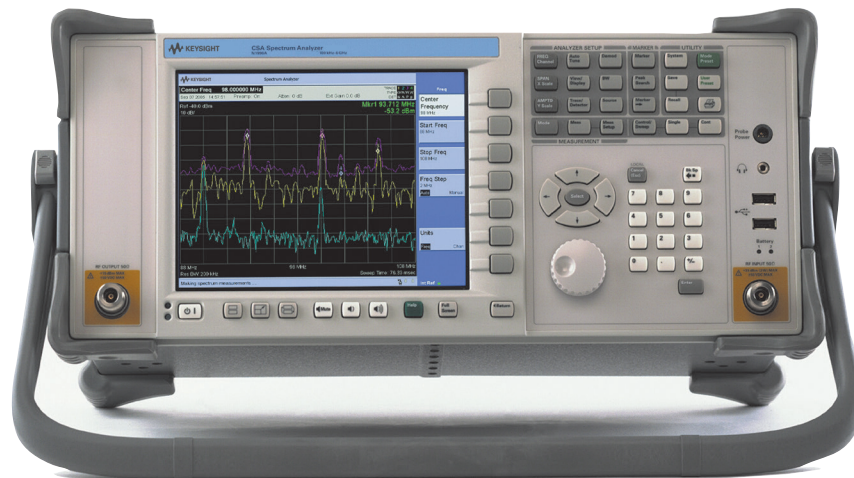


# Keysight Technologies

## CSA Spectrum Analyzer N1996A

Technical Overview



Traditional Keysight quality and reliability with the performance you need, the convenience you want, and the price you can afford...

## Exceptional performance...anytime, anywhere

### Frequency coverage

- Frequency range: 100 kHz to 3 or 6 GHz
- Signal source: 10 MHz to 3 or 6 GHz
- Preamplifier to 3 or 6 GHz

### Performance

- DANL: -156 dBm/Hz, normalized to 1 Hz
- Best-in-class dynamic range with +18 dBm TOI
- Overall amplitude accuracy:  $\pm 0.5$  dB

### Compact Design

- Weight: 7.5 kg with built-in signal source, preamplifier, and VSWR bridge
- Battery life: 2 hours (typical)

### Features

- Brightest, highest resolution display in its class (21 cm XGA, 1024 x 768)
- 1 dB electronic step input attenuator
- 10 Hz to 5 MHz RBW standard, 10% adjustable to 200 kHz, 1 Hz to 50 MHz VBW
- USB and LAN standard

## The Keysight CSA Spectrum Analyzer

A general purpose spectrum analyzer is the engineer's most flexible test tool. The Keysight Technologies, Inc. CSA spectrum analyzer extends that flexibility with its performance, ease-of-use, and unprecedented reliability.

Performance and quality you expect at a price you can afford

The Keysight CSA spectrum analyzer brings a level of performance not seen previously in a compact spectrum analyzer. The highest dynamic range in its price class is achieved with unmatched distortion performance, substantial noise performance, and standard 10 Hz resolution bandwidth. The instrument also offers overall amplitude accuracy of  $\pm 0.5$  dB. Now you get all of this capability and more, with excellent reliability and low service and support costs.

Ease-of-use means greater efficiency

The user interface is designed to give expert users access to all of the power of the Keysight CSA. Logically grouped hard keys, soft keys, and menus allow intuitive control of parameters like input attenuation, bandwidth, and detector type. Features such as auto-tune, auto-scale, auto-range, 1 dB step attenuator, built-in preamp, and onboard help make the Keysight CSA easy to use even for non-experts.

