Audio Analyzers
R&S®UP300/UP350

10 Hz to 80 kHz

R&S Smart Instruments™
The new product family from Rohde & Schwarz

First Edition October 2005

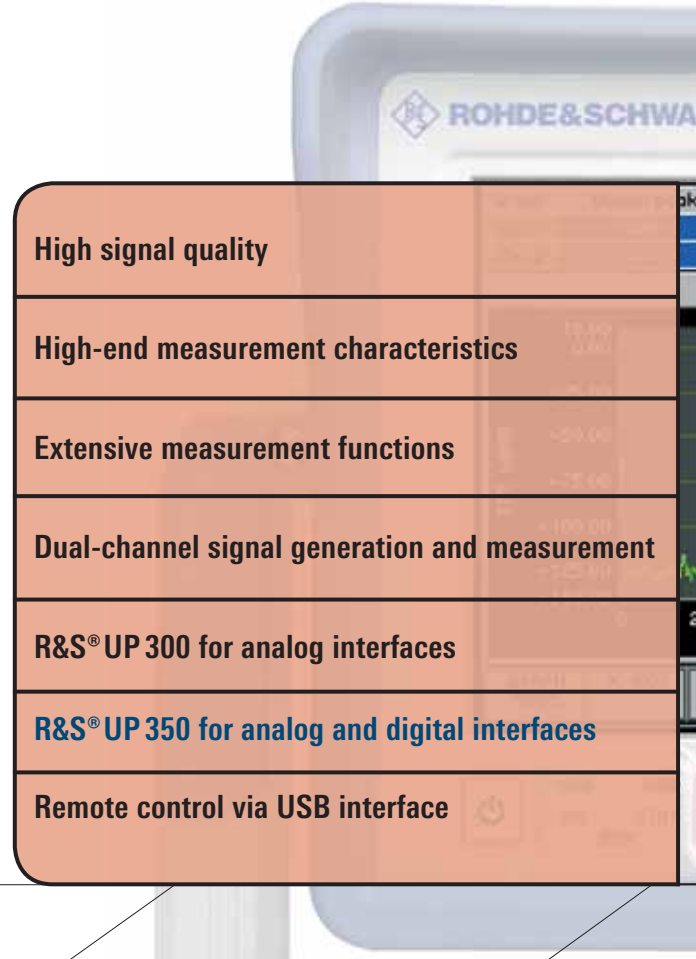
ROHDE&SCHWARZ

Professional audio analyzer for production, laboratory and service

The R&S®UP300 and R&S®UP350 are favorably priced audio analyzers with a frequency range up to 80 kHz that can handle any of today's common applications. The instruments feature a broad scope of functions, good technical characteristics and compact design. The R&S®UP300 includes all conventional audio engineering measurements and generates the required test signals. Its analog inputs and outputs are dual-channel in design.

The R&S®UP350 goes one step further by providing digital audio interfaces and the capability to measure the digital audio protocol and digital sampling rate.

