DATA SHEET

U8903B

Performance Audio Analyzer

Introduction

Make multi-functional and higher-performance audio measurements with the U8903B audio analyzer. With the extremely low residual distortion of < -110 dB, the U8903B allows you to measure the most demanding audio devices with high accuracy. Perform audio measurements via a *Bluetooth*® link with the new *Bluetooth* option, and make the highest resolution two-channel measurements available when you expand your bandwidth to 1.5 MHz. With these options and more, the U8903B audio analyzer offers you a configurable audio test solution to meet your specific audio application needs.

KEYSIGHT TECHNOLOGIES

Key Features

- Test low distortion devices with low residual distortion of < –110 dB
- Expand your measurement bandwidth (with the wide bandwidth option N3431A) to measure from DC or 10 Hz to a maximum of 1.5 MHz
- Make *Bluetooth* audio measurements with the new *Bluetooth* option
- Perform speech and audio quality measurements with Perceptual Objective
- Listening Quality Assessment (POLQA) and Perceptual Evaluation of Speech Quality (PESQ)
- Configure the U8903B up to 8 analog analyzer channels
- Implement automatic test with the test sequence function
- Characterize Signal-to-Noise Ratios, SINAD, IMD, DFD, THD ratio, THD+N level, crosstalk, and more
- Apply weighing functions, standard filters, and custom filters, including notch filter features
- Configure your unit with the digital audio interface option, offering AES3/SPDIF and DSI standard digital audio formats
- Test a variety of current components and applications with a logic level input range of 1.2 V to 3.3 V (DSI)
- Eliminate the need to rewrite programs into the SCPI command with the built-in compatibility mode.

Bluetooth Audio Testing – Accurate, Convenient and High Performance

Bluetooth version 4.0

With the constant evolution of *Bluetooth* specifications, many handheld devices are designed to be compatible with the latest version of *Bluetooth* to take advantage of the technology's latest breakthroughs. The U8903B audio analyzer's *Bluetooth* option operates with version 4.0 and transmits a maximum output power of 5 dBm, ensuring that you can connect to and accurately test a wide variety of *Bluetooth* devices. Over the air *Bluetooth* audio testing with the U8903B should be conducted in a shielded chamber. It's also suitable for audio tests for IoT devices.

Figure 1. The back panel of the U8903B.

Link monitoring with received power indicator and bit error rate measurement

Ensure the quality of your *Bluetooth* link and easily troubleshoot connection issues with two functions designed for the *Bluetooth* option: the received power indicator and bit error rate measurement.

The received power indicator is a visual indication of the power strength of the device-under-test (DUT). This gives users a quick and convenient way to check that the *Bluetooth*-RF link is strong enough.

The bit error rate (BER) measurement shows the amount of error, given as a percentage, in the connection between the U8903B and the *Bluetooth* DUT. If the engineer receives a BER measurement above 0%, they can adjust the design or setting of the circuit or replace a component on the circuit; a reduction in the BER measurement means that the changes have improved the link quality. By monitoring changes in the BER value, engineers can determine the causes of the link quality deterioration

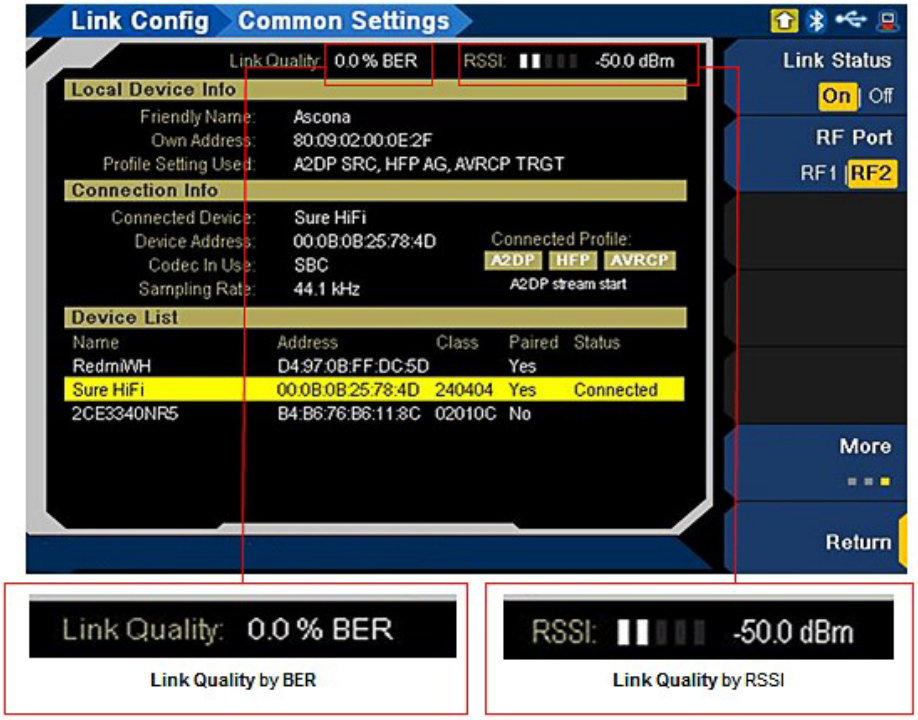

Figure 2. The bit error rate (BER) measurement and the received power indicator (RSSI) functions help ensure the quality of your *Bluetooth* link.

Local loopback capability

The U8903B audio analyzer comes with local loopback capability to provide fast, accurate loopback testing of *Bluetooth* chipsets, modules, and devices. The U8903B is capable of simulating the *Bluetooth* audio gate (under HFP or HSP) to test a *Bluetooth* device. Engineers are required to test the uplink and downlink between the U8903B and the DUT. The loopback capability allows the uplink signal to be looped back at the U8903B and sent to the DUT, ensuring that both the uplink and downlink are tested at the same time. Without this feature, engineers will need to test the uplink and downlink separately, which would double the test time and require more wiring.