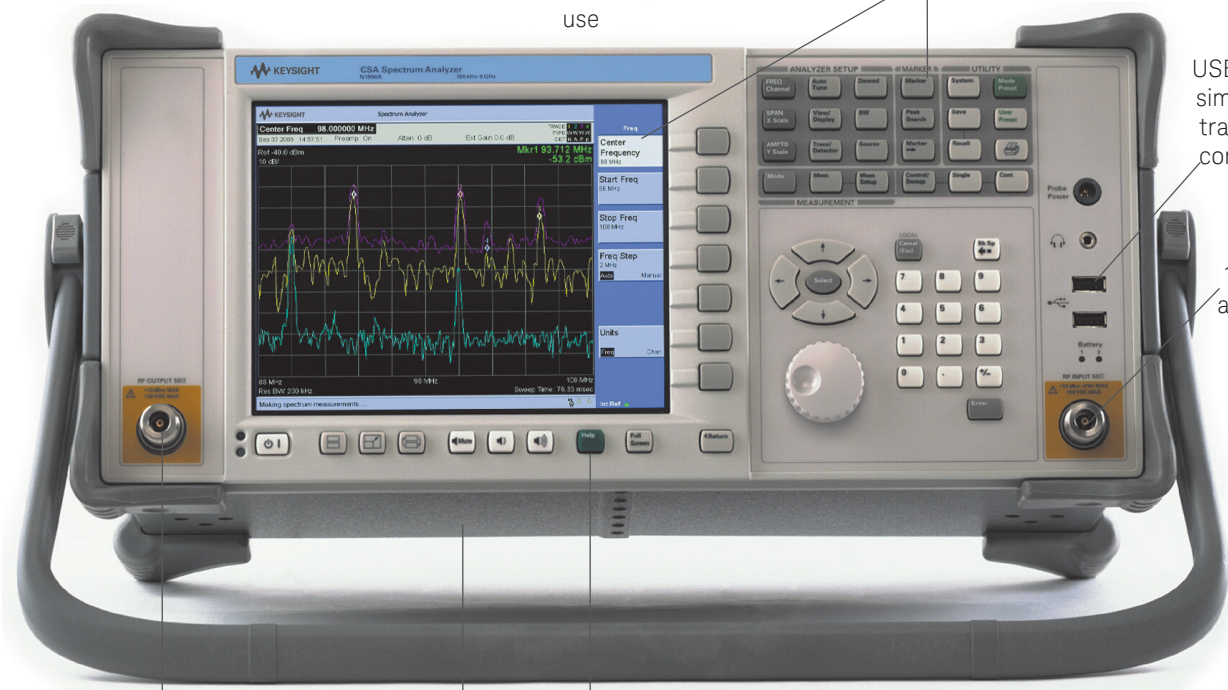
Light weight and portable at 8.5 kg with batteries

Bright, high resolution, 21.4 cm XGA display is excellent for outdoor use

Easy user interface speeds measurement process and reduces training time

USB 1.1 ports simplify data transfer and connectivity

1 dB step attenuator (best in class)



Signal source enables system, cable, and component measurements

Shallow depth of 25 cm (with bumpers) conserves bench space

Built-in help

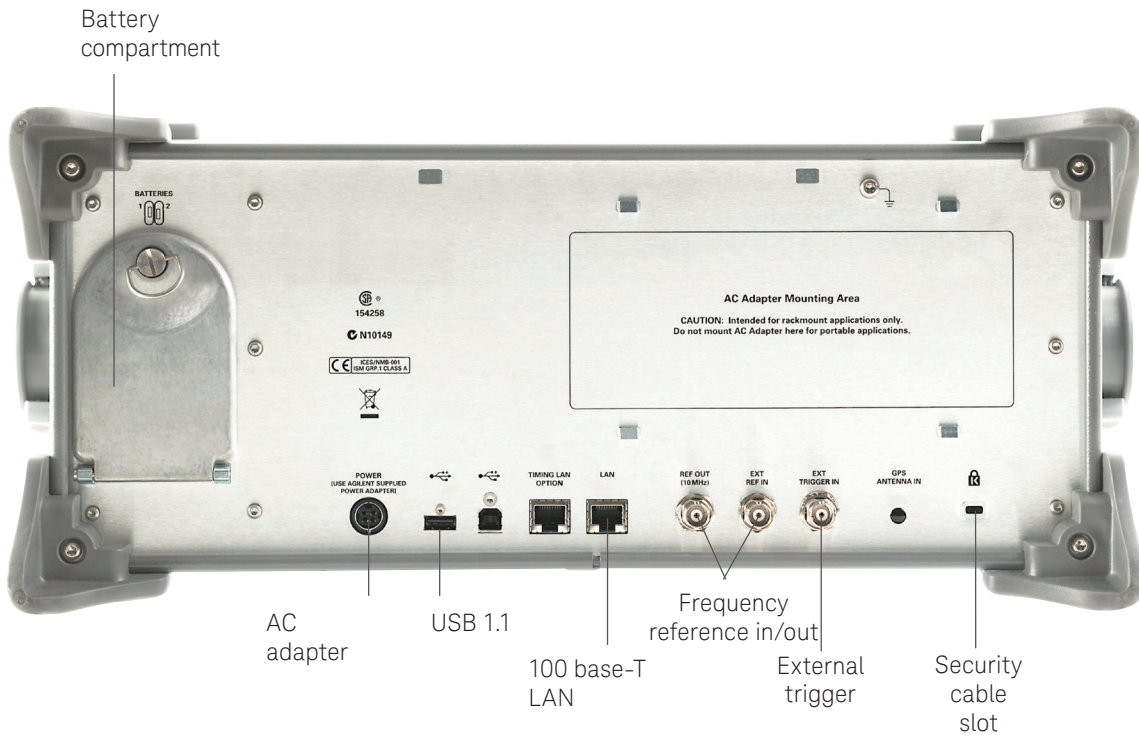
VSWR bridge is built-in, reducing the complexity of stimulus/response measurements

Built-in preamplifier increases sensitivity

Traditional Keysight quality and reliability with the performance you need, the convenience you want, and the price you can afford...

