



Introduction

Make multi-functional and higher performance audio measurements with the U8903B audio analyzer. With 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.

Key Features

- Test low distortion devices with a 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 SCPI command with the built-in compatibility mode

Table of Contents

Introduction	02
Key Features	02
Bluetooth Audio Testing – Accurate, Convenient and High Performance	04
Expand Your Options to Meet Your Application Needs	08
Advance Your Measurement Testing	10
Expand Your Digital Audio Test Capabilities	11
Product Characteristics	12
Specifications and Features	13
Ordering Information	25

(C - 1/1)00000 (

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.



Figure 1. The back panel of the U8903B, with Bluetooth audio option installed.

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 deviceunder-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.

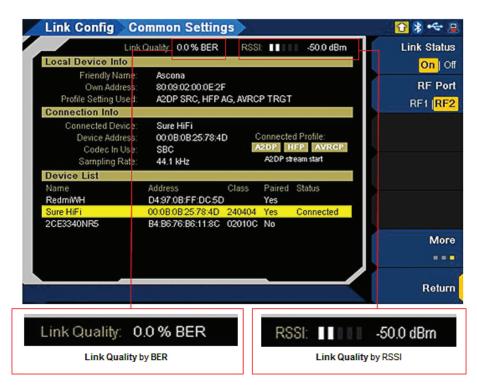


Figure 2. The bit error rate (BER) measurement and the received power indicator (RSSI) functions help ensure the quality of your *Bluetooth* link.

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 a 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.

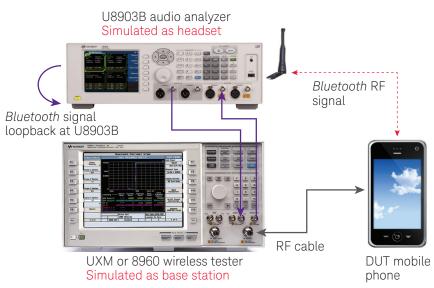
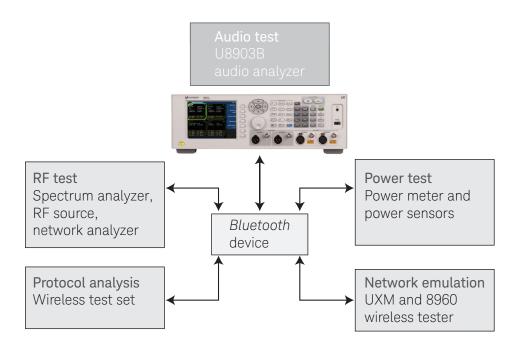


Figure 3. Example of a loopback test case – measuring the *Bluetooth* audio quality of a mobile phone.

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: N4010A wireless connectivity 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 and 8960 wireless testers (to simulate 2G/3G/4G mobile networks).



···· // ··· // ··· ··· //

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 is capable of simultaneous measurement, on all channels, making the U8903B the ideal choice for multichannel systems such as 5.1 or 7.1 surround sound.

et 🚦				nalyzer	Analog A	
Func. Config	ON		Frequency 1.0000 kHz	Amplitude 1.0000 Vrms	Waveform Sine	AG2
	ON		Frequency 1.0000 kHz	Amplitude 1.0000 Vrms	Waveform Sine	AG2
Filters Config	ON	4.THD+N Level 2.3820 μV	3.THD+N Ratio -112.6 dB	^{2.Vac} 1.0260 V	1.Frequency 1.0000 kHz	AA1
Meas Config	ON	4.THD+N Level 2.2856 μV	3.THD+N Ratio -112.9 dB	^{2.Vac} 1.0196 V	1.Frequency 1.0000 kHz	AA2
	ON	4.THD+N Level 2.5063 μV	3.THD+N Ratio -112.2 dB	^{2.Vac} 1.0271 V	1.Frequency 1.0000 kHz	EAA.
Input Config	ON	4.THD+N Level 2.3843 μV	3.THD+N Ratio -112.6 dB	2.Vac 1.0198 V	1.Frequency 1.0000 kHz	AA4
Wav File	ON	4.THD+N Level 2.4823 μV	3.THD+N Ratio -112.3 dB	^{2.Vac} 1.0241 V	1.Frequency 1.0000 kHz	AA5
	ON	4.THD+N Level 2.4507 μV	3.THD+N Ratio -112.3 dB	^{2.Vac} 1.0202 V	1.Frequency 1.0000 kHz	AA6
Statistics	ON	4.THD+N Level 2.2467 μV	3.THD+N Ratio -113.2 dB	^{2.Vac} 1.0330 V	1.Frequency 1.0000 kHz	AA7
Track Channel None	ON	4.THD+N Level 2.9388 ⊔V	3.THD+N Ratio -110.8 dB	^{2.Vac} 1.0191 V	1.Frequency 1.0000 kHz	AAB

Figure 4. The U8903B's GUI, showing 8 analyzer channel measurements.

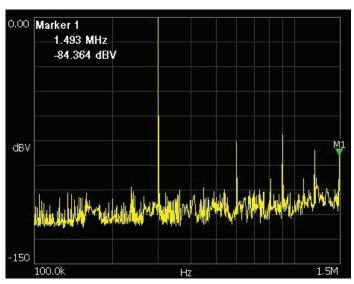


Figure 5. This screenshot shows an FFT plot of a 300 kHz source and the U8903B's unique ability to measure up the 5th harmonic with unprecedented resolution.

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.

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 works 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 3G and 4G/LTE mobile phone network equipment, VoIP phone and network equipment and HD voice test applications.

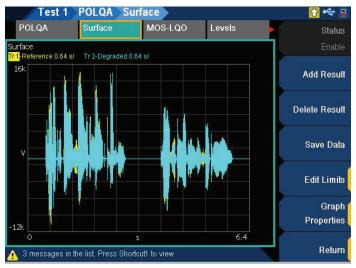


Figure 6. A graph comparison view between the Reference source file and Degraded file.

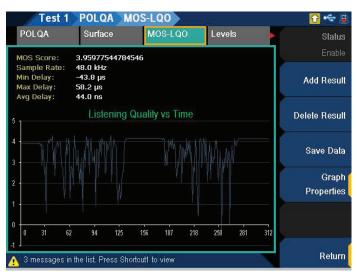


Figure 7. The MOS (Mean Opinion Score) scoring, indicating the rating of the DUT's voice quality.

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.

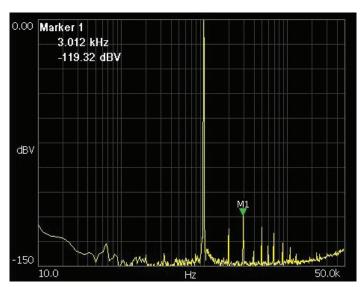


Figure 8. An FFT plot showing the residual distortion

Test sequence control

The built-in test sequencer allows users to create flexible and easy-to-use test sequences that automates testing and provides 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 as well as define Pass/Fail decisions, reducing test development time as well as 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 9. The test sequence control function comes with a selection of preconfigured measurements and 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 113. 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 in 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 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	
Power consumption	≤ 250 VA
Power requirements	100 to 240 V _{ac}
	47 to 63 Hz
Operating environment	Operating temperature from 0 to 55°C
	Relative humidity at 20% to 80% RH (non-condensing)
	Altitude up to 3000 m
	Pollution Degree 2
	Installation Category II
Storage compliance	-40 to 70°C
Safety compliance	IEC 61010-1/EN61010-1
	Canada: CAN/CSA-C22.2 No. 61010-1-12
	USA: ANSI/UL Std. No. 61010-1
EMC compliance	IEC 61326-1/EN 61326-1
	Canada: ICES/NMB-001
	Australia/New Zealand: AS/NZS CISPR11
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)
Weight	8.5 kg

1

Specifications and Features

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

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 $\Omega,$ 100 $\Omega,$ 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	
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	
5 Hz 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	
Crosstalk		

1. Includes contributions from Generator and Analyzer. Individual contributions are typically less than the values stated.

