

Agilent U8903A Audio Analyzer

Make an Audible Difference

Data Sheet

Capabilities

- Select generator, analyzer, graph and sweep modes with one-button access
- Measure at DC and from 10 Hz to 100 kHz
- Characterize signal-to-noise ratio, SINAD, IMD, DFD, THD+N ratio, THD+N level, crosstalk, and more
- Apply weighting functions, standard filters and custom filters
- Stimulate your device with high-quality signals and arbitrary waveforms
- View numerical and graphical displays of measurement results
- Connect to a PC through GPIB, LAN and USB interfaces



Whether listening to mono, stereo or surround, the human ear knows what sounds good. Measuring “how good,” however, can be a challenge. The Agilent U8903A audio analyzer helps you measure and quantify audio performance in applications such as wireless audio, analog components and ICs, and consumer audio.

Across the audio spectrum and beyond, this scalable, single-unit solution provides versatile measurement functions, diverse test signals and powerful analysis capabilities. Whatever your application, the U8903A can help you make an audible difference in device performance.

Step up from the HP 8903B

The U8903A is the next-generation replacement for the widely used HP 8903B audio analyzer. Application note ‘Migrating Code from the 8903B to U8903A (5990-4135EN)’ provides compatible equivalent commands, and sample test programs comparing the old R2D2 codes with new U8903A SCPI commands’.



Agilent Technologies

The U8903A audio analyzer combines the functionality of a distortion meter, SINAD meter, frequency counter, AC voltmeter, DC voltmeter and FFT analyzer with a low-distortion audio source. On the bench or in a test system, its accuracy and versatility will help you make an audible difference in your end product.

Measure and analyze essential audio parameters

With the U8903A, you can measure below, across and above the audio spectrum with its 10 Hz to 100 kHz frequency range and built-in DC measurements. Its dual input channels let you perform stereo audio, frequency response, wireless and component tests—all at a single-channel price.

Easily characterize parameters such as signal-to-noise ratio, SINAD, intermodulation distortion (IMD), different-frequency distortion (DFD), total harmonic distortion (THD+N ratio, THD+N level), crosstalk and more. Additional measurement capabilities include AC level, DC level, frequency count and frequency spectrum (through FFT analysis; see Figure 1).

For all measurements, you can apply weighting functions as well as low-pass, high-pass and standard filters (Figure 2). You can also create custom filters using MATLAB® and other applications and upload them through the analyzer's USB port. Filters and weighting functions can be applied one, two or three at a time.

Generate high-quality test signals

The built-in, dual-channel signal generator lets you stimulate your device with a variety of high-quality signals: sine (–105 dB noise floor), square, rectangular, noise (Gaussian and rectangular), two-tone and multi-tone (up to 60) (Figure 3). To simulate complex and real-world signals, you can also create arbitrary waveforms with up to 16,384 points and a 321.5 kHz sampling rate.

The output voltage range is 0 V to 8 Vrms with 1% accuracy. For unbalanced connections, you can select 50 Ω or 600 Ω output impedance.

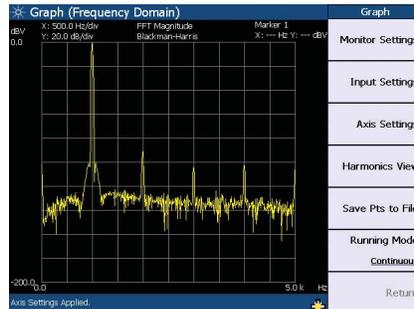


Figure 1: Perform FFT analysis with up to 32 Kpoints and a wide selection of informative graphing functions.

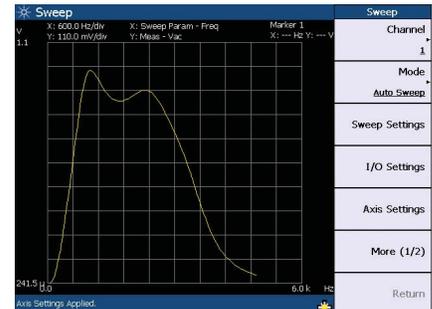


Figure 2: Apply an extensive selection of filters, including a variety of weighting functions.