### Easy to upgrade

Unique among our products, each Keysight CSA spectrum analyzer comes with options installed, ready to be activated. This allows for easy upgrades, enabling users to reconfigure the instrument as needs change. Signal source and preamplifier upgrades may require service center calibration.

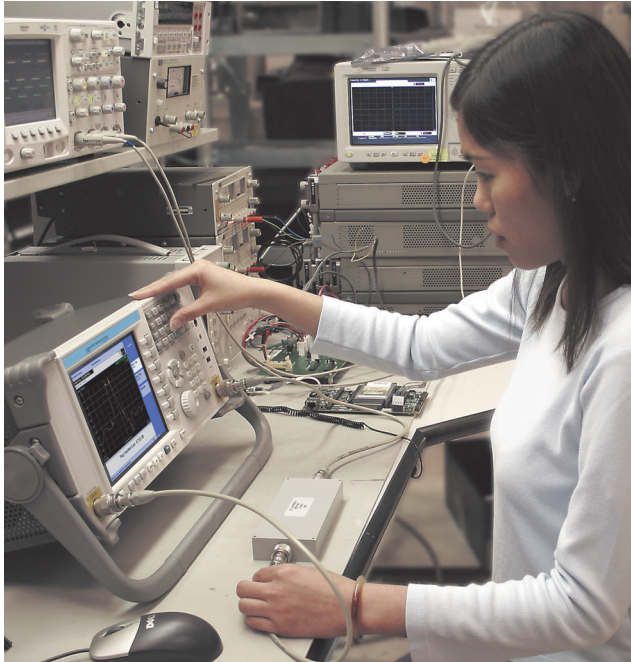


### Connectivity is simple

Transport data to a PC easily via USB memory device. Download firmware upgrades from the Web into the instrument. Remotely control your instruments using SCPI commands over a 100 base-T LAN.



## Accurate, Rugged, Dependable, and Flexible

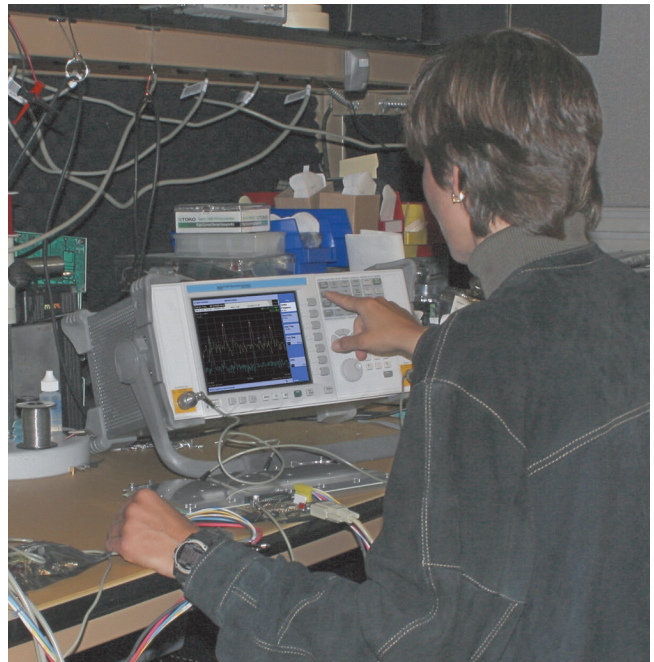


The Keysight CSA is optimized for manufacturing with its combination of high performance, modern connectivity, and the industry's best reliability.

The instrument was designed for fast sweep speeds in narrow resolution bandwidths and fast in-channel measurements, as well as the highest achievable dynamic range in its price class. Remote control via 100 Base T LAN and SCPI reduce the complexity and time to develop automation software, enhance compatibility with existing systems, and reduce training time for manufacturing staff. All of these attributes are designed to reduce cost-of-test, while the excellent reliability assures the lowest overall cost of ownership.

Now you can afford the excellence of a Keysight spectrum analyzer at each engineer's bench!