Loopback testing is applicable to *Bluetooth* module design or mobile devices, which require validation of its *Bluetooth* audio quality in both uplink and downlink communications. The feature provides highly accurate measurements as there is no potential audio degradation by the U8903B's internal audio signal processing. Users also receive the full functions of audio measurement, with the tests processed in the analog audio domain, not the *Bluetooth* domain.

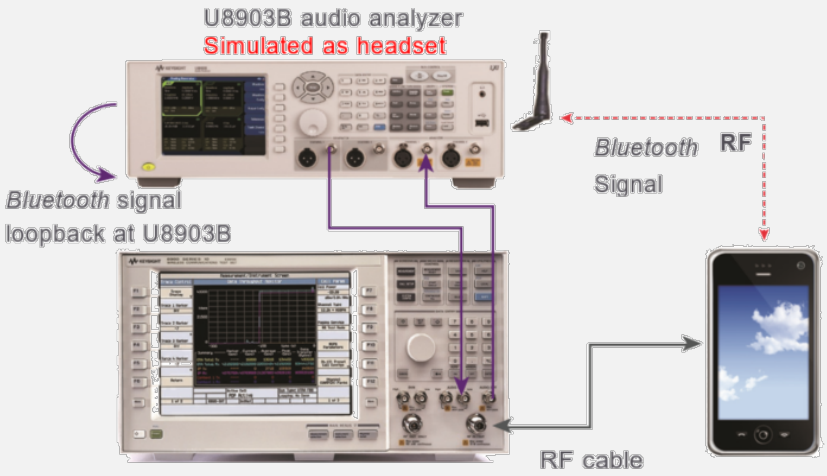

Figure 3. Example of a loopback test case – measuring the *Bluetooth* audio quality of a mobile phone.

Total Keysight *Bluetooth* solution

With the U8903B's *Bluetooth* option, Keysight Technologies now offers a total *Bluetooth* test solution by providing all the test instruments required for the design and production of *Bluetooth* devices.

- RF test: ESA-E Series spectrum analyzers, X-Series signal analyzers, MXG and EXG signal generators
- Protocol Analysis: Keysight E6640A EXM wireless test set
- High-performance audio test: U8903B performance audio analyzer with *Bluetooth* option
- Power test: Keysight power meters and power sensors family
- Network emulation: UXM wireless testers (to simulate 2G/3G/4G mobile networks)

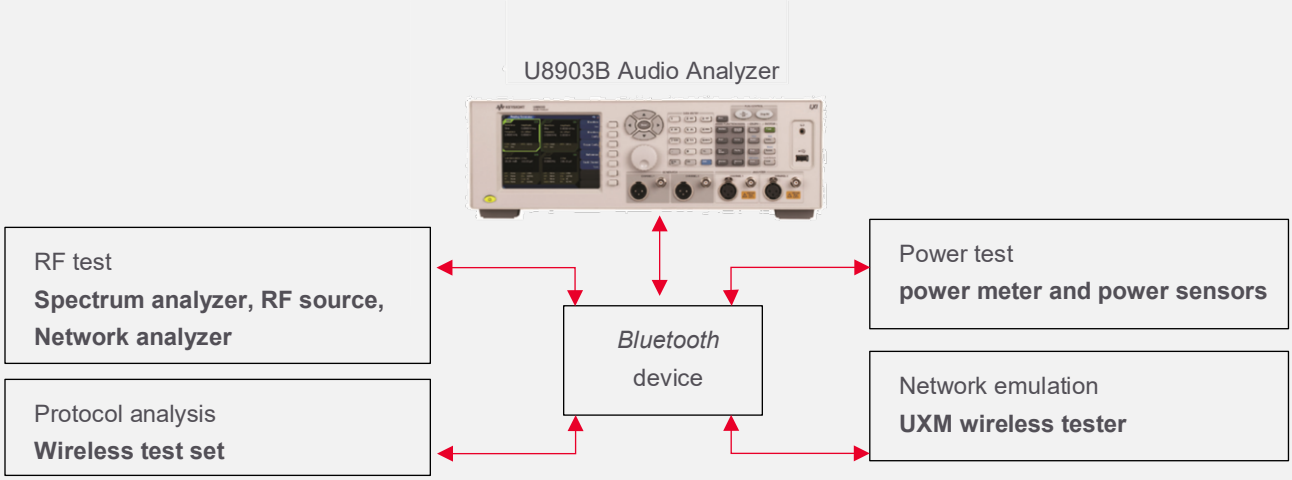

Figure 4. Total Keysight *Bluetooth* solution.

Expand Your Options to Meet Your Application Needs

Configurable measurement channels

The U8903B audio analyzer can be configured to 4 or 8 analog analyzer channels. The instrument can simultaneously measure all channels, making the U8903B the ideal choice for multichannel systems such as 5.1 or 7.1 surround sound.

Figure 5. The U8903B's GUI, showing 8 analyzer channel measurements.

1.5 MHz wide bandwidth

The U8903B comes with a wide bandwidth option (N3431A), which expands the analog input bandwidth up to 1.5 MHz, with 24-bit resolution and two-million-point FFT. This option is ideal for looking at the spectrum from Class D amplifiers or switching supplies where frequency components or noise well above the audio band can have a detrimental effect on audio quality. It is also suited to applications where low-frequency spectrum analyzers were previously used. This option is only available for the two front panel analog analyzer channels.