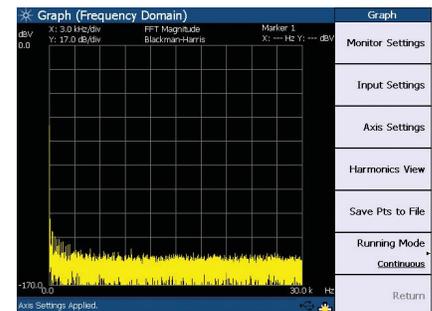
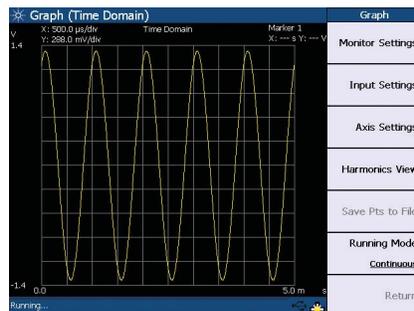


Figure 3: Utilize high-quality test signals that provide low distortion and low noise level.

Easily perform manual and automated tests

One-button access makes it easy to select the four main operating modes: analyzer, generator, graph and sweep. The 5.7-inch color display provides numeric readouts as well as graphical views of analog sweeps, FFT spectra and more.

For PC-based control on the bench or in a test system, the U8903A includes GPIB, LAN and USB interfaces. If your system currently uses an HP 8903B audio analyzer, the application note 'Migrating Code from the 8903B to U8903A (5990-4135EN)' describes compatible equivalent commands, and provides sample test programs comparing the old R2D2 codes with new U8903A SCPI commands'.

Replace your 8903B and add next-generation capabilities

For nearly two decades, the HP 8903B provided unparalleled versatility and performance in audio applications. Today, the U8903A audio analyzer builds on the legacy of the 8903B by offering faster single-point measurements (0.4 sec vs. 3.0 sec) as well as a wider frequency range, expanded performance and greater functionality (Tables 1, 2 and 3). Because the U8903A is based on the latest digital technologies, we also predict greater instrument uptime on the bench and in test systems.

With the U8903A, you can configure measurements faster through its graphical user interface (GUI) and one-button selection of major operating modes. The color screen lets you view dual-parameter displays from one or two channels as well as graphical displays of sweeps, frequency spectra and more (Figure 4).



Figure 4: The new U8903A audio analyzer offers numerous improvements over the widely used HP 8903B.

	U8903A	HP 8903B
Frequency range	DC and 10 Hz to 100 kHz	20 Hz to 100 kHz
Frequency accuracy	5 ppm (0.0005%)	0.004%

Table 1: Comparison of frequency range and accuracy

	U8903A	HP 8903B
AC voltage input range	0 V to 140 Vrms	0.3 mVrms to 300 Vrms
AC accuracy	± 1%	± 4%
DC voltage input range	0 to ± 200 V	4 V to 300 V
DC accuracy	± 1%	± 1%

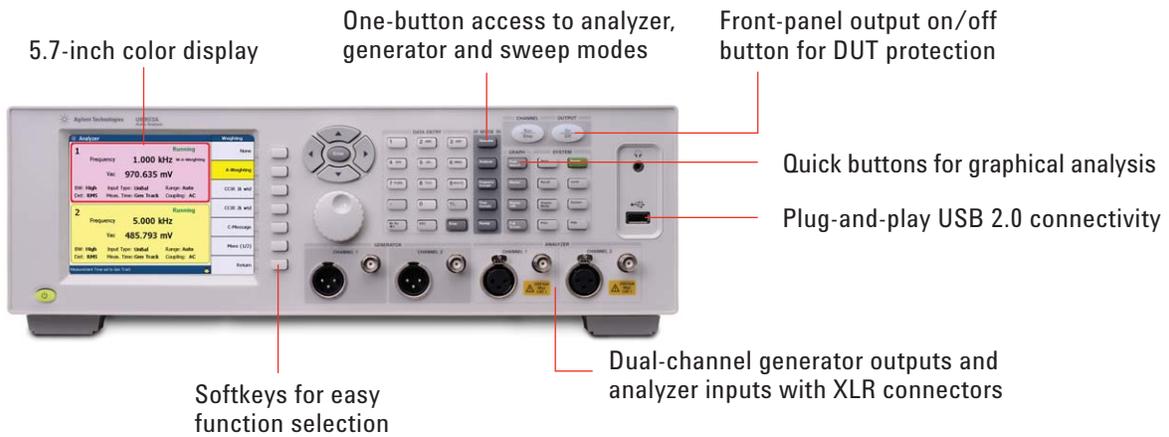
Table 2: Comparison of accuracy and ranges in AC and DC level measurements