You get true Keysight performance with TOI of +18 dBm, 10 Hz minimum RBW (1 Hz minimum VBW) with 10% adjustability, and 1 dB step attenuator. The large, bright, 21 cm, 1024 x 768 pixel, XGA display (best-in-class), convenient form factor, and straightforward portability of data with a USB memory device make the Keysight CSA spectrum analyzer easy to use. Features like auto-tune and auto-scale ensure that newer users can quickly make use of this extensive performance and capability.



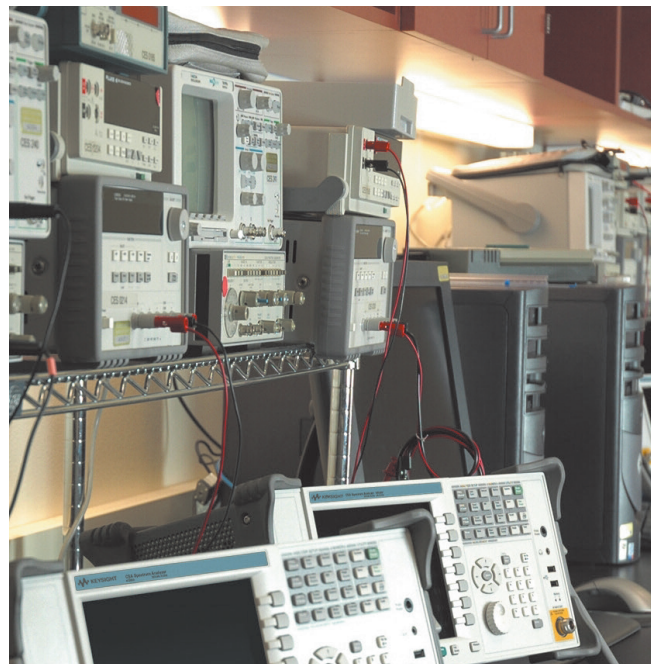


The Keysight CSA's field-ready features make it an ideal choice for installation and maintenance of today's complex communication systems.

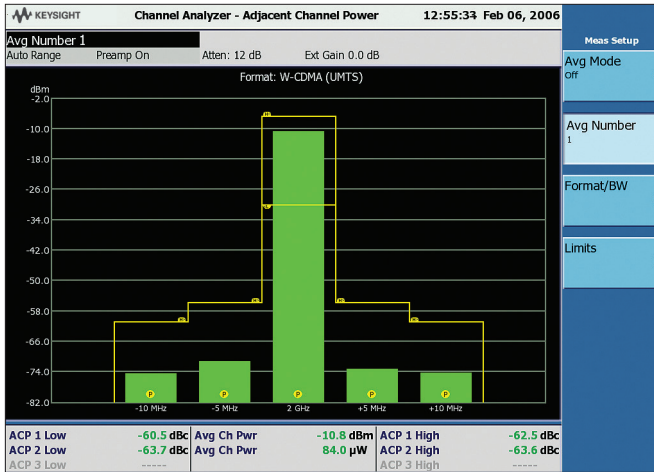
Weighing just 7.5 k (16.5 lbs) with rugged bumpers, and a comfortable, adjustable bail handle, the Keysight CSA spectrum analyzer is able to deliver powerful measurement capability where and when you need it. This analyzer has more than two hours of battery life and a bright, high-resolution display, perfect for use in the field. This instrument combines the functionality of a general-purpose spectrum analyzer, network analyzer, and power meter into a simple, easy-to-use package. The built-in VSWR bridge, optional internal signal source, and stimulus/ response measurement suite confirm the Keysight CSA spectrum analyzer as the best installation and maintenance solution in its price class.

The Keysight CSA brings the power of spectrum analysis to the teaching lab, enabling professors to easily communicate signal theory to their students.

Easy transformation between time and frequency domains simplifies the understanding of digital modulation formats. Built-in help and auto-setup features bring full spectrum analysis capability into the hands of aspiring experts. With the shallow form factor conserving valuable lab bench space, exceptional performance, and affordable price, the Keysight CSA spectrum analyzer is a sensible addition to undergraduate and technical teaching lab stations.



