, 15-pin mini D-SUB
Format	VGA (31.5 kHz horizontal, 60 Hz vertical sync rates, non-interlaced) Analog RGB
Resolution	640 X 480
Noise source drive output (used by Option 219)	
Connector	BNC female
Output voltage	On 28.0 ± 0.1 V (60 mA maximum)
	Off < 1 V
Remote programming	
GPIB interface	Connector IEEE-488 bus connector
	GPIB codes SH1, AH1, T6, SR1, RL1, PP0, DC1, C1, C2, C3, and C28, DT1, L4, C0
Serial interface connector	9-pin D-SUB male (factory use only)
LAN TCP/IP interface	RJ45 Ethertwist
USB interface (Option 111, standard)	Slave mode/device-side only, USB 2.0 compliant, type B connector
Parallel printer interface connector	25-pin D-SUB female
321.4 MHz IF output[1]	
Connector	SMA female, 50 Ω nominal
Frequency	321.4 MHz nominal
Conversion gain	+2 to +4 dB nominal
Pre-sel tune output	
Connector	BNC female

1 Not available for the E4447A.

PSA Series Ordering Information

For further information, refer to PSA Configuration Guide, 5989-2773EN

PSA Series spectrum analyzer

E4443A 3 Hz to 6.7 GHz
E4445A 3 Hz to 13.2 GHz
E4440A 3 Hz to 26.5 GHz
E4447A 3 Hz to 42.98 GHz
E4446A 3 Hz to 44 GHz
E4448A 3 Hz to 50 GHz

Options

To add options to a product, use the following ordering scheme:
Model E444xA (x = 0, 3, 5, 6, 7 or 8)
Example options E4440A-B7J, E4448A-1DS

Warranty & Service

Standard warranty is one year.

R-51B-001-3C	1-year return-to-Agilent warranty extended to 3 years

Calibration [1]

R-50C-011-3	Inclusive calibration plan, 3 year coverage
R-50C-013-3	Inclusive calibration plan and cal data, 3 year coverage
E444xA-0BW	Service manual
E444xA-UK6	Commercial calibration certificate with test data
E444xA-A6J	Factory ANSI Z540 standard-compliant calibration
E444xA-1A7	Factory ISO 17025 standard-compliant calibration
R-52A	Calibration software and licensing (ordered with PSA)
N7810A	PSA Series calibration application software (stand-alone order)

1. Options not available in all countries

Measurement Personalities

E444xA-226	Phase noise	
E444xA-219	Noise figure	Requires Option IDS or 110 to meet specifications
E444xA-241	Flexible digital modulation analysis	
E444xA-BAF	W-CDMA	Requires B7J
E444xA-210	HSDPA/HSUPA (for W-CDMA)	Requires B7J and BAF
E444xA-202	GSM w/ EDGE	Requires B7J
E444xA-B78	cdma2000	Requires B7J
E444xA-214	1xEV-DV	Requires B7J and B78
E444xA-204	1xEV-DO	Requires B7J
E444xA-BAC	cdmaOne	Requires B7J
E444xA-BAE	NADC, PCD	Requires B7J
E444xA-217	WLAN	Requires 122 or 140
E444xA-211	TD-SCDMA power measurement	
E444xA-212	TD-SCDMA modulation	
E444xA-213	HSPA for TD-SCDMA	requires Option 212
E444xA-215	External source control	
E444xA-266	Programming code compatibility suite	
E444xA-233	Built-in measuring receiver personality	
E444xA-23A	AM/FM/PM triggering	Requires Option 233
E444xA-23B	CCITT filter	Requires Options 233 and 107
E444xA-239	N9039A RF preselector control	

Hardware

E444xA-1DS	RF internal preamplifier (100 kHz to 3 GHz)	Excludes 110
E444xA-110	RF/µW internal preamplifier (10 MHz to upper frequency limit of the PSA)	Excludes 1DS
E444xA-B7J	Digital demodulation hardware	
E444xA-122	80 MHz bandwidth digitizer	E4440A/43A/45A/46A/48A, excludes 140, 107, H70
E444xA-140	40 MHz bandwidth digitizer	E4440A/43A/45A/46A/48A, excludes 122, 107, H70
E444xA-123	Switchable MW preselector bypass	Excludes AYZ
E444xA-124	Y-axis video output	
E444xA-AYZ	External mixing	E4440A/47A/46A/48A only, excludes 123
E444xA-107	Audio input 100 kΩ	Requires 233 to operate; excludes 122, 140
E444xA-111	USB device side I/O interface	Now shipped standard
E444xA-115	512 MB user memory	Excludes 117, Shipped standard in all PSA instruments with serial number prefix ≥ MY4615 unless 117 is installed
E4440A-BAB	Replaces type-N input connector with APC 3.5 connector	
E444xA-H70	70 MHz IF output	Excludes 122, 140. Not available for E4447A
E444xA-HYX	21.4 MHz IF output	Available for all PSA models