	U8903A	HP 8903B
Frequency range	10 Hz to 100 kHz	20 Hz to 100 kHz
Residual THD+N (signal distortion) at 80 kHz BW	≤ -101 dB (at 1kHz, 1Vrms), 20 Hz to 20 kHz	-80 dB (or 15 µV), 20 Hz to 20 kHz

Table 3: Comparison of range and residual THD+N measurements

Take a closer look

Front panel



Rear panel



Upgraded rear panel

The next release of the U8903A will include multi-channel measurement capabilities designed for the testing of consumer audio products. Total channel count will expand from two to eight with the additional six inputs and outputs accessible through the rear panel of the instrument. For the latest information, please visit www.agilent.com/find/audioanalyzer.

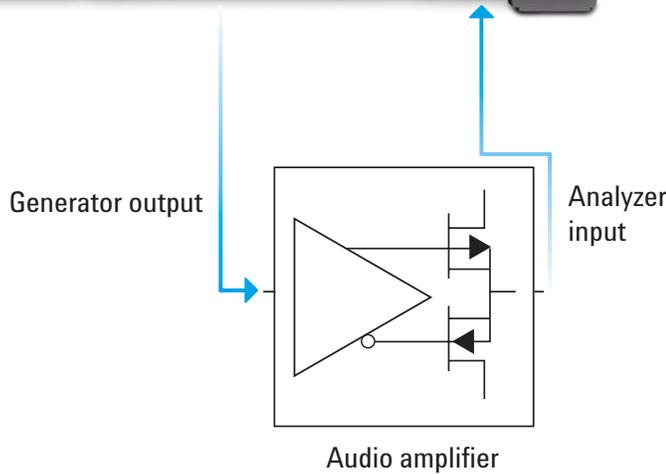


Address challenging audio applications

General audio testing

The U8903A provides essential measurement capabilities that enable efficient analysis of audio amplifiers and other devices in the audio chain. For example, the analyzer includes balanced and unbalanced outputs and inputs. It also provides a wide selection of filters and enhances your flexibility by making it easy to upload customized filters. With an array of sweep functions and flexible data display formats for each measurement, you'll be ready to address a wide range of challenging audio applications.

Amplifier testing



Balanced inputs

In the quest for higher output power, many audio amplifiers use bridged output stages. Such amplifiers can be difficult to characterize because their outputs cannot be grounded. To test these devices, the usual approach has been to use a balanced, calibrated isolation transformer connected to an analyzer with an unbalanced input.

The widely used HP 8903B eliminated the need for a transformer, but it was still necessary to float the analyzer input before connecting the bridged device and making measurements. With Agilent U8903A, you simply make a balanced connection with an XLR connector and make measurements—no floating required.

Standard and custom filters

A selection of built-in filters simplifies audio measurements by providing weighting networks required by international standards. These include CCIR, CCIR/ARM and CCIT weighting filters; a C message filter; and an ANSI "A" weighting filter. In addition to the standard filters, you can create custom filters using applications such as MATLAB or Agilent VEE and upload the filters through the analyzer's USB port. The U8903A also includes selectable 15 kHz, 20 kHz and 30 kHz low-pass filters to reject unwanted out-of-band signals and noise.

Display scaling and formatting

U8903A gives you flexible control over data displays. For example, you can choose volts, millivolts, dBm into 600 ohms (or other resistance values), or watts for AC level measurements, and select percent or dB for distortion measurements.

Address challenging audio applications (continued)

Swept measurements

With its internal audio source and precise digital control, the U8903A can perform automatic swept measurements of frequency response, distortion and signal-to-noise. For example, to check the frequency response of an active filter, only a few steps are required. After connecting the device and setting the required source level, simply enter the start and stop frequencies, and then press the “Sweep” key (Figure 5).