# Measurements and Features

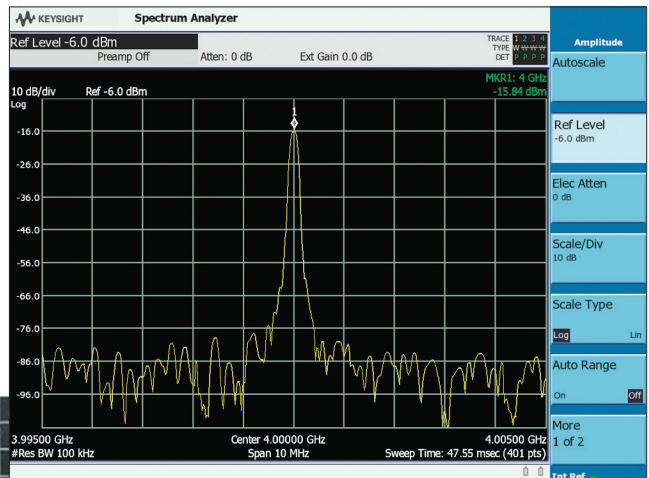


## Communication channel measurements

The Keysight CSA spectrum analyzer includes a number of communication system channel measurements, allowing users to accurately assess the performance of common wireless telephony and other channel-based communication systems and components. Using preset format-based or custom parameters, the operator can easily determine distortion levels and channel power using the adjacent channel power function. Similarly, the occupied bandwidth function quickly determines power and bandwidth of signals with complex modulation.

## New general purpose features

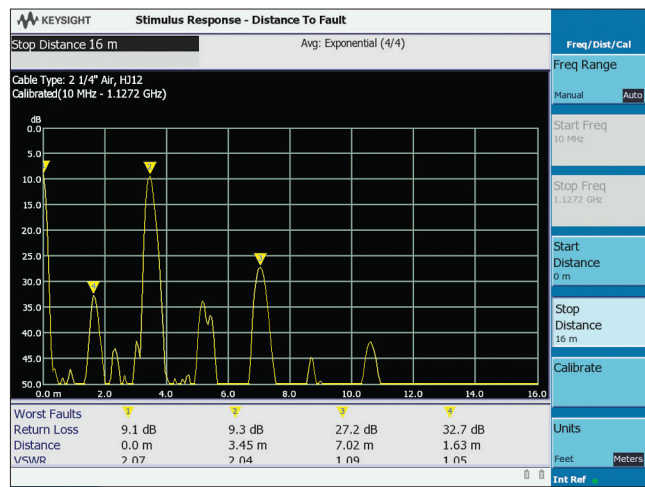
The Keysight CSA offers a wide range of innovative features designed to assist non-expert users to easily set up and make valid measurements. The one button auto-tune function centers the largest signal on screen and reduces the frequency span, allowing the user to quickly zoom in. Auto-scale sets the reference level and amplitude scale for best signal viewing. Auto-range performs a full-band background sweep, optimizing input attenuation and preamplifier settings, ensuring that off-screen signals are not compressing the RF stage, assuring accurate measurement results.





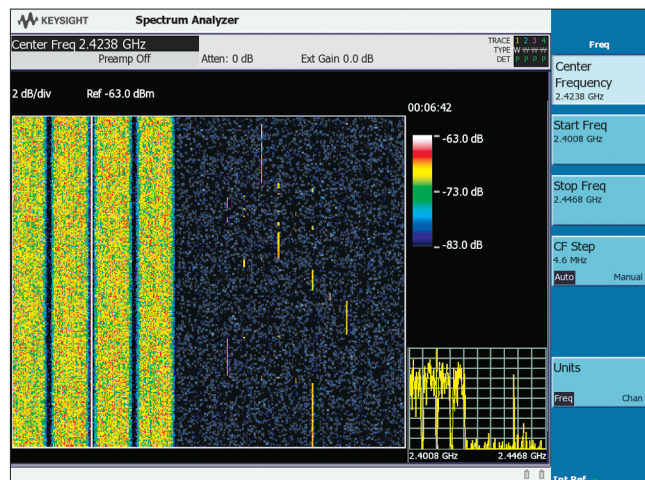
## Return loss, cable fault, and insertion loss capabilities

The Keysight CSA's built-in signal source and VSWR bridge enable a powerful range of scalar measurements not commonly found in general purpose spectrum analyzers. With the stimulus/response measurement suite, the Keysight CSA spectrum analyzer can characterize active and passive single and dual-port devices such as cables, filters, amplifiers, multiplexers, antennas, and switches. Measurements included are 1 and 2 port insertion loss, return loss, and distance-to-fault. The combination of robust capabilities and spectrum analysis tools can greatly simplify and accelerate installation and maintenance of complex components and systems.



## Use the spectrogram to analyze the stability of a signal over time, or to detect and identify signals interfering with the system of interest.