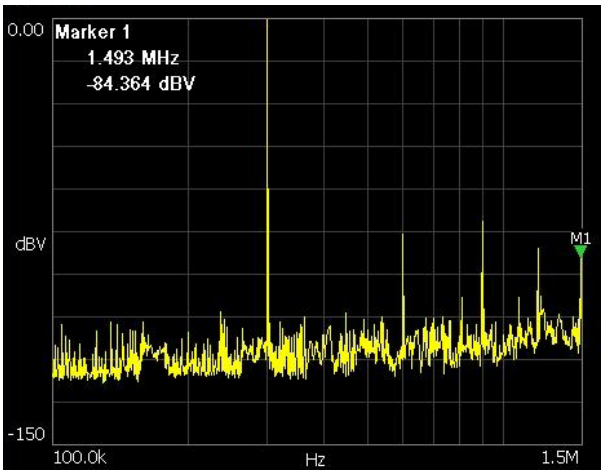

Figure 6. This screenshot shows an FFT plot of a 300 kHz source and the U8903B's unique ability to measure the 5th harmonic with unprecedented resolution.

Voice quality with PESQ and POLQA

The U8903B audio analyzer now offers the ITU-T standard perceptual objective listening quality assessment (POLQA), which is also known as ITU-T P.863, as well as perceptual evaluation of speech quality (PESQ) as recommended in ITU-T P.862.

POLQA and PESQ work by comparing a degraded (usually by typical network transmission interferences) or processed signal to the original reference signal. The perceptual differences between the two signals are then rated based on the mean opinion score (MOS) test, which uses a scale from 1 (bad) to 5 (excellent).

POLQA comes with improvements over its predecessor, PESQ (ITU-T P.862), and has been extended to handle higher bandwidth audio signals, supporting measurements in the common audio bandwidth carried by telephone networks (300 Hz to 3.4 kHz) as well as wideband and super-wideband speech signals (up to 14 kHz) needed to assess HD voice quality. With POLQA, the U8903B is suited for testing 4G/LTE and 5G mobile phone network equipment, VoIP phone and network equipment, and HD voice test applications

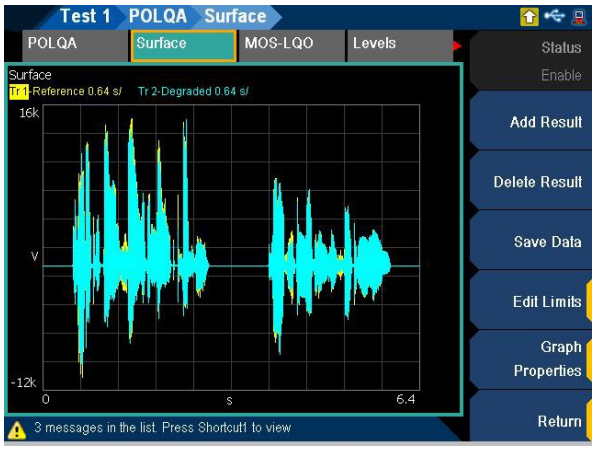

Figure 7. A graph comparison view between the Reference source file and degraded file.

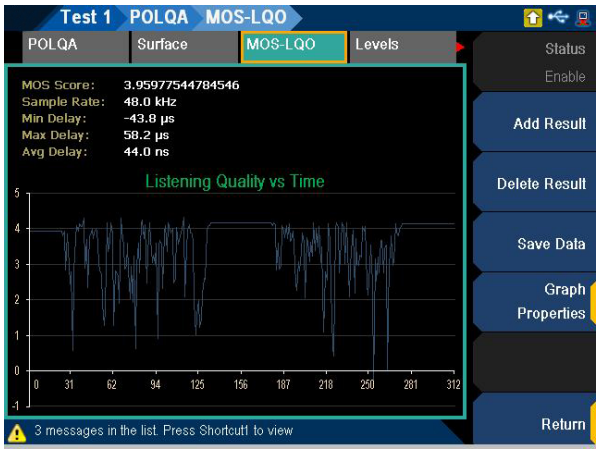

Figure 8. The MOS (Mean Opinion Score) scoring, indicating the rating of the DUT's voice quality.

Advance Your Measurement Testing

Low residual distortion

The U8903B comes with extremely low residual distortion and noise. The residual distortion is < –110 dB, enabling the measurement of the most demanding devices. This performance is available for up to 8 channels simultaneously.

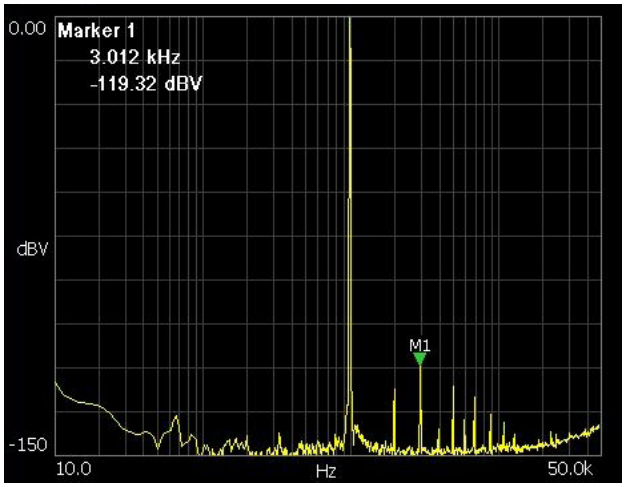

Figure 9. An FFT plot shows the residual distortion.

Test sequence control

The built-in test sequencer allows users to create flexible and easy-to-use test sequences that automate testing and provide test reports. This function removes the need to write complicated programming code or to purchase an additional external controller. Users can set up and define the types of measurements and define Pass/Fail decisions, reducing test development time and test time for the device-under-test (DUT). The test sequence function operates with all options and supports voice quality analysis and *Bluetooth* audio measurements.