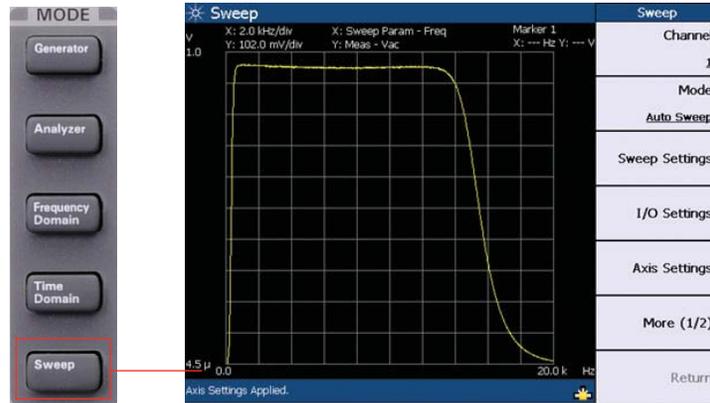
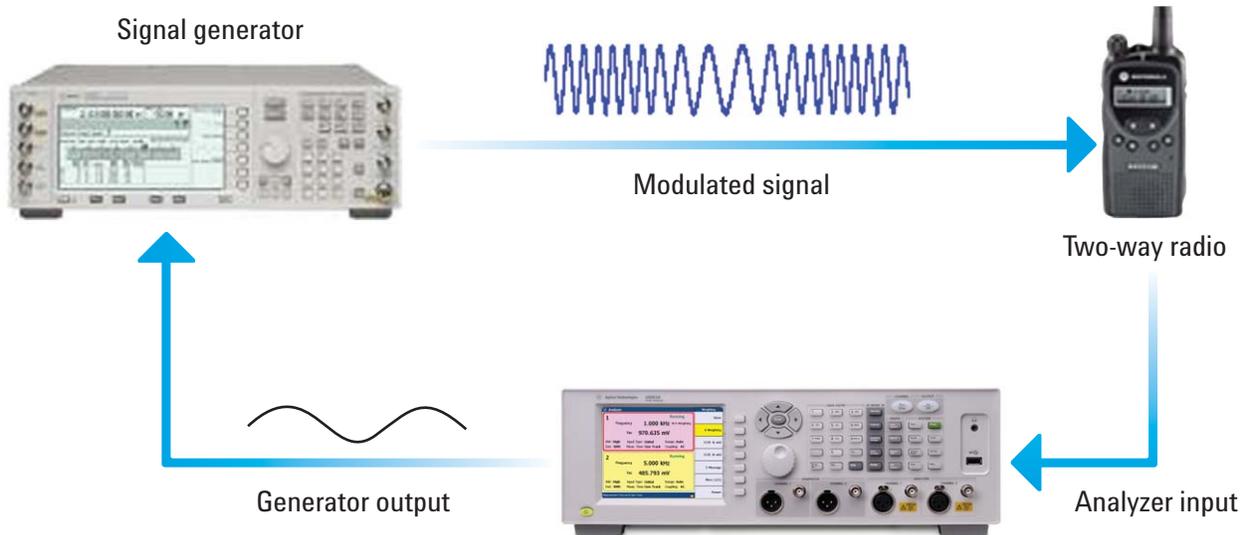


Figure 5: Use a single button to access the swept measurement mode.