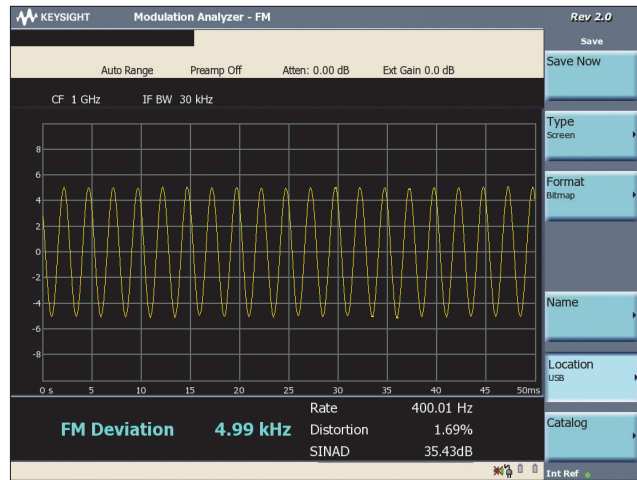
The spectrogram view is essentially a time capture of spectral activity that can be optimized to focus on an area of interest, detailing differences in the frequency and amplitude of spectral components as a function of time. A common use for spectrograms is in the identification and eradication of unwanted interference in communications systems. Spectrograms can also monitor the stability of a circuit or system over time, temperature, vibration, etc.





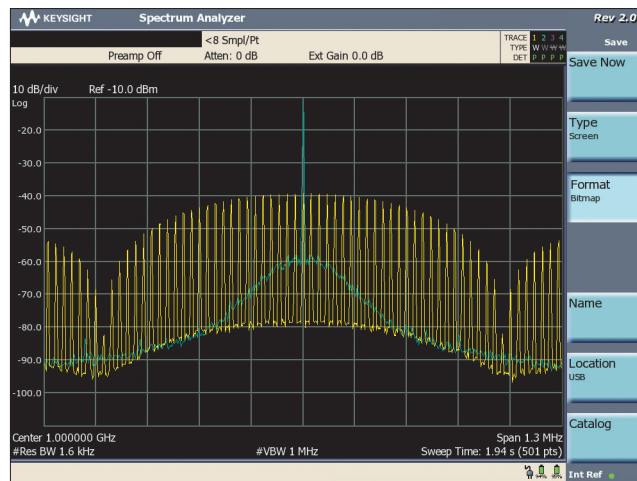
The Keysight CSA's optional modulation measurement suite provides functional and parametric analysis of AM and FM.

Whether you're making modulation depth or frequency deviation measurements for AM or FM devices, the Keysight CSA spectrum analyzer gives you the full range of metrics you need. The detailed measurement information – including deviation, modulation rate, distortion, SINAD, and carrier power – ensures a full understanding of the modulation characteristics. Both time domain and frequency domain views of the data allow you to analyze the signal quickly from different perspectives. The tune-and-listen option capability lets you hear the signal and classify it based on its audio qualities.



## Analyze pulsed signals

The CSA clearly and easily displays pulsed signals in the frequency domain. You can measure the amplitude difference between a CW signal and a pulsed signal. The example to the right shows the  $\text{Sinx}/x$  of a pulsed signal along with the associated CW signal.