PC Software

E444xA-230	BenchLink Web Remote Control Software	
E444xA-235	Wide BW digitizer external calibration wizard	Requires 122 or 140 E4443A/45A/40A/46A/48A

Accessories

E444xA-1CM	Rack mount kit
E444xA-1CN	Front handle kit
E444xA-1CP	Rack mount with handles
E444xA-1CR	Rack slide kit
E444xA-015	6 GHz return loss measurement accessory kit
E444xA-045	Millimeter wave accessory kit
E444xA-0B1	Extra manual set including CD ROM

Related Literature

Publication Title	Publication Type	Publication Number
PSA in general		
Selecting the Right Signal Analyzer for Your Needs	Selection Guide	5968-3413E
PSA Series	Brochure	5980-1284E
PSA Series	Configuration Guide	5989-2773EN
Self-Guided Demonstration for Spectrum Analysis	Product Note	5988-0735EN
Wide bandwidth and vector signal analysis		
40/80 MHz Bandwidth Digitizer	Technical Overview	5989-1115EN
Using Extended Calibration Software for Wide Bandwidth Measurements, PSA Option 122 & 89600 VSA	Application Note 1443	5988-7814EN
PSA Series Spectrum Analyzer Performance Guide Using 89601A Vector Signal Analysis Software	Product Note	5988-5015EN
89650S Wideband VSA System with High Performance Spectrum Analysis	Technical Overview	5989-0871EN
Measurement personalities and applications		
Phase Noise Measurement Personality	Technical Overview	5988-3698EN
Noise Figure Measurement Personality	Technical Overview	5988-7884EN
External Source Measurement Personality	Technical Overview	5989-2240EN
Flexible Digital Modulation Analysis Measurement Personality	Technical Overview	5989-1119EN
W-CDMA and HSDPA/HSUPA Measurement Personalities	Technical Overview	5988-2388EN
GSM with EDGE Measurement Personality	Technical Overview	5988-2389EN
cdma2000 and 1xEV-DV Measurement Personalities	Technical Overview	5988-3694EN
1xEV-DO Measurement Personality	Technical Overview	5988-4828EN
cdmaOne Measurement Personality	Technical Overview	5988-3695EN
WLAN Measurement Personality	Technical Overview	5989-2781EN
NADC/PDC Measurement Personality	Technical Overview	5988-3697EN
TD-SCDMA Measurement Personality	Technical Overview	5989-0056EN
Built-in Measuring Receiver Personality / Agilent N5531S Measuring Receiver	Technical Overview	5989-4795EN
BenchLink Web Remote Control Software	Product Overview	5988-2610EN
IntuiLink Software	Data Sheet	5980-3115EN
Programming Code Compatibility Suite	Technical Overview	5989-1111EN
Hardware options		
PSA Series Spectrum Analyzers Video Output (Option 124)	Technical Overview	5989-1118EN
PSA Series Spectrum Analyzers, Option H70,70 MHz IF Output	Product Overview	5988-5261EN
Spectrum analyzer fundamentals		
Optimizing Dynamic Range for Distortion Measurements	Product Note	5980-3079EN
PSA Series Amplitude Accuracy	Product Note	5980-3080EN
PSA Series Swept and FFT Analysis	Product Note	5980-3081EN
PSA Series Measurement Innovations and Benefits	Product Note	5980-3082EN
Spectrum Analysis Basics	Application Note 150	5952-0292
Vector Signal Analysis Basics	Application Note 150-15	5989-1121EN
8 Hints for Millimeter Wave Spectrum Measurements	Application Note	5988-5680EN
Spectrum Analyzer Measurements to 325 GHz with the Use of External Mixers	Application Note 1453	5988-9414EN
EMI	Application Note 150-10	5968-3661E

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