Transmitter and receiver testing

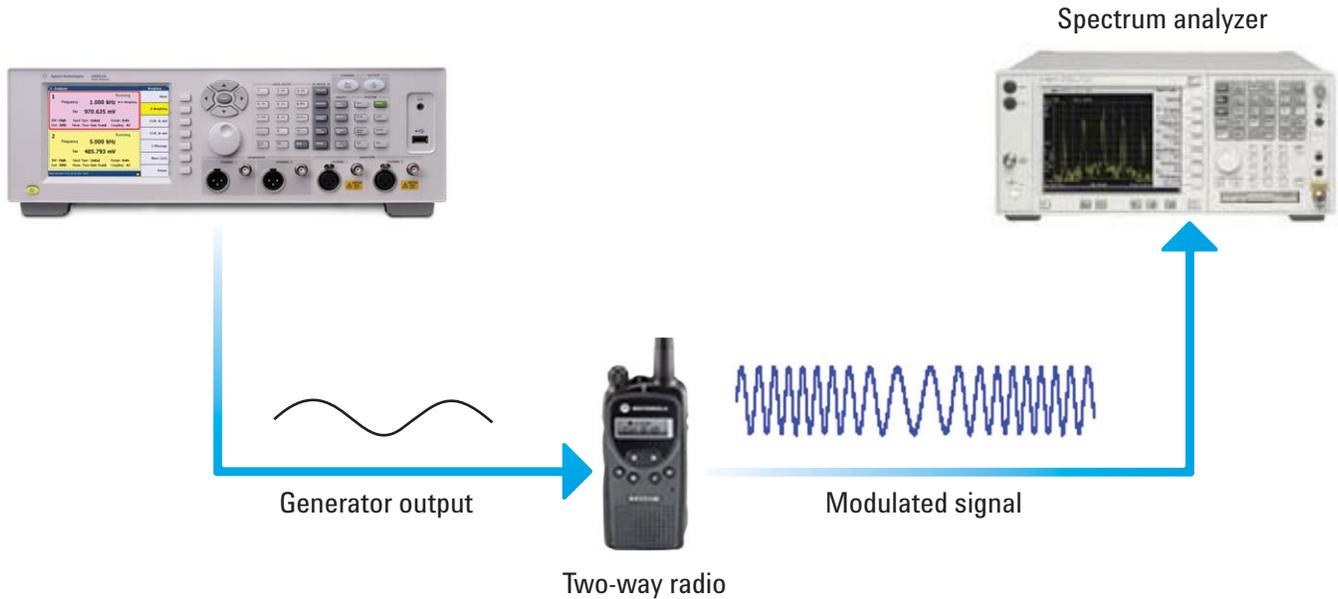
The U8903A includes several measurement features that simplify the testing of the transceivers used in devices such as car radios, telephones, mobile radios, broadcast radios, FM tuners and television. The U8903A can handle all of these applications when combined with a modulating signal generator for receiver testing and a signal analyzer for transmitter testing (see diagrams).

Receiver testing



Address challenging audio applications (continued)

Transmitter testing



True-RMS detection

To accurately characterize signals with high noise content, true-RMS detection is required. The U8903A employs true-RMS detection for all signals with crest factor less than three. In addition, quasi-peak detection (CCIR 468-4) and peak-to-peak detection are also available through softkey selections.

Built-in filters

The U8903A includes a variety of essential filters for transmitter and receiver testing. Its CCITT, CCIR, and C-message weighting filters meet international standards for receiver testing. For transmitter testing, the seven-pole 400 Hz high-pass filter provides better than 40 dB rejection of signals up to 250 Hz, letting you measure transmitter audio distortion to 1% without disabling squelch signals.

For even greater flexibility, you can apply custom filters created using applications such as MATLAB and Agilent VEE. Once you've uploaded a filter via the U8903A's USB port, it can be applied to your measurements through a softkey selection. In all, you can apply up to three filters at a time.

SINAD measurements

Commonly used to test FM receivers, SINAD measurements must be made repeatedly when checking receiver sensitivity or adjacent-channel selectivity. To smooth out the typically noisy signals that are present during receiver testing, the analyzer's SINAD mode employs extra filtering circuits. These have been optimized for high speed and excellent repeatability: The U8903A provides distortion and SINAD measurements with an acquisition time of less than 1.5 seconds and a measurement rate of greater than two readings per second after locking.

Signal-to-noise ratio

To characterize signal quality in AM receivers, the U8903A can automatically make the necessary signal-to-noise ratio measurements. It does this by monitoring the incoming AC signal level while turning its low-distortion source on and off.

Characteristics

Power Consumption

250 VA

Power Requirements

- 100 V_{ac} to 240 V_{ac}
- 47 Hz to 63 Hz

Operating Environment

- Operating temperature from 0 °C to 55 °C
- Relative humidity at 30% to 80% RH (noncondensing)
- Altitude up to 3000 m
- Pollution Degree 2
- Installation Category II

Storage Compliance

-55 °C to 75 °C

Safety Compliance

Certified with:

- IEC 61010-1:2001/EN61010-1:2001 (2nd Edition)
- Canada: CAN/CSA-C22.2 No. 61010-1-04
- USA: Ansi/UI 61010-1:2004

Emc Compliance

- IEC 61326-1:2005/EN 61326-1:2006
- Canada: ICES-001:2004
- Australia/New Zealand: AS/NZS CISPR11:2004

Dimensions (W x D x H)

426.80 x 405.00 x 141.35 mm

Weight

< 7.5 kg (without cards)

Warranty

One year for U8903A

Three months for standard-shipped accessories (see page 13)

Specifications

The following specifications are based on performance with a 30 minutes warm-up time and at a temperature from 0 °C to 55 °C unless stated otherwise.