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)	\leq -95 dB (at 23 ±5°C)(typical), \leq -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 (20 Hz to 20 kHz)	≤ -106 dB at 1 V _{rms} (typical)	
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		
Туре	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 $V_{\rm rms}$ (Gaussian), 0 to 5 $V_{\rm rms}$ (Rectangular), 0 to 3.6 $V_{\rm rms}$ (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	
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 variab	ble phase, DC, and square
Output level	
Range	–11.3 to 11.3 V
Amplitude accuracy ¹	±1.5% (±250 mV to ±11.3 V)

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

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 mV _{rms} to 300 V _{rms} ³ (balanced)
Measurement range	$< 1 \mu V_{rms}^{4}$ 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 k Ω
CMRR	
≤ 20 kHz (input range ≤ 3.2 V)	≥ 80 dB ⁵ (typical)
≤ 20 kHz (input range > 3.2 V)	$\geq 50 \text{ dB}^5 \text{(typical)}$
Crosstalk	
≤ 20 kHz	\leq -140 dB + 0.1 μ V (typical)

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	$< 1 \mu V_{rms}$ to 140 V _{rms}
3 dB measurement bandwidth	Measurement bandwidth 96 kHz
Detection	RMS
Display resolution	% up to 3 decimal places (dB up to 2 decimal places)
Residual THD + N at 1 kHz, 1 V _{rms}	\leq -108 dB, <-110 dB (at 23 ±5°C) ² (typical)
(20 Hz to 20 kHz bandwidth)	\leq -100 dB (from 0 to 55°C)
Residual THD at 1 kHz, 1 V _{rms}	≤ –111 dB, ≤–116 dB (at 23 ±5°C) ² (typical)
(20 Hz to 20 kHz bandwidth)	≤ –103 dB (from 0 to 55°C)
Residual noise 20 Hz to 20 kHz bandwidth	≤ 1.3 μV _{rms}
SNR	• 1113
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	rms to the rms
Туре	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, 3.2V, 10V, 32V, 100V, 140V
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
< 96 kHz ¹	±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	6 digits
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)

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

(ES) Equipements Scientifiques SA - Département Tests & Mesures - 127 rue de Buzenval BP 26 - 92380 Garches Tél. 01 47 95 99 45 - Fax. 01 47 01 16 22 - e-mail: tem@es-france.com - Site Web: www.es-france.com

10

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

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

Sweep

Amplitude accuracy (flat top window)

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

±0.1 dB (±1.2%)

Bluetooth audio features

Bluetooth features				
Bluetooth core version	4.0, excluding Low Power E	nergy		
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 settin	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)