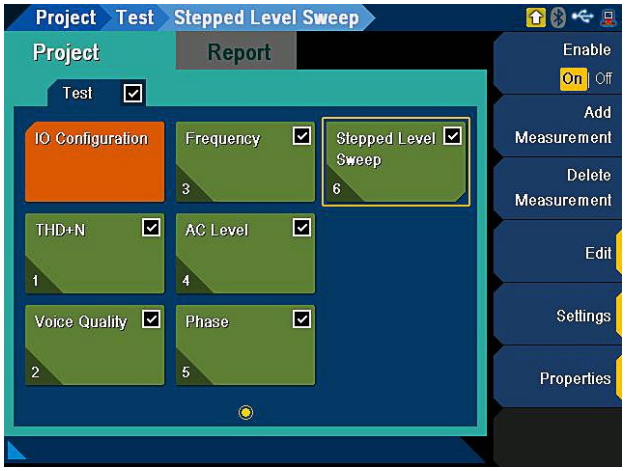

Figure 10. The test sequence control function comes with a selection of pre-configured measurements. It allows users to select the most frequently used test sequences for their daily measurement.

Expand Your Digital Audio Test Capabilities

Cover your application needs with multiple digital audio interfaces

Test a wide range of digital audio applications with the industry's standard interfaces: AES3/SPDIF and Digital Serial Interface (DSI). Used in the testing and validation of consumer electronics and digital audio-related ICs, both digital audio interfaces are available with the U8903B Option DGT. The U8903B also supports multiple DSI formats, such as I2S, Left Justified, Right Justified, and DSP. These formats are suitable for most digital audio design and verification applications

Measure more applications with a wide logic level input range

The U8903B comes with completely variable logic I/O levels between 1.2 V and 3.3 V, offering the ultimate compatibility with current and future devices. In addition, the U8903B-105 DSI cable (optional accessories) is designed to make connections between the audio analyzer and the DUT extremely simple. The cable provides a convenient connection to the 25-way DSI connector on the rear of the instrument. The other end of the cable offers all the data and clock lines on individual BNC connectors for quick and easy connection to the DUT.

The U8903B also comes with a mode to help customers transition to the new generation of audio analyzers. This mode allows the new U8903B to mimic the legacy audio analyzer, performing measurements and even displaying the same GUI measurement screen as the legacy audio analyzer. For customers currently using the legacy audio analyzer in their test rack, the U8903B also comes with a built-in code emulator that automatically converts the code directly into SCPI commands, the language used by the U8903B.

Product Characteristics

Description	Specifications
Power consumption	≤ 250 VA
Power requirements	100 to 240 V_{ac}
	47 to 63 Hz
Operating environment	Operating temperature from 0 to 55 °C
	Maximum Relative Humidity (non-condensing): 95%RH up to 40 °C, decreases linearly to 45%RH at 55 °C [1]
	Altitude up to 3000 m
	Pollution Degree 2
	Installation Category II
Storage compliance	–40 to 70 °C
Safety & EMC[2] compliance	Refer to Declaration of Conformity for the latest revisions of regulatory compliance at: www.keysight.com/go/conformity
Instrument dimensions (W x D x H)	425.60 mm (16.76 in) x 425.00 mm (16.73 in) x 133.60 mm (5.25 in)
Connectivity	LAN, GPIB and USB
Weight	8.5 kg

Notes:

1. From 40°C to 55°C, the maximum % Relative Humidity follows the line of constant dew point.
2. This is a sensitive measurement apparatus by design and may have some performance loss when exposed to ambient continuous electromagnetic phenomenon. Measurement Considerations – use shielded or twisted cable, use common mode choke & ferrite clamp.

Specification and Features

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

Analog generator specifications and features

Analog generator specifications and features	
Output features	
Generated waveforms	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), WAV file playback
Connection type	
Balanced	XLR
Unbalanced	BNC
Common mode	XLR
Impedance	
Balanced	40 Ω, 100 Ω, 600 Ω
Unbalanced	20 Ω, 50 Ω, 600 Ω
Common mode	40 Ω, 100 Ω, 600 Ω or 10 Ω unbalanced as per IEC-60268
Grounding	
	True floating or grounded
Maximum output power into 600 Ω	
Balanced (600 Ω)	20 dBm
Unbalanced (600 Ω)	14 dBm
Sine, dual sine, and variable phase	
Dual sine ratio range	0 to 100%
Phase	–180 to 179.99°
Sweep	Frequency, amplitude, phase

Analog generator specifications and features	
Frequency	
Range	5 Hz to 80 kHz
Accuracy	± (2 ppm + 100 µHz)
Resolution	0.1 Hz
Output	
Range (balanced)	0 to 16 V_{rms}
Range (unbalanced/common)	0 to 8 V_{rms}
Current limit (typical)	50 mA
Amplitude accuracy at 1 kHz	± 0.09 dB (± 1%) (from 0 to 55 °C)
Amplitude resolution	1 µ V_{rms} (limited to five digits of resolution)
Flatness Ref 1 kHz	
5 Hz to 20 kHz	± 0.008 dB
20 kHz to 80 kHz	± 0.08 dB
THD and THD+N	
Residual THD + N at 1 kHz, 1 V_{rms} (20 Hz to 20 kHz bandwidth)	≤ –108 dB, < –110 dB (at 23 ± 5 °C)[1] (typical) ≤ –100 dB (from 0 to 55 °C) [1]
Residual THD at 1 kHz, 1 V_{rms} (20 Hz to 20 kHz bandwidth)	≤ –111 dB, ≤ –116 dB (at 23 ± 5 °C)[1] (typical) ≤ –103 dB (from 0 to 55 °C)[1]
Residual THD, 5 Hz to 25 KHz, 0.32, 1, 3.2, 10 Vrms	< –85 dB (at 23 ± 5 °C)[2]
Residual THD, 25 KHz to 50 KHz, 0.32, 1, 3.2, 10 Vrms	< –77 dB (at 23 ± 5 °C)[2]
Residual THD, 50 KHz to 70 KHz, 0.32, 1, 3.2, 10 Vrms	< –67 dB (at 23 ± 5 °C)[2]
Residual THD, 70 KHz to 80 KHz, 0.32, 1, 3.2, 10 Vrms	< –85 dB (at 23 ± 5 °C)[2]