# Specifications

<b>Frequency</b>			
Range	100 kHz to 3 GHz (Option 503) 100 kHz to 6 GHz (Option 506)		
Frequency readout accuracy	± {frequency indication x frequency reference accuracy + 1% x span + 10% x RBW + 0.5 x [span/(sweep points -1)] + 1Hz}		
Internal reference accuracy	≤ ± 5 ppm/year (within 2 years of adjustment)		
Aging rate	≤ ± 2 ppm/year		
Temperature stability	≤ ± 1 ppm		
<b>Resolution bandwidth (RBW)</b>			
<b>10 Hz to 200 kHz in 10% steps, 250 kHz, 300 kHz, 510 kHz, 1 MHz, 3 MHz, 5 MHz</b>			
Selectivity (60 dB/3 dB bandwidth ratio)	Digital, approximately Gaussian shape		
Span > 0; RBW ≤ 200 kHz	< 8.4:1 (nominal)		
Span > 0; RBW ≥ 250 kHz	< 4.5:1 (nominal)		
Zero span; RBW ≤ 10 kHz	< 6.5:1 (nominal)		
Zero span; RBW ≤ 200 kHz	< 3:1 (nominal)		
Zero span	3 kHz to 5 MHz in 1, 3, 5 sequence, 250 kHz and 1.25 MHz		
Accuracy			
(RBW ≤ 200 kHz)	< 2% zero span; < 7% span > 0 (nominal)		
(RBW = 250 kHz, 300 kHz, 1 MHz, 3 MHz)	< 4% zero span; < 4% span > 0 (nominal)		
Video bandwidth (VBW)	1 Hz to 8 MHz and 50 MHz (wide open) 1 Hz to 10 Hz in 1 Hz steps 10 Hz to 3 MHz in 10% steps 4, 5, 6, 8, 30 MHz		
<b>Displayed average noise level (typical)</b>	<b>Preamp on 10 Hz RBW</b>	<b>Preamp off 10 Hz RBW</b>	<b>Preamp on norm to 1 Hz</b>
500 MHz	-148 dBm	-130 dBm	-158 dBm/Hz
1 GHz	-146 dBm	-128 dBm	-156 dBm/Hz
2 GHz	-142 dBm	-124 dBm	-152 dBm/Hz
3 GHz	-144 dBm	-130 dBm	-154 dBm/Hz
4 GHz	-142 dBm	-128 dBm	-152 dBm/Hz
5 GHz	-139 dBm	-125 dBm	-149 dBm/Hz
6 GHz	-136 dBm	-122 dBm	-146 dBm/Hz
<b>Phase noise</b>	<b>-85 dBc at 10 kHz offset (500 MHz to 2.5 GHz, typical)</b> <b>-124 dBc at 1 MHz offset (10 MHz to 2.2 GHz, nominal)</b> <b>-82 dBc at 10 kHz offset (2.5 to 6 GHz, typical)</b>		
<b>Sweep and trace update times</b>			
Sweep time setting range (zero span)	1 μs to 10 s*		
Remote sweep and trace transfer			
Span = 0	120 ms minimum		
Span ≤ 100 MHz	300 ms		
Span = 3 GHz	1 sec		
Trace points	Settable 2 to 1001, 401 default		
<b>Amplitude accuracy (20 to 30 °C)</b>			
Overall amp accuracy (95% confidence) (20 to 30 °C, peak detector, preamplifier off, input signal 0 dBm to -50 dBm)	±0.5 dB 10 MHz to 1 GHz ±0.6 dB 1 GHz to 3 GHz ±0.8 dB 3 GHz to 6 GHz		
Absolute amp accuracy at 50 MHz ref	±0.4 dB		
Frequency response (when RBW ≤ 200 kHz)	±0.7 dB 250 kHz to 10 MHz ±0.4 dB 10 MHz to 1 GHz ±0.6 dB 1 GHz to 2.7 GHz ±0.7 dB 2.7 GHz to 3 GHz ±1.1 dB 3 GHz to 6 GHz		
Scale fidelity	±0.2 dB (-10 to -80 dBm mixer level)		
RBW switching	±0.3 dB		
Attenuator switching	±0.2 dB (nominal)		

\* RBW dependent, refer to technical specifications for details

## Specifications (continued)

<b>Amplitude</b>	
Maximum average continuous power (Attenuator $\geq$ 19 dB)	+33 dBm
Maximum DC	50 V dc
Input attenuator range	0 to 40 dB in 1 dB step
1 dB gain compression	+13 dBm (nominal)
<b>Spurs and residuals</b>	
Third order intermodulation	
TOI (third order intercept)	+18 dBm nominal
Second order harmonic (SHI)	+45 dBm (> 700 MHz); +30 dBm (< 700 MHz)
Input related spurs	< -60 dBc (with exceptions, as noted in the technical specifications)
Residuals	< -90 dBm (with exceptions, as noted in the technical specifications)
<b>Preamplifier</b>	
	<b>100 kHz to 3 GHz (Option P03)</b>
	<b>100 kHz to 3 GHz (Option P06)</b>
Gain	22 dB (nominal) < 2.7 GHz 18 dB (nominal) < 6 GHz
<b>Stimulus/response suite</b>	
	<b>10 MHz to 3 or 6 GHz (N8995A Option SR3 or SR6)</b>
<b>General</b>	
Internal data storage	2 MB for user states and traces
Display	21.3 cm (8.4 inches), color, XGA TFT-LCD
Weight with batteries	8.5 kg
Weight without batteries	7.5 kg
Dimensions without bumpers and handles	17.7 x 42.5 x 23.2 cm
Operating temperature	A/C power: 0 to 40 °C; battery power: 0 to 50 °C
Probe power output	+15 V at 150 mA -12 V at 150 mA
EMI compatibility	
Radiated emissions	CISPR 11, Class A
Conducted emissions	CISPR 11, Class A
<b>Input/output</b>	
RF input	Type N, female (50 $\Omega$ )
Signal source output	Type N, female (50 $\Omega$ )
USB-A	USB 1.1 (low power device only)
LAN 10/100 Base-T	RJ-45 connector
Reference out	BNC (female), 10 MHz, 0 dBm nominal
Reference in	BNC (female), 1 MHz, 2.048 MHz, 4.95 MHz, 10 MHz, 13 MHz, 15 MHz, 19.6608 MHz, 0.5 Hz (even second clock), -5 to +10 dBm nominal
External trigger input	BNC (female)
<b>AM/FM modulation analysis</b>	
Demodulation bandwidth	$\leq$ 5 MHz
Modulation rate range	
100 kHz $\leq$ $f_c$ $\leq$ 10 MHz	20 Hz to 10 kHz
10 MHz $\leq$ $f_c$ $\leq$ 3/6 GHz	50 Hz to 200 kHz
AM demodulation	
Modulation depth	0 to 100%
Modulation rate accuracy	
Rate < 1 kHz	1 Hz nominal
Rate $\geq$ 1 kHz	< 0.1% nominal
AM depth accuracy	$\pm$ 3% of reading nominal
FM demodulation	
Peak deviation	
100 kHz $\leq$ $f_c$ $\leq$ 10 MHz	Max 40 kHz
10 MHz $\leq$ $f_c$ $\leq$ 3/6 GHz	Max 400 kHz
Modulation rate accuracy	
Rate < 1 kHz	1 Hz nominal
Rate < 1 kHz	< 0.1 % nominal