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

POLQA measurement, 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		

1. Auto select according to EUT.

Digital generator features¹

Frequency 51/2 to 0.45 sampling rate (Fs) Accuracy =10 pon Fatness =0.001 dB Residual ThO - N 4 -140 dB Square - Frequency range 51/2 to 0.45 Fs SMPTE IMD (1:1/4:1/10:1) - Frequency (LF) ton 4 0 to 500 Hz High frequency (LF) ton 2 to 6 0 Hz, or 0.45 Fs (Michever is lower] Mader atiol, E/HFR 10.1, 4.4, or -11 Sweep Upper frequency, Lew (To 6 0 Hz) PTO UEC 60118/LEC 60280 - Frequency 10 to 10 Hz, or 0.45 Fs (Michever is lower] Ot UEC 60118/LEC 60280 - Frequency 80 Hz to 2 Hz D'Ifference frequency 80 Hz to 2 Hz Ot per frequency 3 to 79 HHz, or 0.45 Fs (Michever is lower] Sweep Upper frequency, and amplitude Oto 11 Hz Advice Sweep Upper frequency, and amplitude Advice - Sweep Upper frequency, and amplitude Advice - Sweep Upper frequency, and amplitude	Sine, dual sine, and variable phase	
Acuaray 40 pm Flatnass 40 001 08 Raidual 1H0 + N 4.10.04 Square Frequency range Frequency range 5.12.10.045 Fs SMPTE IMD (1:1/4:1/10:1) Frequency (LF) tone Low (requency (LF) tone 4.00 to 500 Hz High frequency (LF) tone 4.00 to 500 Hz High frequency (LF) tone 2.00 KHz, or 0.45 Fs (whichever is lower) Sweep Upper frequency, lower frequency, and amplitude DFO (LEC 6018/LEC 6028) Frequency Frequency 80 Hz to 2.45 Fs (whichever is lower) Diger frequency 80 Hz to 2.45 Fs (whichever is lower) Deper frequency 80 Hz to 2.45 Fs (whichever is lower) Center frequency 80 Hz to 2.45 Fs (whichever is lower) Center frequency 80 Hz to 2.45 Fs (whichever is lower) Center frequency 80 to 2.45 Fs (whichever is lower) Store Upper frequency, Lower frequency, and amplitude Noise The store to 2.5 NoFs (whichever is lower) Store Upper frequency and amplitude, and phase data Frequency rate 5 NAB Frequency rate	Frequency	
Flamesis 4.0.001 dB Residual TND + N 4140 dB Square - Frequency range 5 Hz to 0.45 Fs SWFTE IMD (1:1/4:1/10:1) - Frequency (LF) tone 40 to 500 Hz High frequency (MF) tone 2 to 60 MHz, or 0.45 Fs (whichever is lower) Mixed ratio (LF) FP 10.1, 41, or 1.1 Sweep Upper frequency, lower frequency, and amplitude DF UIC 50118/LE 602680 - Frequency 00 Hz to 2 Hz Upper frequency 80 Hz to 2 KHz Upper frequency 8 to 80 Hz, or 0.45 Fs (whichever is lower) Center frequency 8 to 80 Hz, or 0.45 Fs (whichever is lower) Sweep Upper frequency, and amplitude Noise	Range	5 Hz to 0.45 sampling rate (Fs)
Residual THD - N 4 -140 dB Square Frequency range SMPTET IMD (1:1/4:1/10:1) Frequency (LF) tone Frequency (LF) tone 4 0 to 500 Hz Lew frequency (LF) tone 2 to 60 MHz, or 0.45 Fs (whichever is lower) Mixed ratio (LFHF) 101, 41, or 1.1 Sweep Upper frequency, lower frequency, and amplitude DFD (EC 60168/EFE Frequency Difference frequency 3 to 0 2 MHz Difference frequency 3 to 0 2 MHz Difference frequency 3 to 7 9 MHz, or 0.45 Fs (whichever is lower) Center frequency 3 to 7 9 MHz, or 0.45 Fs (whichever is lower) Center frequency 3 to 7 9 MHz, or 0.45 Fs (whichever is lower) Sweep Upper frequency, lower frequency, and amplitude Noise Trequency (Low 0 A5 Fs (whichever is lower) Sweep Upper frequency, lower frequency, and amplitude Noise Trequency (Low 0 A5 Fs (whichever is lower) Sweep Upper frequency (Low 0 A5 Fs (whichever is lower) Signal Determined by the user selected file File format WWE (wav) Maximum file size 5 0 MB	Accuracy	±10 ppm
Square Frequency Frequency 5 bit to 0.45 Fs Marter Mon (1114/4.710-1) Frequency Low frequency (LF) Ione 40 to 500 Hz High frequency (LF) Ione 2 to 60 kHz, or 0.45 Fs (whichever is lower) Mased rasio (LF.FF) 101, 41, or 1.1 Sweep Upper frequency, lower frequency, and amplitude DF (EC 60118/EC 60268) Frequency Frequency 50 kHz, or 0.45 Fs (whichever is lower) Ofference frequency 80 Hz to 2 kHz Upper frequency, lower frequency, and amplitude Frequency Sweep Upper frequency, and amplitude Ores Terquency 3 tr 80 kHz, or 0.45 Fs (whichever is lower) Sweep Upper frequency, lower frequency, and amplitude Noise Terquency 10 to 1 FFS Arbitray Verve Sweep Signal Determined by the user selected file File resolution 8, 16, or 24 bits Frequency range 2 hz to 0.45 Fs Multinoe File selected file Frequency rate 2 hz to 0.45 Fs Multion Signal	Flatness	±0.001 dB
Frequency5 Hz to 0.45 FsSMPTE IND (1:1/4:1/10:1)Frequency (LF) tone40 to 500 HzHigh frequency (LF) tone40 to 500 HzMigh frequency (LF) tone40 to 500 HzMigh frequency (LF) tone2 to 50 KHz, or 0.45 Fs (whichever is lower)Migh frequency (LF) toneMigh frequency (LF) toneSweepUpper frequency, and ampiltudeDFI (EC 6018/LEC 60268)Frequency80 Hz to 2 KHzO 40 to 2 kHZA 40 to 2 kHZA 10 to 40 kG kA 10 to 40 kG kO 40 to 40 kG kO 40 to 40 kG kGSequen	Residual THD + N	≤ -140 dB
SMPTE IMD (F1/43.1/10:1) Frequency Low frequency (LF) tone 40 to 500 Hz High frequency (LF) 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 DFG (EC 6018/EC 60268) Frequency Ifference frequency 80 Hz to 2 kHz Upper frequency 3 to 80 kHz, or 0.45 Fs (whichever is lower) Sweep Upper frequency, and amplitude Noise	Square	
Frequency Frequency LFJ tone 40 to 500 Hz Law frequency LFJ tone 2 to 60 kHz, or 0.45 Fs (whichever is lawer) Mixed ratio (LF.HF) 10:1, 4.1, or 1.1 Sweep Upper frequency, lower frequency, and ampiltude DFD (LEC 60268)	Frequency range	5 Hz to 0.45 Fs
Low frequency (FF) tone40 to 500 HzHigh requency (FF) tone2 to 60 kHz, or 0.45 Fs (whichever is lower)Miked ratio (CHPH)101, 41, or 11SweepUpper frequency, lower frequency, and amplitudeDFO tice 60118/TEC 60268)FereuencyFrequency80 Hz to 2 kHzDifference frequency80 Hz to 2 kHzUpper frequency3 to 80 kHz, or 0.45 Fs (whichever is lower)Center frequency3 to 78 kHz, or 0.45 Fs (whichever is lower)SweepUpper frequency, lower frequency, and amplitudeNoiseTo 73 kHz, or 0.45 Fs (whichever is lower)SweepUpper frequency, lower frequency, and amplitudeNoiseTo 78 kHz, or 0.45 Fs (whichever is lower)SynepRectangular, Gaussian, Triangular, and PinkAmplitude0 to 1 FFSArbitraryStandall, Gaussian, Triangular, and PinkFile formatWAVE (wav)Maximum file size5.0 MBFile resolution8, 16, or 24 bitsFrequency range2 Hz to 0.45 FsMultitonSignalSinglandDetermined by the user specified frequency, amplitude, and phase data.Frequency rate2 cycles to 65535 cyclesBurst on to burst off ratio0 to 100%Maximum number of tones64Singles/step1 to 2558Constant valueTo 2268 to 65535 cyclesBurst on to burst off ratio1 to 85535Constant valueTo 2575Constant valueTo 2575Constant value1 to 65535Constant valueTo	SMPTE IMD (1:1/4:1/10:1)	
High frequency (HF) tone 2 to 60 kHz, or 0.45 Fs (whichever is lower) Mixed ratio (LFHP) 10.1, 41, or 1.1 Sweep Upper frequency, lower frequency, and amplitude DFD (EC 60118/IEC 60268) Frequency Upper frequency 3 to 80 kHz, or 0.45 Fs (whichever is lower) Center frequency 3 to 80 kHz, or 0.45 Fs (whichever is lower) Sweep Upper frequency, lower frequency, and amplitude Noise Value of the standard amplitude Type Rectangular, Gaussian, Triangular, and Pink Amplitude 0 to FS Arbitrary Sonal 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 Upper secoles 0.5535 cycles Signal Determined by the user specified frequency, amplitude, and phase data Frequency rate 2 Hz to 0.45 Fs Multitone Upper secoles 0.5535 cycles Burst on to burst off ratio 0 to 100% Maximum number of tones	Frequency	
Mixed ratio (LF.HF) 10.1, 41, or 1.1 Sweep Upper frequency, Lower frequency, and amplitude DFU (EC 60718/LEC 60268) Frequency Frequency 80 Hz to 2 kHz Difference 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, and amplitude Noise Type Type Rectangular, Gaussian, Triangular, and Pink Amplitude 0 to 1 FFS Arbitrary Signal Determined by the user selected file File romat 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 range 2 Hz to 0.45 Fs Multitone Sine burst Sine burst Cycles to 65535 cycles Burst on to burst off ratio 0 to 100% Montonicity Samples/step Samples/step 1 to 32	Low frequency (LF) tone	40 to 500 Hz