Analog generator specifications and features	
Notes: 1. Includes contributions from Generator and Analyzer. Individual contributions are typically less than the values stated. 2. Residual THD is calculated based on up to the 9th harmonic.	
Crosstalk	
≤ 20 kHz	≤ –130 dB + 0.1 µV (typical)
Square	
Frequency range	5 Hz to 30 kHz
Rise time	< 2 µs
Output	
Range (balanced)	0 to 45.2 V_{pp}
Range (unbalanced/common)	0 to 22.6 V_{pp}
Amplitude accuracy at 1 kHz	± 1%
SMPTE IMD (1:1/4:1/10:1)	
Mixed ratio (LF: HF)	10:1, 4:1, or 1:1
Residual IMD (20 Hz to 20 kHz)	≤ –95 dB (at 23 ± 5 °C) (typical), ≤ –90 dB (from 0 to 55 °C) (typical)
Sweep	Upper frequency, lower frequency, amplitude
Frequency	
Low frequency (LF) tone	40 to 500 Hz
High frequency (HF) tone	2 to 60 kHz
Output	
Range (balanced)	0 to 16 V_{rms}
Range (unbalanced/common)	0 to 8 V_{rms}
DFD (IEC 60118/IEC 60268)	
Inherent distortion	≤ –106 dB at 1 V_{rms} (typical)

Analog generator specifications and features	
(20 Hz to 20 kHz)	
Sweep	Upper frequency, center frequency, amplitude
Frequency	
Difference frequency	80 Hz to 2 kHz
Upper frequency	3 to 80 kHz
Center frequency	3 to 79 kHz
Output	
Range (balanced)	0 to 16 V_{rms}
Range (unbalanced/common)	0 to 8 V_{rms}
Noise	
Type	Gaussian, rectangular, pink
Output	
Range (balanced)	0 to 7.2 V_{rms} (Gaussian), 0 to 10 V_{rms} (Rectangular), 0 to 7.2 V_{rms} (Pink)
Range (unbalanced/common)	0 to 3.6 V_{rms} (Gaussian), 0 to 5 V_{rms} (Rectangular), 0 to 3.6 V_{rms} (Pink)
Arbitrary	
Signal	Determined by the user selected file
Sample rate	192 kHz
Length	Up to 5 minutes, depending on waveform file
Multitone	
Signal	Determined by the user-specified frequency, amplitude, and phase data
Sample rate	192 kHz

Analog generator specifications and features	
Length	1024 to 65536 points/channel
Maximum number of tones	64
WAV file playback	
Type of file	.WAV file
Sample rate	192 kHz
Length	Up to 5 minutes, depending on waveform file
DC **Output**	
Range (balanced)	–22.6 to 22.6 V
Range (unbalanced/common)	–11.3 to 11.3 V
Amplitude accuracy	± 1%
DC offset	
Applicable for all waveform types except variable phase, DC, and square	
Output level	
Range	–11.3 to 11.3 V
Amplitude accuracy [1]	± 1.5% (± 250 mV to ± 11.3 V)

Note:

1. DC output and DC offset output are functional from 0 to ± 250 mV. The amplitude accuracy for this range is not warranted.

Analog analyzer specifications and features

Analog analyzer specifications and features	
Input specifications	
Frequency range	10 Hz to 96 kHz[2]
Coupling	DC, AC
Input ranges	320 mV_{rms} to 140 V_{rms} [3] (unbalanced)
	320 m V_{rms} to 300 V_{rms} [3] (balanced)
Measurement range[1]	< 1 µ V_{rms} [4] to 300 V_{rms}
Maximum rated input	200 V_p for altitude up to 3000 m
Input protection	Overload protection for all ranges, onscreen warning message on the front panel
Connection type	
Balanced	XLR
Unbalanced	BNC
Measurement bandwidth	
Bandwidth	96 kHz [2]
Impedance	
Balanced	300 Ω (3 W max), 600 Ω (1.5 W max), 200 kΩ
Unbalanced	300 Ω (3 W max), 600 Ω (1.5 W max), 100 kΩ
CMRR	
≤ 20 kHz (input range ≤ 3.2 V)	≥ 80 dB [5] (typical)
≤ 20 kHz (input range > 3.2 V)	≥ 50 dB [5] (typical)
Crosstalk	
≤ 20 kHz	≤ –140 dB + 0.1 µV (typical)
Notes:	

Analog analyzer specifications and features	
1. Maximum input range of 300Vrms only apply for balance input, in equivalence to ±150Vrms from each phase to ground 2. Accuracy deteriorates as the measurement tends towards the Nyquist frequency of 96 kHz. Full performance can be expected ≤ 95.9 kHz. 3. For the available input ranges, refer to the U8903B User Guide. 4. Defined by the 24-bit measurement. 5. When AC coupled, CMRR will deteriorate at low frequencies	
THD + N and SINAD	
Display range	–999.999 dB to 0 dB
Accuracy	
20 Hz to 20 kHz	± 0.5 dB @ 0.32 V, 1 V, 3.2 V, 10 V, 32 V, 100 V, 140 V
< 96 kHz [1]	± 0.7 dB @ 0.32 V, 1 V, 3.2 V, 10 V, 32 V, 100 V, 140 V
Input voltage range	< 1 μV_{rms} to 140 V_{rms}
3 dB measurement bandwidth	Measurement bandwidth 96 kHz
Detection	RMS
Residual THD + N at 1 kHz, 1 V_{rms} (20 Hz to 20 kHz bandwidth)	≤ –108 dB, <–110 dB (at 23 ± 5 °C)[2] (typical) ≤ –100 dB (from 0 to 55 °C)
Residual THD at 1 kHz, 1 V_{rms} (20 Hz to 20 kHz bandwidth)	≤ –111 dB, ≤–116 dB (at 23 ± 5 °C)[2] (typical) ≤ –103 dB (from 0 to 55 °C)
Residual noise 20 Hz to 20 kHz bandwidth	≤ 1.3 μV_{rms}
SNR	
Display range	0 to 999.999 dB
Accuracy	
20 Hz to 20 kHz	± 0.5 dB @ 0.32 V, 1 V, 3.2 V, 10 V, 32 V, 100 V, 140 V
< 96 kHz [1]	± 0.7 dB @ 0.32 V, 1 V, 3.2 V, 10 V, 32 V, 100 V, 140 V
Input voltage range	< 1 μV_{rms} to 140 V_{rms}
Triggering	