Audio generator

Generated waveform	Sine, Dual sine, Variable Phase, Square, Noise (Gaussian and Rectangular), Arbitrary, DC, Multitone, SMPTE IMD (1:1, 4:1, and 10:1), DFD (IEC 60118/IEC 60268)
Sine, Dual Sine, And Variable Phase	
Frequency	
Range	5 Hz to 80 kHz
Accuracy	5 ppm
Resolution	0.1 Hz
Output	
Range (Balanced)	0 V to 16 V _{rms}
Range (Unbalanced/Common)	0 V to 8 V _{rms}
Amplitude accuracy	± 1%
Amplitude resolution	1 μV _{rms} (limited to five digits of resolution)

Specifications (continued)

Flatness	
20 Hz to 20 kHz	± 0.01 dB
5 Hz to 80 kHz	± 0.1 dB
THD + N at 1 kHz, 1 V_{rms}, 20 Hz to 20 kHz bandwidth	≤ -95 dB (at 23 °C ± 5°C) ≤ -92 dB (from 0 °C to 18 °C and 28 °C to 55 °C)
Dual sine ratio range	0 dB to 100 dB
Phase	-180 ° to 179.99 °
Sweep	Frequency, amplitude, phase
Square	
Frequency	
Range	5 Hz to 30 kHz
Output	
Range (Balanced)	0 V to 45.2 V _{pp}
Range (Unbalanced/Common)	0 V to 22.6 V _{pp}
Rise time	< 2 μs
SMPTE IMD (1:1/4:1/10:1)	
Frequency	
Low frequency (LF) tone	40 Hz to 500 Hz
High frequency (HF) tone	2 kHz to 60 kHz
Output	
Range (Balanced)	0 V to 16 V _{rms}
Range (Unbalanced/Common)	0 V to 8 V _{rms}
Mixed ratio (LF:HF)	10:1, 4:1, or 1:1
Residual IMD (20 Hz to 20 kHz)	≤ -92 dB
Sweep	Upper frequency, lower frequency, amplitude
DFD (IEC 60118/IEC 60268)	
Frequency	
Difference frequency	80 Hz to 2 kHz
Upper frequency	3 kHz to 80 kHz
Center frequency	3 kHz to 79 kHz
Output	
Range (Balanced)	0 V to 16 V _{rms}
Range (Unbalanced/Common)	0 V to 8 V _{rms}
Inherent distortion (20 Hz to 20 kHz)	≤ -101 dB
Sweep	Upper frequency, center frequency, amplitude
Arbitrary/Multitone	
Sample rate	312.5 kHz
Length	32 to 32768 points/channel
Maximum number of tones	(Length/2) - 1
Noise	
Type	Gaussian, Rectangular
Output	
Range (Balanced)	0 V to 7.2 V _{rms} (Gaussian), 0 V to 13.16 V _{rms} (Rectangular)
Range (Unbalanced/Common)	0 V to 3.6 V _{rms} (Gaussian), 0 V to 6.58 V _{rms} (Rectangular)
DC	
Output	
Range (Balanced)	-22.6 V to 22.6 V
Range (Unbalanced/Common)	-11.3 V to 11.3 V
Amplitude accuracy	± 1.5%

Specifications (continued)