Sweep Upper frequency, lower frequency, and amplitude DFD (ICE 6018//EC 60268) Frequency Erequency 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 Amplitude 0 to 1 FFS Arbitrary Signal Elle format WAVE (rew) Maximum file size 5.0 MB Frequency rate 5.0 VB Verguency rate 5.0 VB Verguency rate 2.4 to 0.45 Fs Multitone 2 Signal Determined by the user specified frequency, amplitude, and phase data Frequency rate 2.4 to 0.45 Fs Multitone 2 Signal Determined by the user specified frequency, amplitude, and phase data Frequency rate 2.1 to 0.45 Fs Maximum number of tones 64 Sine burst 2 Period 2 cycles to 65535 cycles Burst on to burst off ratio	High frequency (HF) tone	2 to 60 kHz, or 0.45 Fs (whichever is lower)
DFD (IEC 60118/IEC 60268) International and the second	Mixed ratio (LF:HF)	10:1, 4:1, or 1:1
Frequency 80 Hz to 2 KHz Difference frequency 3 to 80 KHz, or 0.45 Fs (whichever is tower) Center frequency 3 to 79 KHz, or 0.45 Fs (whichever is tower) Sweep Upper frequency, lower frequency, and amplitude Noise T Type Rectangular, Gaussian, Triangular, and Pink Amplitude 0 to 1 FFS Arbitrary T Signal Determined by the user selected file File format WAVE (.wav) Maximum file size 5.0 MB File requency range 2 Hz to 0.45 Fs Multitone Signal Determined by the user selected file File requency, amplitude, and phase data 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 Signal Maximum number of tones 64 Signal Suest on to burst off ratio 0 to 100% Signal More to freatio 1 cycles to (65534 or period - 1, whichever is lower) Signal Burst on to burst off ratio <td< td=""><td>Sweep</td><td>Upper frequency, lower frequency, and amplitude</td></td<>	Sweep	Upper frequency, lower frequency, and amplitude
Difference frequency80 Hz to 2 kHzUpper frequency3 to 30 kHz, or 0.45 Fs (whichever is lower)Center frequency3 to 70 kHz, or 0.45 Fs (whichever is lower)SweepUpper frequency, lower frequency, and amplitudeNoiseTTypeRectangular, Gaussian, Triangular, and PinkAmplitude0 to 1 FFSArbitrarySignalSignalDetermined by the user selected fileFile formatWAVE (wav)Maximum file size5.0 MBFile resolution8, 16, or 24 bitsFrequency range2 Hz to 0.45 FsMuttoreSignalSignalDetermined by the user specified frequency, amplitude, and phase dataFrequency range2 Hz to 0.45 FsMuttoreSignalPeriod2 cycles to 65535 cyclesSine burstPeriodPeriod2 cycles to 65535 cyclesBurst on to burst off ratio1 to 22788Mutking one and walking zeroIto 65236Samples/step1 to 32788Muting one and walking zeroIto 6535 syclesConstant value-Amplitude-Amplitude-Defersion-Samples/step1 to 5536Differ-Confest-Differ-Differ-Differ-Differ-DistributionNone, triangular, or rectangular	DFD (IEC 60118/IEC 60268)	
Upper frequency3 to 80 kHz, or 0.45 Fs (whichever is lower)Center frequency3 to 79 kHz, or 0.45 Fs (whichever is lower)SweepUpper frequency, lower frequency, and amplitudeNoiseTypeTypeRectangular, Gaussian, Triangular, and PinkAmplitude0 to 1 FFSArbitraryTetermined by the user selected fileFile formatWAVE (wav)Maximum file size5.0 MBFile resolution8, 16, or 24 bitsFrequency range2 Hz to 0.45 FsMultitone2SignalDetermined by the user specified frequency, amplitude, and phase dataFrequency rate2 Hz to 0.45 FsMultitoneSignalSignalDetermined by the user specified frequency, amplitude, and phase dataFrequency rate2 Ly to 0.45 FsMaximum number of tones64Sine burstSice burstPeriod2 cycles to 65535 cyclesBurst on to burst off ratio0 to 100%MonotonicitySamples/stepSamples/step1 to 82768Walking one and walking zeroSamples/stepSamples/step1 to 85355Constant Value-1 FFS to 1 FFSDC offset-1 FFS to 1 FFSDitherDither oneDistributionNone, triangular, or rectangular	Frequency	
Center frequency 3 to 79 kHz, or 0.45 Fs (whichever is lower) Sweep Upper frequency, lower frequency, and amplitude Noise T Type Rectangular, Gaussian, Triangular, and Pink Amplitude 0 to 1 FFS Arbitrary Signal File format WAVE (waw) Maximum file size 5.0 MB File format WAVE (waw) 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 Sine burst Site burst Period 2 cycles to 65535 cycles Burst on 1 cycles to (65534 or period – 1, whichever is lower) Burst on 1 cycles to (65534 or period – 1, whichever is lower) Samples/step 1 to 32768 Walking one and walking zero Samples/step Samples/step 1 to 65355 Constant value Amplitude Anplitude -1 FFS to 1 FFS<	Difference frequency	80 Hz to 2 kHz
Center frequency 3 to 79 kHz, or 0.45 Fs (whichever is lower) Sweep Upper frequency, lower frequency, and amplitude Noise T Type Rectangular, Gaussian, Triangular, and Pink Amplitude 0 to 1 FFS Arbitrary E Signal Determined by the user selected file File format WAVE (waw) Maximum file size 5.0 MB File resolution 8, 16, or 24 bits Frequency range 2 Hz to 0.45 Fs Multitone Utermined by the user specified frequency, amplitude, and phase data Frequency rate 2 Hz to 0.45 Fs Maximum number of tones 64 Sine burst Sto 100% Monotonicity Uto 100% Samples/step 1 to 32768 Walking one and walking zero Samples/step Samples/step 1 to 65355 Constant value -1 FFS to 1 FFS DC offset -1 FFS to 1 FFS DC offset -1 FFS to 1 FFS Dither Ditherust	Upper frequency	3 to 80 kHz, or 0.45 Fs (whichever is lower)
NoiseTypeRectangular, Gaussian, Triangular, and PinkAmplitude0 to 1 FFSArbitarySignalDetermined by the user selected fileFile formatWAVE (waw)Maximum file size5.0 MBFile resolution8, 16, or 24 bitsFrequency range2 Hz to 0.45 FsMultioneSignalDetermined by the user specified frequency, amplitude, and phase dataFrequency rate2 Hz to 0.45 FsMuttioneSignalDetermined by the user specified frequency, amplitude, and phase dataFrequency rate2 Hz to 0.45 FsMaximum number of tones64Sine burstPeriod2 cycles to 65535 cyclesBurst on to burst off ratio0 to 5535 cyclesBurst on to burst off ratio1 cycles to (65534 or period - 1, whichever is lower)Samples/step1 to 32768Wulking one and walking zeroSamples/step1 to 65335Constant valueDifferDifferDistributionNone, triangular, or rectangular	Center frequency	3 to 79 kHz, or 0.45 Fs (whichever is lower)
TypeRectangular, Gaussian, Triangular, and PinkAmplitude0 to 1 FFSArbitrarySignalDetermined by the user selected fileFile formatWAVE (wav)Maximum file size5.0 MBFile resolution8, 16, or 24 bitsFrequency range2 Hz to 0.45 FsMuttioneSignalDetermined by the user specified frequency, amplitude, and phase dataFrequency rate2 Hz to 0.45 FsMusimum number of tones64Sine burstPeriod2 cycles to 65535 cyclesBurst on to burst off ratio0 to 100%MontonicitySamples/step1 to 32768Walking one and walking zeroSamples/step1 to 65535Constant valueMutitude-1 FFS to 1 FFSDC offset-DistributionNone, triangular, or rectangular	Sweep	Upper frequency, lower frequency, and amplitude
Amplitude0 to 1 FFSAbitrarySignalDetermined by the user selected fileFile formatWAVE (wav)Maximum file size5.0 MBFile resolution8, 16, or 24 bitsFrequency range2 Hz to 0.45 FsMultitoneSignalSignalDetermined by the user specified frequency, amplitude, and phase dataFrequency rate2 Hz to 0.45 FsMuttioneSignalSignalDetermined by the user specified frequency, amplitude, and phase dataFrequency rate2 Hz to 0.45 FsMaximum number of tones64Sine burstSine burstPeriod2 cycles to 65535 cyclesBurst on1 cycles to (65534 or period - 1, whichever is lower)Burst on to burst off ratio0 to 100%MonotonicitySamples/stepSamples/step1 to 32768Walking one and walking zeroSamples/stepSamples/step1 to 65535Constant value-Amplitude-1 FFS to 1 FFSDC offset-Dc offset-Dither-DistributionNone, triangular, or rectangular	Noise	