Analog analyzer specifications and features	
Type	Free Run, External
Level	5 V
Minimum trigger high voltage	1.25 V
Maximum trigger low voltage	0.5 V
Input impedance	> 10 kΩ
Amplitude	
DC measurement range	0 to ± 200 V
DC accuracy	± 1% @ 0.32, 1V, 3.2 V, 10 V, 32 V, 100 V, 140 V
AC accuracy (at 1 kHz)	0.03 dB (0.35%) (at 23 ± 5 °C)
	0.05 dB (0.58%) (from 0 to 55 °C)
Flatness Ref 1 kHz	
≤ 20 kHz	± 0.008 dB (typically < ± 0.003 dB)
≤ 80 kHz	± 0.08 dB
< 90 kHz	± 0.1 dB
AC level detection	RMS, Peak-to-Peak
Frequency	
Range	10 Hz to 96 kHz [1]
Minimum input	1 mV (S/N > 40 dB)
Accuracy	± (2 ppm + 100 µHz) (≤ 50 kHz) ± 5 ppm (> 50 kHz)
Resolution	5 digits

Notes:

1. Accuracy deteriorates as the measurement tends towards the Nyquist frequency of 96 kHz. Full performance can be expected ≤ 95.9 kHz.
2. Includes contributions from generator and analyzer. Individual contributions are typically less than the values stated.

Analog analyzer specifications and features	
Phase	
Accuracy	
20 Hz to 20 kHz	± 2°
< 96 kHz [1]	± 4°
Minimum input	1 mV (S/N > 40 dB)
Resolution	0.01°
SMPTE IMD	
Residual IMD	≤ 0.0018% (≤ –95 dB) (typical)
DFD (IEC 60118/IEC 60268)	
Inherent distortion (20 Hz to 20 kHz)	≤ –106 dB at 1 V_{rms} (typical)

Note:

1. Accuracy deteriorates as the measurement tends towards the Nyquist frequency of 96 kHz. Full performance can be expected ≤ 95.9 kHz

Analog audio filters

Analog audio filters	
Low pass filter	
	2 kHz, 3 kHz, 5 kHz, 8 kHz, 10 kHz, 10 kHz, 20 kHz, 22 kHz, 30 kHz, 40 kHz, 50 kHz, 80 kHz
High pass filter	
	15 Hz, 20 Hz, 22 Hz, 30 Hz, 50 Hz, 70 Hz, 100 Hz, 200 Hz, 300 Hz, 400 Hz
Weight filter	
	• A weighting (ANSI-IEC “A” weighted, per IEC Rec 179) • CCIR 1 K weighted (CCIR Rec 468) • CCIR 2 K weighted (Dolby 2 K) • C-Message (C-Message per IEEE743) • De-emphasis (50 µs, 75 µs) • CCITT (ITU-T Rec. 041, ITU-T Rec. P.53) • User-defined [1]

Note:

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

Sweep

Sweep	
Generator sweep	
Parameters	Frequency, amplitude, phase
Sweep spacing	Linear, logarithmic
Sweep mode	Auto sweep, auto list
Hold	None, max, min

Audio monitor

Audio monitor	
Auxiliary	
Monitor output	Scaled to give 1 V_{rms} at the top of each analyzer input range
Aux output	0.5 to 5.1 V_{DC} (± 5%), current limited to 100 mA
Headphone connector	
Recommended headphone	Headphone with 3.5 mm connector

Graph features

Graph features	
FFT analyzer	
Size/acquisition length	2048, 4096, 8192, 16384, 32768, 65536, 131072, 262144, 524288, 1M, 2M
Window	Rectangular, Hanning, Hamming, Blackman-Harris, Rife-Vincent 1 and 3, flat top, Kaiser
Amplitude accuracy (flat top window)	± 0.1 dB (± 1.2%)

Bluetooth audio features

***Bluetooth* features**	
Bluetooth core version	4.0, excluding Low Power Energy
RF input/output impedance	50 Ω (nominal)
RF connectors	Type-N female
Maximum RF output	5 dBm
Profiles and supported codecs	
AGHSP/HSP v1.2 (Headset)	CVSD
AGHFP/HFP v1.6 (Hands-free)	CVSD & mSBC (WBS)

A2DP v1.2 (Sink and Source)	SBC, aptX		
AVRCP 1.4 (Controller)	Basic remote-control settings (play, stop, pause, rewind, forward)		
Codec	**Sampling frequency (possible values)**	**Channels supported**	**Resolution**
CVSD	8 kHz	Mono	16 bits/sample
mSBC	16 kHz	Mono	16 bits/sample
SBC, aptX	16 kHz 32 kHz 44.1 kHz 48 kHz	Stereo/Mono/Dual channel/Joint [1]	16 bits/sample

1.5 MHz bandwidth (Option N3431A)

1.5 MHz bandwidth (Option N3431A)	
Input specifications	
Fundamental frequency range	10 Hz to 1.5 MHz
Frequency accuracy	± 2 ppm (> 50 kHz) (with Sample Size ≥ 1 M)
Measurement bandwidth	
Bandwidth	1.5 MHz
Flatness Ref 1 kHz	
≤ 200 kHz	± 0.1 dB
≤ 1 MHz	± 0.5 dB
≤ 1.5 MHz	± 1.0 dB
Residual THD	
Residual THD at 80kHz, 0.32, 1, 3.2, 8Vrms	≤ -80 dB, ≤ -85 dB (typical), (18 - 28 °C)