DC Offset

Applicable for all waveform types except Variable Phase, DC, and Square

Output level

Range	-11.3 V to 11.3 V
Amplitude accuracy	± 1.5%

Output Characteristics

Connection type

Balanced	XLR
Unbalanced	BNC
Common mode	XLR

Impedance

Balanced	100 Ω, 600 Ω
Unbalanced	50 Ω, 600 Ω

Output current limit (typical) 50 mA

Maximum output power into 600 Ω

Balanced (600 Ω)	20 dBm
Unbalanced (600 Ω)	14 dBm

Crosstalk

20 Hz to 20 kHz	≤ -101 dB (at 23 °C ± 5 °C)
	≤ -99 dB (from 0 °C to 18 °C and 28 °C to 55 °C)
20 kHz to 80 kHz	≤ -85 dB

Audio analyzer

Input Characteristics

Connection type

Balanced	XLR
Unbalanced	BNC

Coupling DC, AC

Measurement bandwidth

Low	30 kHz
High	100 kHz

Input ranges 400 mV to 140 V_{rms}

Measurement range < 1 μV⁽¹⁾ to 140 V_{rms}

Maximum rated input 200 V_p for altitude up to 3000 m

Impedance

Balanced	200 kΩ
Unbalanced	100 kΩ

Flatness

20 Hz to 20 kHz	± 0.01 dB ⁽²⁾ (at 23 °C ± 5 °C)
	± 0.012 dB ⁽³⁾ (from 0 °C to 18 °C and 28 °C to 55 °C)
20 kHz to 100 kHz	± 0.1 dB (at 23 °C ± 5 °C)
	± 0.15 dB (from 0 °C to 18 °C and 28 °C to 55 °C)

THD + N at 1 kHz, 1 V_{rms}, 20 Hz to 20 kHz bandwidth ≤ -101 dB

CMRR

≤ 20 kHz (input range ≤ 6.4 V)	≥ 70 dB ⁽⁴⁾
≤ 20 kHz (input range > 6.4 V)	≥ 40 dB ⁽⁴⁾

Crosstalk

20 Hz to 20 kHz	≤ -101 dB
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Input protection Overload protection for all ranges, onscreen warning message on the front panel

Specifications (continued)

Triggering	
Type	Free Run, External
Level	5 V
Minimum trigger high voltage	1.25 V
Maximum trigger low voltage	0.5 V
Input impedance	> 50 kΩ
Amplitude	
DC measurement range	0 to ± 200 V
DC accuracy	± 1%
AC accuracy (20 Hz to 100 kHz)	± 1% (at 23 °C ± 5 °C) ± 2% (from 0 °C to 18 °C and 28 °C to 55 °C)
AC level detection	RMS, Peak-to-Peak, Quasi Peak
Frequency	
Range	10 Hz to 100 kHz
Minimum input	1 mV (S/N > 40 dB)
Accuracy	5 ppm
Resolution	6 digits
Phase	
Accuracy	
< 20 kHz	± 2 °
< 100 kHz	± 4 °
Minimum input	1 mV (S/N > 40 dB)
Resolution	0.01 °
SMPTE IMD	
Residual IMD	≤ 0.0025% (–92 dB)

[1] Defined by 24-bit measurement.

[2] ± 0.01 dB – 0.001 dB/Hz below 50 Hz.

[3] ± 0.012 dB – 0.001 dB/Hz below 50 Hz.

[4] When AC coupled, CMRR will deteriorate at low frequencies.

Graph mode

Size/Acquisition length	256, 512, 1024, 2048, 4096, 8192, 16384, 32768
Window	Rectangular, Hann, Hamming, Blackman-Harris, Rife-Vincent 1 and 3, Flattop
Amplitude accuracy (Flattop window)	± 0.1 dB (± 1.2%)
Display mode	
Time domain	Normal, Interpolate, Peak, Absolute Value
Frequency domain	Displays highest FFT bin between graph points

Audio filters

Low pass filter	<ul style="list-style-type: none"> • 15 kHz low pass • 20 kHz low pass • 30 kHz low pass • User-defined ^[1]
High pass filter	<ul style="list-style-type: none"> • 20 Hz high pass • 100 Hz high pass • 400 Hz high pass • User-defined ^[1]
Weighting filter	<ul style="list-style-type: none"> • A-Weighting (ANSI-IEC "A" weighted, per IEC Rec 179) • CCIR 1K weighted (CCIR Rec. 468) • CCIR 2K weighted (Dolby 2K) • C-Message (C-Message per IEEE 743) • CCITT (ITU-T Rec. O.41, ITU-T Rec. P.53) • User-defined ^[1]

[1] User-defined filters can be uploaded through standard I/O connections.