ArbitrarySignalDetermined by the user selected fileFile formatWAVE (.wav)Maximur file size5.0 MBFile resolution8, 16, or 24 bitsFrequency range2 Hz to 0.45 FsMultitoneSignalDetermined by the user specified frequency, amplitude, and phase dataFrequency rate2 Hz to 0.45 FsMaximum number of tones64Sine burstPeriod2 cycles to 65535 cyclesBurst on1 cycles to (65534 or period – 1, whichever is lower)Burst on to burst off ratio0 to 100%MontonicitySamples/step1 to 32768Walking one and walking zeroSamples/step1 to 65335Ordstart valueAmplitude-1 FFS to 1 FFSDC offset-1 FFS to 1 FFSDitherDither user or extangular	Туре	Rectangular, Gaussian, Triangular, and Pink
SignalDetermined by the user selected fileFile formatWAVE (.wav)Maximum file size5.0 MBFile resolution8.16, or 24 bitsFrequency range2 Hz to 0.45 FsMultitoneSignalSignalDetermined by the user specified frequency, amplitude, and phase dataFrequency rate2 Hz to 0.45 FsMaximum number of tones64Sine burstPeriod2 cycles to 65535 cyclesBurst on1 cycles to (65534 or period – 1, whichever is lower)Burst on to burst off ratio0 to 100%MontonicitySamples/step1 to 32768Valking one and walking zeroSamples/step1 to 65535Or offset-DC offset-1 FFS to 1 FFSDC offset-1 FFS to 1 FFSDC offset-1 FFS to 1 FFSDC offset-1 FFS to 1 FFSDitterUser on cycles on one cycle server on cycle server one cycle serv	Amplitude	
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 Signal Determined by the user specified frequency, amplitude, and phase data Frequency rate 2 Hz to 0.45 Fs Maximum number of tones 64 Sine burst Period Period 2 cycles to 65535 cycles Burst on 1 cycles to (65534 or period – 1, whichever is lower) Burst on to burst off ratio 0 to 100% Monotonicity Samples/step Samples/step 1 to 32768 Walking one and walking zero I to 65535 Constant value -1 FFS to 1 FFS DC offset -1 FFS to 1 FFS DC offset -1 FFS to 1 FFS Ditter U Distribution None, triangular, or rectangular	Arbitrary	
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 selected file
File resolution 8, 16, or 24 bits Frequency range 2 Hz to 0.45 Fs Multitone Environment of the user specified frequency, amplitude, and phase data Frequency rate 2 Hz to 0.45 Fs Maximum number of tones 64 Sine burst Environment of tones Period 2 cycles to 65535 cycles Burst on 1 cycles to (65534 or period – 1, whichever is lower) Burst on to burst off ratio 0 to 100% Monotonicity Ito 32768 Samples/step 1 to 65535 Constant value Ito 65535 DC offset Ito 01 FS DC offset Ito 14 FS DC offset Ito 14 FS Dither Ito 14 FS	File format	WAVE (.wav)
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 Sine burst Period Period 2 cycles to 65535 cycles Burst on 1 cycles to 65534 or period – 1, whichever is lower) Burst on to burst off ratio 0 to 100% Monotonicity Valking one and walking zero Samples/step 1 to 65535 Constant value Amplitude DC offset - DC offset - DC offset - Distribution None, triangular, or rectangular	Maximum file size	5.0 MB
MultitoneSignalDetermined by the user specified frequency, amplitude, and phase dataFrequency rate2 Hz to 0.45 FsMaximum number of tones64Sine burstPeriod2 cycles to 65535 cyclesBurst on1 cycles to (65534 or period – 1, whichever is lower)Burst on to burst off ratio0 to 100%MonotonicityUSamples/step1 to 32768Walking one and walking zeroUSamples/step1 to 65535Ocnstant valueI to 5535DC offsetIDC offset-1 FFS to 1 FFSDitherUDistributionNone, triangular, or rectangular	File resolution	8, 16, or 24 bits
SignalDetermined by the user specified frequency, amplitude, and phase dataFrequency rate2 Hz to 0.45 FsMaximum number of tones64Sine burstPeriod2 cycles to 65535 cyclesBurst on1 cycles to (65534 or period – 1, whichever is lower)Burst on to burst off ratio0 to 100%MonotonicityVSamples/step1 to 32768Walking one and walking zeroVSamples/step1 to 65535Do constant value-1 FFS to 1 FFSDC offset-1 FFS to 1 FFSDC offset-1 FFS to 1 FFSDither-1 FFS to 1 FFSDitherNone, triangular, or rectangular	Frequency range	2 Hz to 0.45 Fs
Frequency rate2 Hz to 0.45 FsMaximum number of tones64Sine burstPeriod2 cycles to 65535 cyclesBurst on1 cycles to (65534 or period – 1, whichever is lower)Burst on to burst off ratio0 to 100%MonotonicitySamples/step1 to 32768Walking one and walking zeroSamples/step1 to 65535Constant valueAmplitude-1 FFS to 1 FFSDC offsetDC offsetDistributionNone, triangular, or rectangular	Multitone	
Maximum number of tones64Sine burstPeriod2 cycles to 65535 cyclesBurst on1 cycles to (65534 or period – 1, whichever is lower)Burst on to burst off ratio0 to 100%MonotonicitySamples/step1 to 32768Walking one and walking zeroSamples/step1 to 65535Constant valueAmplitude-1 FFS to 1 FFSDC offsetDC offsetDC offsetDitherDistributionNone, triangular, or rectangular	Signal	Determined by the user specified frequency, amplitude, and phase data
Sine burstPeriod2 cycles to 65535 cyclesBurst on1 cycles to (65534 or period – 1, whichever is lower)Burst on to burst off ratio0 to 100%MonotonicitySamples/step1 to 32768Walking one and walking zeroSamples/step1 to 65535Constant valueAmplitude-1 FFS to 1 FFSDC offsetDC offset-1 FFS to 1 FFSDitherDistributionNone, triangular, or rectangular	Frequency rate	2 Hz to 0.45 Fs
Period2 cycles to 65535 cyclesBurst on1 cycles to (65534 or period – 1, whichever is lower)Burst on to burst off ratio0 to 100%MonotonicitySamples/step1 to 32768Walking one and walking zeroSamples/step1 to 65535Constant valueAmplitude-1 FFS to 1 FFSDC offsetDC offset-1 FFS to 1 FFSDitherDistributionNone, triangular, or rectangular	Maximum number of tones	64
Burst on1 cycles to (65534 or period – 1, whichever is lower)Burst on to burst off ratio0 to 100%MonotonicityIto 32768Samples/step1 to 32768Walking one and walking zeroIto 65535Constant valueIto 65535Constant valueIto 1 FFS to 1 FFSDC offsetIto 1 FFS to 1 FFSDC offsetIto 1 FFS to 1 FFSDitherIto 1 FFS to 1 FFSDistributionNone, triangular, or rectangular	Sine burst	
Burst on to burst off ratio0 to 100%MonotonicitySamples/step1 to 32768Walking one and walking zeroSamples/step1 to 65535Constant valueAmplitude-1 FFS to 1 FFSDC offsetDC offset-1 FFS to 1 FFSDitherDistributionNone, triangular, or rectangular	Period	2 cycles to 65535 cycles
MonotonicitySamples/step1 to 32768Walking one and walking zeroSamples/step1 to 65535Constant valueAmplitude-1 FFS to 1 FFSDC offsetDC offsetDC offsetDitherDistributionNone, triangular, or rectangular	Burst on	1 cycles to (65534 or period – 1, whichever is lower)
Samples/step1 to 32768Walking one and walking zeroSamples/step1 to 65535Constant value1 to 65535Constant value-1 FFS to 1 FFSAmplitude-1 FFS to 1 FFSDC offset-1 FFS to 1 FFSDC offset-1 FFS to 1 FFSDither-1 FFS to 1 FFSDistributionNone, triangular, or rectangular	Burst on to burst off ratio	0 to 100%
Walking one and walking zeroSamples/step1 to 65535Constant value-1 FFS to 1 FFSAmplitude-1 FFS to 1 FFSDC offset-1 FFS to 1 FFSDC offset-1 FFS to 1 FFSDither-1 FFS to 1 FFSDistributionNone, triangular, or rectangular	Monotonicity	
Walking one and walking zeroSamples/step1 to 65535Constant value-1 FFS to 1 FFSAmplitude-1 FFS to 1 FFSDC offset-1 FFS to 1 FFSDC offset-1 FFS to 1 FFSDither-1 FFS to 1 FFSDistributionNone, triangular, or rectangular	Samples/step	1 to 32768
Samples/step1 to 65535Constant value-1 FFS to 1 FFSAmplitude-1 FFS to 1 FFSDC offset-1 FFS to 1 FFSDC offset-1 FFS to 1 FFSDither-1 FFS to 1 FFSDistributionNone, triangular, or rectangular		
Constant value Amplitude -1 FFS to 1 FFS DC offset -1 FFS to 1 FFS DC offset -1 FFS to 1 FFS Dither -1 FFS to 1 FFS Distribution None, triangular, or rectangular	Samples/step	1 to 65535
Amplitude -1 FFS to 1 FFS DC offset -1 FFS to 1 FFS DC offset -1 FFS to 1 FFS Dither -1 FFS to 1 restangular, or rectangular		
DC offset DC offset -1 FFS to 1 FFS Dither Distribution None, triangular, or rectangular		-1 FFS to 1 FFS
DC offset -1 FFS to 1 FFS Dither Distribution None, triangular, or rectangular		
Dither Distribution None, triangular, or rectangular		-1 FFS to 1 FFS
Distribution None, triangular, or rectangular		
		None, triangular, or rectangular