Note:

1. Auto-select according to EUT

POLQA measurement (Option N3433A), licensed by OPTICOM GmbH

Perceptual Objective Listening Quality Assessment (in line with ITU-T Rec. P.863)	
Numeric results	POLQA score MOS-LQO narrowband and wideband average only
Graphic display (versus time)	POLQA score, MOS-LQO, delay, dropouts, reference signal, and degraded signal

PESQ measurement (Option N3433A), licensed by OPTICOM GmbH

Perceptual Objective Listening Quality Assessment (in line with ITU-T Rec. P.862, 862.1, and 862.2)	
Numeric results	PESQ score MOS-LQO narrowband and wideband average only
Graphic display (versus time)	PESQ score, MOS-LQO, delay, dropouts, reference signal, and degraded signal

Digital generator features [1]

Digital generator features	
Sine, dual sine, and variable phase	
Frequency	
Range	5 Hz to 0.45 sampling rate (Fs)
Accuracy	± 10 ppm
Flatness	± 0.001 dB
Residual THD + N	≤ –140 dB
Square	
Frequency range	5 Hz to 0.45 Fs
SMPTE IMD (1:1/4:1/10:1)	
Frequency	

Low frequency (LF) tone	40 to 500 Hz
High frequency (HF) tone	2 to 60 kHz, or 0.45 Fs (whichever is lower)
Mixed ratio (LF: HF)	10:1, 4:1, or 1:1
Sweep	Upper frequency, lower frequency, and amplitude
DFD (IEC 60118/IEC 60268)	
Frequency	
Difference frequency	80 Hz to 2 kHz
Upper frequency	3 to 80 kHz, or 0.45 Fs (whichever is lower)
Center frequency	3 to 79 kHz, or 0.45 Fs (whichever is lower)
Sweep	Upper frequency, lower frequency, and amplitude
Noise	
Type	Rectangular, Gaussian, Triangular, and Pink
Amplitude	0 to 1 FFS
Arbitrary	
Signal	Determined by the user selected file
File format	WAVE (.wav)
Maximum file size	5.0 MB
File resolution	8, 16, or 24 bits
Frequency range	2 Hz to 0.45 Fs
Multitone	
Signal	Determined by the user-specified frequency, amplitude, and phase data
Frequency rate	2 Hz to 0.45 Fs
Maximum number of tones	64
Note:	

1. Digital generator specifications refer to 24 bits FFS.

Sine burst	
Period	2 cycles to 65535 cycles
Burst on	1 cycle to (65534 or period – 1, whichever is lower)
Burst on to burst off ratio	0 to 100%
Monotonicity	
Samples/step	1 to 32768
Walking one and walking zero	
Samples/step	1 to 65535
Constant value	
Amplitude	–1 FFS to 1 FFS
DC offset	
DC offset	–1 FFS to 1 FFS
Dither	
Distribution	None, triangular, or rectangular
Level	0.5 LSB

AES3/SPDIF interface features

AES3/SPDIF interface features	
Output specifications	
Output connector type	
Balanced	XLR (transformer coupling)
Unbalanced	BNC (grounded)
Optical	TOSLINK connector
Output impedance	
Balanced	110 Ω
Unbalanced	75 Ω
Output level	
Balanced	0.3 to 5.1 V_{pp}
Unbalanced	0.3 to 2.5 V_{pp}
Sampling rate	28 to 192 kHz
Sampling rate accuracy	± 5 ppm
Output level accuracy	± 1 dB (typical)
Audio bit	8 bits to 24 bits
Inherent jitter (typical)	
Balanced	≤ 1.5 ns
Unbalanced	≤ 1.5 ns
Optical	≤ 5 ns
Clock and sync	
Internal master clock	

Maximum clock rate	192 kHz
Accuracy	± 5 ppm
Inherent jitter	≤ 1 ns (typical)
Sync clock output	
Connector type	25-pin female D-SUB connector pin-1
Impedance	50 Ω
Output level	3.3 V (LVCMOS IO standard)
Polarity	Normal or invert
Output type	Bit clock (128 Fs)
Protocol	
Channel status bits	Professional or consumer (all applicable bits are editable for advanced settings)
Format	Professional or consumer
User bits	Set or cleared
Validity flag	Set or cleared

DSI features

DSI features	
Output features	
Output connector type	25-pin female D-SUB connector
	25-pin male D-SUB to BNC connector (optional accessories)
Output impedance	50 Ω
Logic level	1.2 V, 1.5 V, 1.8 V, 2.5 V, 3.3 V, or user defined (LVCMOS standard)
Sampling rate	6.75 kHz to 400 kHz
Sampling rate accuracy	± 5 ppm
Master-clock	
Multiplier	64 to 1024 (depends on the Word Length)
Maximum frequency	51.2 MHz
Maximum bit clock	51.2 MHz
Maximum sampling rate	400 kHz
Data format	Left Justified, Right Justified, I^2S, or DSP
Word length	8 bits to 32 bits per channel
Audio bit	8 bits to 24 bits (step by 1 bit)
Word clock rate	6.75 kHz to 400 kHz
Clock and sync	
Internal master clock	
Maximum clock rate	10 MHz
Accuracy	± 5 ppm
Inherent jitter	≤ 1 ns (typical)
Clock source setting (analyzer and generator)	

	Incoming bit clock from DUT
	Internal clock
	External clock from the external sync clock input
DSI clock output	
Impedance	10 kΩ typical
Output level	1.2 to 3.3 V_{pp}
Polarity	Normal or invert
Word clock polarity	
	Leading-edge or falling edge (with respect to bit clock)