Specifications (continued)

Sweep capability

Frequency Sweep (Sine And Dual Sine Waveforms)	
Start point	5 Hz to 80 kHz
Stop point	5 Hz to 80 kHz
Amplitude spot value (Balanced)	0 V to 16 V _{rms}
Amplitude spot value (Unbalanced/Common)	0 V to 8 V _{rms}
Frequency Sweep (Square Waveform)	
Start point	5 Hz to 30 kHz
Stop point	5 Hz to 30 kHz
Amplitude spot value (Balanced)	0 V to 22.6 V _{rms}
Amplitude Spot Value (Unbalanced/Common)	0 V to 11.3 V _{rms}
Frequency Sweep (SMPTE IMD 1:1/4:1/10:1 Waveform)	
Start point (Upper frequency)	2 kHz to 60 kHz
Start point (Lower frequency)	40 Hz to 500 Hz
Stop point (Upper frequency)	2 kHz to 60 kHz
Stop point (Lower frequency)	40 Hz to 500 Hz
Amplitude spot value (Balanced)	0 V to 16 V _{rms}
Amplitude spot value (Unbalanced/Common)	0 V to 8 V _{rms}
Frequency Sweep (DFD IEC 60118/IEC 60268 Waveform)	
Start point (Upper frequency)	3 kHz to 80 kHz
Start point (Center frequency)	3 kHz to 79 kHz
Stop point (Upper frequency)	3 kHz to 80 kHz
Stop point (Center frequency)	3 kHz to 79 kHz
Amplitude spot value (Balanced)	0 V to 16 V _{rms}
Amplitude spot value (Unbalanced/Common)	0 V to 8 V _{rms}
Difference frequency spot value	80 Hz to 2 kHz
Voltage Sweep	
Start point (Balanced)	0 V to 16 V _{rms} ^[1]
Start point (Unbalanced/Common)	0 V to 8 V _{rms} ^[1]
Stop point (Balanced)	0 V to 16 V _{rms} ^[1]
Stop point (Unbalanced/Common)	0 V to 8 V _{rms} ^[1]
Frequency spot value (Sine and Dual sine waveforms)	5 Hz to 80 kHz
Frequency spot value (Square waveform)	5 Hz to 30 kHz
Frequency spot value (SMPTE IMD 1:1/4:1/10:1 waveform)	40 Hz to 500 Hz (lower frequency), 2 kHz to 60 kHz (upper frequency)
Frequency spot value (DFD IEC 60118/IEC 60268 waveform)	3 kHz to 80 kHz (upper frequency), 3 kHz to 79 kHz (center frequency), 80 Hz to 2 kHz (difference frequency)
DC Sweep	
Start point (Balanced)	-22.6 V to 22.6 V
Start point (Unbalanced/Common)	-11.3 V to 11.3 V
Stop point (Balanced)	-22.6 V to 22.6 V
Stop point (Unbalanced/Common)	-11.3 V to 11.3 V
Phase Sweep	
Start point	-180 ° to 179.99 °
Stop point	-180 ° to 179.99 °

[1] This range is applicable for sine wave only.

Ordering Information

Model Number	Description
U8903A – 200	2-channel audio analyzer

Standard-shipped accessories



LAN and USB cables, power cord, Product Reference CD-ROM (contains U8903A Quick Start Guide and User Guide), Quick Start Guide, 1GB USB Flash Memory device and Certificate of Calibration.

Optional accessories



U8903A - 101
Male BNC to Male BNC cable; 1.2 m



U8903A - 102
Male BNC to Male RCA cable; 2m



U8903A - 103
Male XLR to Female XLR cable; 2m

U8903A - 908
Rack mount kit – standard 3U

U8903A – ABJ
Japanese User Guide (hardcopy)



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Quickly choose and use your test equipment solutions with confidence.

Make an audible difference

In audio applications, measuring “how good” is fast, easy and accurate with the Agilent U8903A audio analyzer. Across the audio spectrum and beyond, this single-unit solution provides versatile measurement functions, diverse test signals and powerful analysis capabilities for bench and test-system use. For applications in wireless audio, analog components and ICs, consumer audio, and beyond, the U8903A can help you make an audible difference in your end product.

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Revised: October 6, 2008

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Printed in USA, July 3, 2009
5990-3831EN



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