1. Digital generator specifications refer to 24 bits FFS.

AES3/SPDIF interface features

BalancedXLR (transformer coupling)UnbalancedBNC (grounded)OpticalCollUNK connectorOutput impedance10.0Unbalanced75 QOutput levelBalanced0.3 to 5.1 V _{po} Unbalanced0.3 to 5.1 V _{po} Unbalanced0.3 to 5.2 S V _{po} Sampling rate28 to 192 kHzSampling rate accuracy45 ppmOutput level accuracy41 dB (typical), ±1.5 dBAudio bit8 bits to 24 bitsInherent jitter (typical)41 nsBalanced4.15 nsOptical5 nsCock and gro4.5 ppmCock and gro4.5 ppmCock and gro4.5 ppmInherent jitter (typical)4.5 ppmInherent jitter4.5 ppmCock and gro4.5 ppmInherent jitter5 ppmInherent jitter4.1 pp (spical)Syn clock rate1.9 kHzAccuracy4.5 ppmInherent jitter4.1 ns (typical)Syn clock rate5.0 QOutput level3.3 V (LVCMOS 10 standard)Output typeBit clock (128 Fs)Protesional or consumer (all applicable bits are editable for advanced settings)Protesional or consumerFormatUse bitsSet or cleared	Output specifications	
Unbalanced BNC (grounded) Optical TOSLINK connector Output impedance 110 Ω Unbalanced 75 Ω Output level 10 Ω Unbalanced 0.3 to 5.1 V _{sp} Unbalanced 0.3 to 2.5 V _{sn} Sampling rate 28 to 192 kHz Sampling rate accuracy 45 ppm Output level accuracy 41 dB (typical), ±1.5 dB Audio bit 8 bits to 24 bits Inherent jitter (typical) 41 dB (typical), ±1.5 dB Audio bit 8 bits to 24 bits Unbalanced 4.1.5 ns Unbalanced 4.1.5 ns Unbalanced 4.1.5 ns Optical 4.5 ns Clock and sync 100 Clock and sync 110 (typical) Clock and sync 110 (typical) Inherent jitter 4.1 s ns Maximum clock rate 192 kHz Accuracy 4.5 ppm Inherent jitter 4.1 ns (typical) Sync olock output 2 <n ns<="" td=""> Concetor type 5.0 pin m</n>	Output connector type	
Optical TOSLINK connector Output impedance Balanced Balanced 110 0 Unbalanced 75 0 Output level Balanced Balanced 0.3 to 5.1 V _{pp} Balanced 0.3 to 5.2 V _{pp} Balanced 0.3 to 2.5 V _{pp} Unbalanced 0.3 to 2.5 V _{pp} Sampling rate 2.8 to 192 kHz Sampling rate accuracy ±5 ppm Output level accuracy ±1 dB (typical), ±1.5 dB Audio bit 8 bits to 24 bits Inherent jitter (typical) Balanced Voltat level accuracy ±1.5 ns Optical ≤ 5 ns Clock and sync Inherent jitter Vankimum clock rate 192 kHz Accuracy ±5 ppm Inherent jitter ≤ 1 ns (typical) Sync clock output Sppm Connector type 25-pin male D-SUB connector pin-1 Impedance 50 Ω Output level 3.3 V (UKMOS IO standard) Polator Soutput level Output type Bit clock (128 Fs) Proteol Charne	Balanced	XLR (transformer coupling)
Output impedance Balanced 110 Ω Unbalanced 75 Ω Output level 0 Balanced 0.3 to 5.1 V _{pp} Unbalanced 0.3 to 5.2 V _{pc} Sampling rate 28 to 192 kHz Sampling rate accuracy 45 ppm Output level accuracy 410 fk (yrical), ±1.5 dB Audio bit 8 bits to 24 bits Inherent jiter (typical) 10 fk (yrical), ±1.5 dB Audio bit 8 bits to 24 bits Inherent jiter (typical) 10 fk (yrical), ±1.5 dB Unbalanced 4.15 ns Unbalanced 4.15 ns Optical 4.5 ns Clock and sync 10 fk (yrical) Internal master clock 10 fk (yrical) Maximum clock rate 192 kHz Accuracy ±5 ppm Inherent jitter ±1 ns (typical) Inherent jitter ±1 ns (typical) Inherent jitter ±3 ns (typical) Output level 3.3 v (UVCMOS IO standard) Polacity type Sone cloce uput Inherenti	Unbalanced	BNC (grounded)
Balanced10 QUnbalanced75 QOutput levelBalanced0.3 to 2.5 V _{po} Sampling rate28 to 192 kHzSampling rate accuracy±5 ppmOutput level accuracy±1 dB (typical), ±1.5 dBAudio bit8 bits to 24 bitsInherent jitter (typical)±1 5 nsBalanced≤1.5 nsOptical≤5 nsClock and sync±5 ppmKarlanced192 kHzAccuracy±1.5 nsOptical≤5 nsClock and sync±5 ppmClock and sync±5 ppmClock and sync±5 ppmClock and sync±5 ppmInherent jitter192 kHzAccuracy±5 ppmInherent jitters formatSync Ock output±5 ppmConnector type50 QOutput level3.3 V (LVCMOS IO standard)PolarityNormal or invertOutput typeBit clock (128 Fs)ProteotFrofessional or consumer (all applicable bits are editable for advanced settings)FormatProfessional or consumerUse bitsSet or cleared	Optical	TOSLINK connector
Unbalanced 75 Ω Output level Balanced 0.3 to 5.1 V _{pp} Balanced 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 Inherent jitter (typical) Balanced ≤1.5 ns Inherent jitter (typical) Balanced ≤1.5 ns Inherent jitter (typical) Balanced ≤1.5 ns Cock and sync Clock and sync Spm Inherent jitter (typical) Maximum clock rate 192 kHz Spm Accuracy ±5 ppm Inherent jitter Sync clock output Sp pm Spm Connector type 25-pin male D-SUB connector pin-1 Impedance Impedance 50 Ω Output level 3.3 V (LVCMOS IO standard) Polarity Normal or invert Output level Si conscion or consumer (all applicable bits are editable for advanced settings) Fortact Verticesional or consumer Consumer (all applicable bits are editable for advanced settings)	Output impedance	
Output levelBalanced0.3 to 5.1 V _{pp} Balanced0.3 to 5.5 V _{pp} Sampling rate28 to 192 kHzSampling rate accuracy45 ppmOutput level accuracy41 dB (typical), ±1.5 dBAudio bit8 bits to 24 bitsInherent jiter (typical)8 bits to 24 bitsBalanced4.1.5 nsUnbalanced4.1.5 nsOptical2.5 nsClock and sync192 kHzKarimu nclock rate192 kHzAccuracy4.5 ppmInherent jiter (typical)1 ns (typical)Sync lock autput25-pin male D-SUB connector pin-1Inherent jiter3.3 V (LVCMOS IO standard)Polatol3.3 V (LVCMOS IO standard)Polatol8 tick (128 Fis)ProtocolChannel status bitsProfessional or consumer (all applicable bits are editable for advanced settings)FormatProfessional or consumerUser bitsSet or cleared	Balanced	110 Ω
Balanced0.3 to 5.1 V _{pp} Unbalanced0.3 to 2.5 V _{pp} Sampling rate28 to 192 kHzSampling rate accuracy45 ppmOutput level accuracy41 dB (typical), ±1.5 dBAudio bit8 bits to 24 bitsIharent jitter (typical)41 DS (Social Social	Unbalanced	75 Ω
Image: DescriptionUnbalanced0.3 to 2.5 V_{go}^{0} Sampling rate28 to 192 kHzSampling rate accuracy±5 ppmOutput level accuracy±1 dB (typical), ±1.5 dBAudio bit8 bits to 24 bitsInherent jitter (typical)Balanced≤ 1.5 nsUnbalanced≤ 1.5 nsOptical≤ 5 nsClock and syncInternal master clockMaximum clock rate192 kHzAccuracy±5 ppmInherent jitterSync clock outputConnector type25-pin male D-SUB connector pin-1Impedance50 QOutput level3.3 V (LVCMOS IO standard)PolarityNormal or invertOutput typeBit clock (128 Fs)ProtecolFordessional or consumer (all applicable bits are editable for advanced settings)FormatProfessional or consumerUser bitsSet or cleared	Output level	
Sampling rate28 to 192 kHzSampling rate accuracy±5 ppmOutput level accuracy±1 dB (typical), ±1.5 dBAudio bit8 bits to 24 bitsInherent jitter (typical)8 bits to 24 bitsBalanced≤ 1.5 nsUnbalanced≤ 1.5 nsOptical≤ 5 nsClock and syncClock and syncInternal master clock192 kHzMaximum clock rate192 kHzAccuracy±5 ppmInherent jitter≤ 1 ns (typical)Sync clock output50 nConnector type25-pin male D-SUB connector pin-1Impedance50 nOutput level3.3 V (LVCMOS IO standard)PolarityMard or invertOutput typeBit clock (128 Fs)ProtoolForesional or consumer (all applicable bits are editable for advanced settings)FormatProfessional or consumerUser bitsSet or cleared	Balanced	0.3 to 5.1 V _{pp}