Digital analyzer features

Digital analyzer features	
Amplitude	
AC level range	< –120 to 0 dBFS
DC level range	± 1 FFS
AC accuracy	± 0.001 dB (at 1 kHz)
DC accuracy	± 0.001 dB
AC flatness	± 0.001 dB (10 Hz to 0.45 Fs)
Unit (reference)	FFS, %FS, V, dBFS, LSB, dBr, dBu, dBV, Hex, Dec, and x
Frequency	
Range	5 Hz to 0.45 Fs
Accuracy	± 5 ppm (10 Hz to 0.45 Fs)
Phase	
Accuracy	± 0.005°
Resolution	± 0.001°
THD+N	
Range	10 Hz to 0.45 Fs
Accuracy	± 0.3 dB
Residual distortion	≤ –140 dB
IMD	
SMPTE IMD	1:1/ 4:1/10:1
High frequency	2 to 60 kHz, or 0.45 Fs (whichever is lower)
Low frequency	40 to 500 Hz
Accuracy	± 0.5 dB

DFD	
Frequency difference	80 Hz to 2 kHz
Center frequency	3 to 79 kHz, or 0.45 Fs (whichever is lower)
Accuracy	± 0.5 dB

AES3/SPDIF interface features

AES3/SPDIF interface features	
Input specifications	
Input connector type	
Balanced	XLR (transformer coupling)
Unbalanced	BNC (grounded)
Optical	TOSLINK connector
Input impedance	
Balanced	110 Ω or high impedance (> 2 kΩ)
Unbalanced	75 Ω or high impedance (20 kΩ typical)
Input level	
Balanced	0.3 to 5.1 V_{pp}
Unbalanced	0.3 to 2.5 V_{pp}
Sampling rate	28 to 192 kHz
Sampling rate accuracy	±5 ppm
Output level accuracy	±1 dB (typical), ±1.5 dB
Audio bit	8 bits to 24 bits
Clock and sync	
Internal master clock	

Maximum clock rate	192 kHz
Accuracy	± 5 ppm
Inherent jitter	≤ 1 ns (typical)
Sync clock input	
Connector type	BNC (SYNC IN on the rear panel)
Impedance	10 kΩ
Polarity	Normal or invert
Protocol	
Channel status bits	Professional or consumer (all applicable bits are editable for advanced settings)
Format	Professional or consumer
User bits	Set or cleared
Validity flag	Set or cleared

DSI features

DSI features	
Input specifications	
Input connector type	25-pin female D-SUB connector
	25-pin male D-SUB to BNC connector (optional accessories)
Input impedance	≥ 10 kΩ
Logic level	1.2 V, 1.5 V, 1.8 V, 2.5 V, 3.3 V, or user defined (LVCMOS standard)
Sampling rate	6.75 to 400 kHz
Sampling rate accuracy	± 5 ppm
Master-clock	

Multiplier	64 to 1024 (depends on the Word Length)
Maximum frequency	51.2 MHz
Maximum bit clock	51.2 MHz
Maximum sampling rate	400 kHz
Data format	Left justified, right justified, I_2S, or DSP
Word length	8 bits to 32 bits per channel
Audio bit	8 bits to 24 bits (step by 1 bit)
Word clock rate	6.75 kHz to 400 kHz
Clock and sync **Internal master clock**	
Maximum clock rate	10 MHz
Accuracy	± 5 ppm
Inherent jitter	≤ 1 ns (typical)
Clock source setting (analyzer and generator)	
	Incoming bit clock from DUT
	Internal clock
	External clock from the external sync clock input
DSI clock input	
Impedance	10 kΩ typical
Output level	1.2 to 3.3 V_{pp}
Polarity	Normal or invert
Word clock polarity	
	Leading-edge or falling edge (with respect to bit clock)

Ordering Information

Product model	Description
U8903B-STD	Performance audio analyzer, 2 channels
Measurement channel options	
U8903B-AN4	Analog analyzer, 4 channels
U8903B-AN8	Analog analyzer, 8 channels
U8903B-DGT	Digital audio card
***Bluetooth* option**	
U8903B-BLU	*Bluetooth* card
U8903B-BL2	*Bluetooth* card, secondary option slot
Bundling options [1]	
U8903B-201	Performance audio analyzer with 4 analog analyzer channels, digital audio (AES3/SPDIF and DSI digital audio). This bundle option is suitable for consumer audio or automotive infotainment system test.
U8903B-210	Performance audio analyzer with 4 analog analyzer channels, digital audio (AES3/SPDIF and DSI digital audio), and *Bluetooth.* This bundle option is suitable for consumer audio or automotive infotainment system test with *Bluetooth* devices.
U8903B-212	Performance audio analyzer; 2 channels with 50-ohm impedance. This bundle option is suitable for consumer audio tests.
Note: 1. The bundle options include U8903B-STD and other options. They are designed for some common applications or required by some specific customers.	
Optional software	
N3431A	Wide bandwidth option –1.5 MHz (fixed perpetual license)
N3433A	POLQA and PESQ measurement software (fixed perpetual license)
Optional accessories	
11500A	Cable assembly, Type-N (male) to Type-N (male), DC to 6.0 GHz
U8903A-101	Male BNC to male BNC cable; 1.2 m

U8903A-102	Male BNC to male RCA cable, 2 m
U8903A-103	Male XLR to female XLR cable; 2 m
U8903A-908	Rackmount kit
U8903B-105	Cable, digital serial interface for DSI input and output connection
U8903A-107	Cable, accessory – Male XLR-2 male BNC analyzer, 0.26 m
U8903A-108	Cable, accessory – Female XLR-2 male BNC generator, 0.26 m
U8903A-109	BNC accessory kit
Warranty and services	
U8903B-1A7	ISO17025 compliant calibration with test data
U8903B-A6J	ANSI Z540 compliant calibration with test data

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