## Ordering Information

N1996A-503 CSA base box 3 GHz (batteries not included)
N1996A-506 CSA base box 6 GHz (batteries not included)
N1996A-P03 Preamp 3 GHz
N1996A-P06 Preamp 6 GHz
N8995A-SR3 Stimulus/response suite (3 GHz)
N8995A-SR6 Stimulus/response suite (6 GHz)
N1996A-271 Spectrogram
N1996A-SRK Stimulus/response cal. kit
N1996A-1CM Rack-mount kit
N1996A-1CP Rack-mount kit with handles
N1996A-BAT Battery pack (2 batteries)
N1996A-BCG External battery charger
N1996A-SCC Soft carrying case
N1996A-HTC Transit case (hard cover)
N1996A-ABA Manual hard copy (English)
N1996A-ABJ Manual hard copy (Japanese)
N1996A-AB2 Manual hard copy (Simplified Chinese)
N1996A-0BW Service documentation
N1996A-AFM AM/FM tune and listen
N8996A-1FP AM/FM demodulation metrics

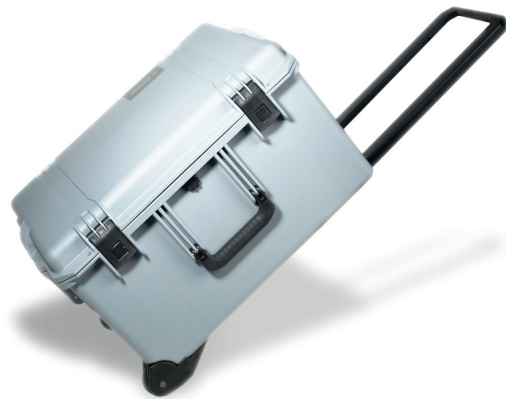
## Configuration requirement notes

The Keysight CSA spectrum analyzer includes documentation on a CD and an AC adapter.

1. The 3 GHz stimulus/response suite N8995A (Option SR3) requires a frequency range of 100 kHz to 3 GHz (Option 503).
2. The stimulus/response suite N8995A (Option SR6) requires a frequency range of 100 kHz to 6 GHz (Option 506).
3. The 3 GHz preamplifier (Option P03) is for use with the 100 kHz to 3 GHz frequency range (Option 503).
4. The 6 GHz preamplifier (Option P06) is for use with the 100 kHz to 6 GHz frequency range (Option 506).
5. The N1996A-HTC transit case is designed to be used with the N1996A-SCC soft carrying case.
6. N1996A-AFM AM/FM tune and listen is for both Option 503 and Option 506.
7. N8996A-1FP AM/FM Demodulation metric is for both Option 503 and Option 506.



Stimulus/response calibration kit recommended to improve the accuracy of the stimulus/response measurement suite (N1996A-SRK)



Transit case (hard cover)



Soft carrying case



External battery charger (batteries not included)



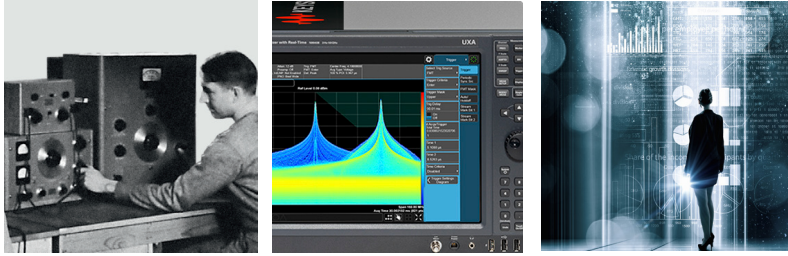
Battery pack (2 batteries)



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