Sampling rate accuracy ±5 ppm Output level accuracy ±1 dB (typical), ±1.5 dB Audio bit 8 bits to 24 bits Inherent jitter (typical) Balanced 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 Sona Clock output Connector type 25-pin male D-SUB connector pin-1 Impedance 50 Q Output level 3.3 V (LVCMOS IO standard) Polarity Normal or invert Output type Bit clock (128 Fs) Protocol Ensignal or consumer (all applicable bits are editable for advanced settings) Format Professional or consumer User bits Set or cleared	Unbalanced	0.3 to 2.5 V _{pp}
Output level accuracy±1 dB (typical), ±1.5 dBAudio bit8 bits to 24 bitsInherent jitter (typical)Balanced≤ 1.5 nsUnbalanced≤ 1.5 nsOptical≤ 5 nsClock and syncInternal master clockMaximur clock rate192 kHzAccuracy±5 ppmInherent jitter≤ 1 ns (typical)Sync clock outputConnector type25-pin male D-SUB connector pin-1Impedance50 QOutput level3.3 V (LVCMOS IO standard)PolarityNormal or invertOutput typeBit clock (128 Fs)ProtocolForessional or consumer (all applicable bits are editable for advanced settings)FormatProfessional or consumerUser bitsSet or cleared	Sampling rate	28 to 192 kHz
Audio bit8 bits to 24 bitsInherent jitter (typical)Balanced≤ 1.5 nsUnbalanced≤ 1.5 nsOptical≤ 5 nsClock and syncInternal master clockMaximum clock rate192 kHzAccuracy±5 ppmInherent jitter≤ 1 ns (typical)Sync clock outputConnector type25-pin male D-SUB connector pin-1Impedance50 ΩOutput level3.3 V (LVCMOS IO standard)PolarityNormal or invertOutput typeBit clock (128 Fs)ProtocolProfessional or consumer (all applicable bits are editable for advanced settings)FormatProfessional or consumerUser bitsSet or cleared	Sampling rate accuracy	±5 ppm
Inherent jitter (typical) 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 male D-SUB connector pin-1 Impedance 50 Q 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	Output level accuracy	±1 dB (typical), ±1.5 dB
Balanced≤ 1.5 nsUnbalanced≤ 5 nsOptical≤ 5 nsClock and syncInternal master clockMaximum clock rate192 kHzAccuracy±5 ppm±5 ppm100 clock outputSync clock output25-pin male D-SUB connector pin-1Impedance50 ΩOutput level3.3 V (LVCMOS 10 standard)PolarityNormal or invertOutput typeBit clock (128 Fs)ProtocolProfessional or consumer (all applicable bits are editable for advanced settings)FormatProfessional or consumerUser bitsSet or cleared	Audio bit	8 bits to 24 bits
Ubalanced ≤ 1.5 ns Optical ≤ 5 ns Clock and sync Internal master clock Internal master clock 192 kHz Accuracy ±5 ppm Inherent jitter ≤ 1 ns (typical) Sync clock output 25-pin male 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 V Channel status bits Professional or consumer (all applicable bits are editable for advanced settings) Format Professional or consumer User bits Set or cleared	Inherent jitter (typical)	
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 25-pin male 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	Balanced	≤ 1.5 ns
Clock and sync Internal master clock Maximum clock rate 192 kHz Accuracy ±5 ppm Inherent jitter ≤ 1 ns (typical) Sync clock output 25-pin male D-SUB connector pin-1 Connector type 25-pin male 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 Verticessional or consumer (all applicable bits are editable for advanced settings) Format Professional or consumer User bits Set or cleared	Unbalanced	≤ 1.5 ns
Internal master clock Maximum clock rate 192 kHz Accuracy ±5 ppm Inherent jitter ≤ 1 ns (typical) Sync clock output 25-pin male D-SUB connector pin-1 Connector type 25-pin male 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 Professional or consumer (all applicable bits are editable for advanced settings) Format Professional or consumer User bits Set or cleared	Optical	≤ 5 ns
Maximum clock rate192 kHzAccuracy±5 ppmInherent jitter≤ 1 ns (typical)Sync clock output25-pin male D-SUB connector pin-1Connector type25-pin male D-SUB connector pin-1Impedance50 ΩOutput level3.3 V (LVCMOS IO standard)PolarityNormal or invertOutput typeBit clock (128 Fs)ProtocolProfessional or consumer (all applicable bits are editable for advanced settings)FormatProfessional or consumerUser bitsSet or cleared	Clock and sync	
Accuracy±5 ppmInherent jitter≤ 1 ns (typical)Sync clock outputSync clock outputConnector type25-pin male D-SUB connector pin-1Impedance50 ΩOutput level3.3 V (LVCMOS IO standard)PolarityNormal or invertOutput typeBit clock (128 Fs)ProtocolProfessional or consumer (all applicable bits are editable for advanced settings)FormatProfessional or consumerUser bitsSet or cleared	Internal master clock	
Inherent jitter ≤ 1 ns (typical) Sync clock output 25-pin male D-SUB connector pin-1 Connector type 25-pin male 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 Professional or consumer (all applicable bits are editable for advanced settings) Format Professional or consumer User bits Set or cleared	Maximum clock rate	192 kHz
Sync clock outputConnector type25-pin male D-SUB connector pin-1Impedance50 ΩOutput level3.3 V (LVCMOS IO standard)PolarityNormal or invertOutput typeBit clock (128 Fs)ProtocolProfessional or consumer (all applicable bits are editable for advanced settings)FormatProfessional or consumerUser bitsSet or cleared	Accuracy	±5 ppm
Connector type25-pin male D-SUB connector pin-1Impedance50 ΩOutput level3.3 V (LVCMOS IO standard)PolarityNormal or invertOutput typeBit clock (128 Fs)ProtocolChannel status bitsProfessional or consumer (all applicable bits are editable for advanced settings)FormatProfessional or consumerUser bitsSet or cleared	Inherent jitter	≤ 1 ns (typical)
Impedance50 ΩOutput level3.3 V (LVCMOS IO standard)PolarityNormal or invertOutput typeBit clock (128 Fs)ProtocolChannel status bitsProfessional or consumer (all applicable bits are editable for advanced settings)FormatProfessional or consumerUser bitsSet or cleared	Sync clock output	
Output level3.3 V (LVCMOS IO standard)PolarityNormal or invertOutput typeBit clock (128 Fs)ProtocolProfessional or consumer (all applicable bits are editable for advanced settings)FormatProfessional or consumerUser bitsSet or cleared	Connector type	25-pin male D-SUB connector pin-1
Polarity Normal or invert Output type Bit clock (128 Fs) Protocol Professional or consumer (all applicable bits are editable for advanced settings) Format Professional or consumer User bits Set or cleared	Impedance	50 Ω
Output type Bit clock (128 Fs) Protocol Professional or consumer (all applicable bits are editable for advanced settings) Format Professional or consumer User bits Set or cleared	Output level	3.3 V (LVCMOS IO standard)
Protocol Channel status bits Professional or consumer (all applicable bits are editable for advanced settings) Format Professional or consumer User bits Set or cleared	Polarity	Normal or invert
Channel status bitsProfessional or consumer (all applicable bits are editable for advanced settings)FormatProfessional or consumerUser bitsSet or cleared	Output type	Bit clock (128 Fs)
Format Professional or consumer User bits Set or cleared	Protocol	
User bits Set or cleared	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	Validity flag	Set or cleared

DSI features

Output features	
Output connector type	25-pin male D-SUB connector
	25-pin female 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 ² S, 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 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

AC level range< -120 to 0 dBFS	
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 Frequency Range 5 Hz to 0.45 Fs Accuracy ±5 ppm (10 Hz to 0.45 Fs) Phase	
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 Range 5 Hz to 0.45 Fs Accuracy ±5 ppm (10 Hz to 0.45 Fs) Phase ±0.005° Resolution ±0.001° THD+N ±0.001°	
AC flatness±0.001 dB (10 Hz to 0.45 Fs)Unit (reference)FFS, %FS, V, dBFS, LSB, dBr, dBu, dBV, Hex, Dec, and xFrequencyFrequencyRange5 Hz to 0.45 FsAccuracy±5 ppm (10 Hz to 0.45 Fs)Phase±0.005°Accuracy±0.001°THD+N±0.001°	
Unit (reference)FFS, %FS, V, dBFS, LSB, dBr, dBu, dBV, Hex, Dec, and xFrequencyRange5 Hz to 0.45 FsAccuracy±5 ppm (10 Hz to 0.45 Fs)PhaseAccuracy±0.005°Resolution±0.001°THD+N	
FrequencyRange5 Hz to 0.45 FsAccuracy±5 ppm (10 Hz to 0.45 Fs)PhaseAccuracy±0.005°Resolution±0.001°THD+N	
Range 5 Hz to 0.45 Fs Accuracy ±5 ppm (10 Hz to 0.45 Fs) Phase ±0.005° Accuracy ±0.001° THD+N End (10 Hz to 0.45 Fs)	
Accuracy ±5 ppm (10 Hz to 0.45 Fs) Phase ±0.005° Accuracy ±0.001° THD+N Endote	
Phase Accuracy ±0.005° Resolution ±0.001° THD+N	
Accuracy±0.005°Resolution±0.001°THD+NImage: Constraint of the second s	
Resolution ±0.001° THD+N	
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 frequency2 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

Input specifications	
Input connector type	
Balanced	XLR (transformer coupling)
Unbalanced	BNC (grounded)
Optical	TOSLINK connector
Input impedance	
Balanced	110 Ω or high impedance (> 2 k Ω)
Unbalanced	75 Ω or high impedance (20 k Ω 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
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 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

Input specifications		
Input connector type	25-pin male D-SUB connector	
	25-pin female 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 ² S, 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 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

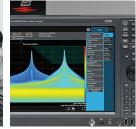
Product model	Description	
U8903B-STD	Performance audio analyzer, 2 channels	
Standard shipped accessories	USB cables	
	Power cord	
	Keysight U8903B audio analyzer product reference CD-ROM	
	Certificate of calibration	
Measurement channel options		
U8903B-AN4	Analog analyzer, 4 channels	
U8903B-AN8	Analog analyzer, 8 channels	
U8903B-DGT	Digital audio card	
Bluetooth option		
U8903B-BLU	Bluetooth card	
U8903B-BL2	Bluetooth card, secondary option slot	
Bundling options		
U8903B-201	Performance audio analyzer with 4 analog analyzer channel, digital audio	
	(AES3/SPDIF and DSI digital audio)	
U8903B-209	Performance audio analyzer; 2 channels with 50 ohm impedance	
U8903B-210	Performance audio analyzer with 4 analog analyzer channel, digital audio (AES3/SPDIF and DSI digital audio) and <i>Bluetooth</i>	
U8903B-211	Performance audio analyzer; 2 channels with 50 ohm impedance and Bluetooth	
U8903B-212	Performance audio analyzer; 96 kHz bandwidth, 2 channels with 50 ohm impedance	
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	
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	

1

Evolving Since 1939

Our unique combination of hardware, software, services, and people can help you reach your next breakthrough. We are unlocking the future of technology. From Hewlett-Packard to Agilent to Keysight.







myKeysight

myKeysight

www.keysight.com/find/mykeysight A personalized view into the information most relevant to you.

http://www.keysight.com/find/emt_product_registration

Register your products to get up-to-date product information and find warranty information.

KEYSIGHT SERVICES Accelerate Technology Adoption.

Keysight Services www.keysight.com/find/service

Keysight Services can help from acquisition to renewal across your instrument's lifecycle. Our comprehensive service offerings—one-stop calibration, repair, asset management, technology refresh, consulting, training and more—helps you improve product quality and lower costs.



Keysight Assurance Plans

www.keysight.com/find/AssurancePlans

Up to ten years of protection and no budgetary surprises to ensure your instruments are operating to specification, so you can rely on accurate measurements.

Keysight Channel Partners

www.keysight.com/find/channelpartners

Get the best of both worlds: Keysight's measurement expertise and product breadth, combined with channel partner convenience.

Bluetooth and the *Bluetooth* logos are trademarks owned by *Bluetooth* SIG, Inc., U.S.A. and licensed to Keysight Technologies, Inc.

www.keysight.com/find/U8903B

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: www.keysight.com/find/contactus

Americas

Canada	(877) 894 4414
Brazil	55 11 3351 7010
Mexico	001 800 254 2440
United States	(800) 829 4444

Asia Pacific

Australia 1 800 629 485 800 810 0189 China 800 938 693 Hong Kong India 1 800 11 2626 Japan 0120 (421) 345 Korea 080 769 0800 1 800 888 848 Malaysia Singapore 1 800 375 8100 0800 047 866 Taiwan Other AP Countries (65) 6375 8100

Europe & Middle East

United Kingdom

For other unlisted countries: www.keysight.com/find/contactus (BP-9-7-17)

0800 0260637

DEKRA Certified

www.keysight.com/go/quality Keysight Technologies, Inc. DEKRA Certified ISO 9001:2015 Quality Management System

This information is subject to change without notice. © Keysight Technologies, 2015 - 2017 Published in USA, September 25, 2017 5991-4551EN www.keysight.com