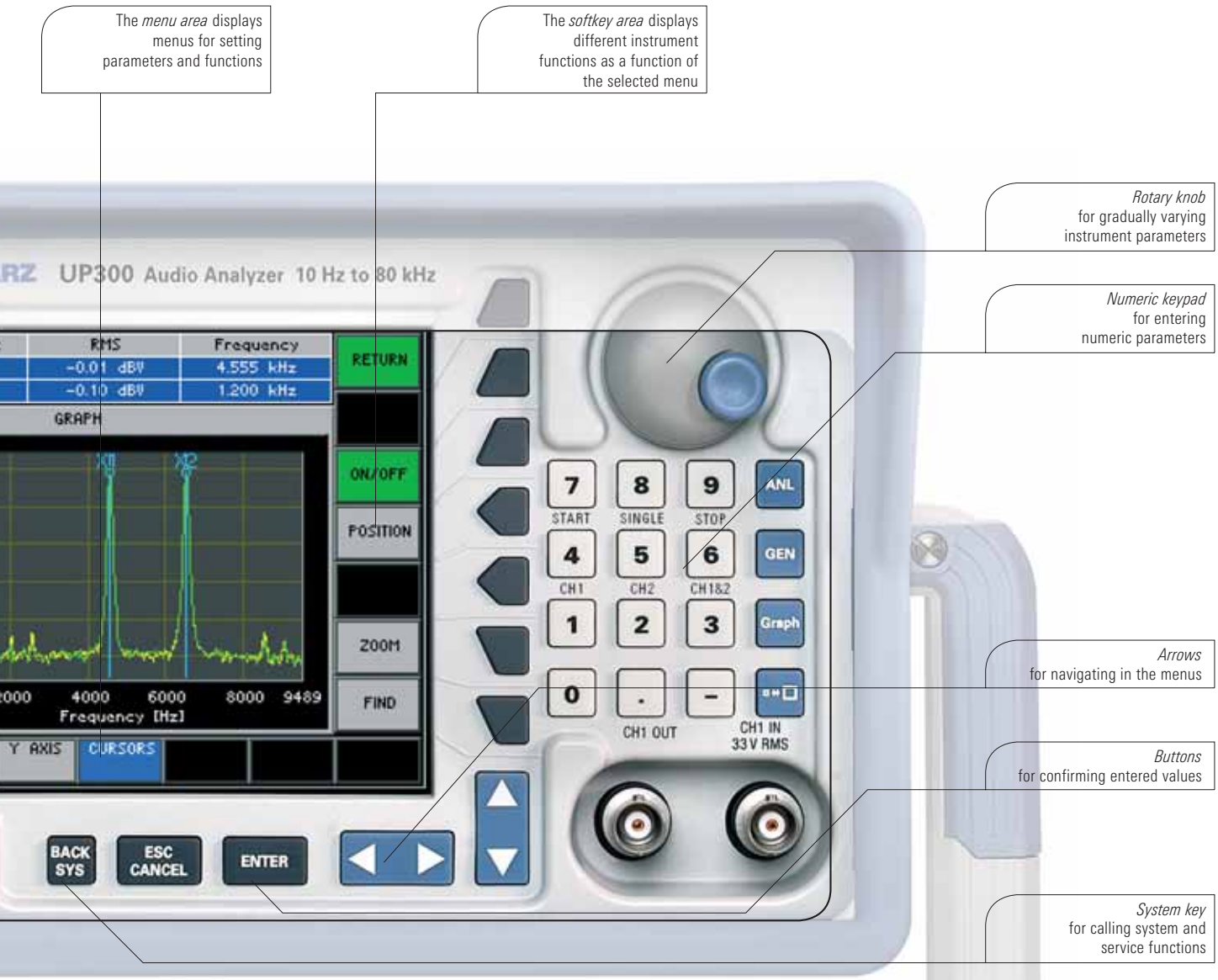
These two audio analyzers offer an immense range of applications — whether on the lab bench, in service or as a flexible measuring instrument in automatic production systems.



- **High signal quality**
- **High-end measurement characteristics**
- **Extensive measurement functions**
- **Dual-channel signal generation and measurement**
- **R&S®UP300 for analog interfaces**
- **R&S®UP350 for analog and digital interfaces**
- **Remote control via USB interface**

Condensed data

R&S®UP300	
Frequency range	10 Hz to 80 kHz
Level range	up to 33 V
Input noise	<2 µV (A-weighted)
Fast Fourier transform	up to 16 ksamples
R&S®UP350, all the above plus	
Sampling rates	32 kHz to 192 kHz



Ergonomic user interface

Operation is menu-guided so that even untrained users will quickly obtain correct results. Clear structures simplify navigation within the menus.

The high-contrast TFT color display with 320 × 240 pixel resolution allows traces to be read even at odd angles or when the incidence of light is unfavorable.

Applications

Because of its large scope of functions, the R&S®UP300 is ideal for numerous analog audio applications. The R&S®UP350 is even more powerful, with the added capability of performing measurements on digital audio instruments.

Generation of diverse test signals, single- or dual-channel

Measurement of linear and nonlinear distortion

Extensive selection of filters as standard

FFT analysis with high resolution

Test signals

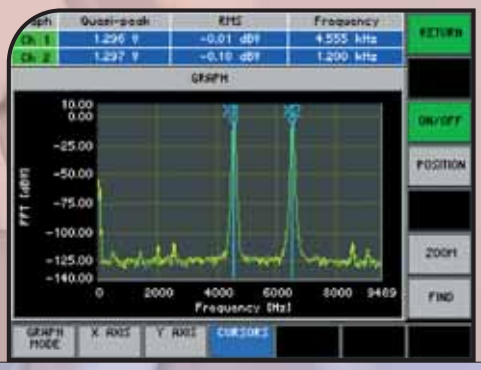
- Sinewave signals for measuring frequency response, level linearity and harmonic distortion
- Level and frequency sweep for sinewave signals
- Two-tone signals for modulation distortion analysis and difference frequency distortion measurement
- Multitone signal from up to 17 sinewave signals of any frequency
- Sinewave burst signal for testing the dynamic response of audio circuits
- Noise for a variety of applications; can also be superimposed on the sinewave signals

Measurement functions

- Level measurement with rms, peak or quasi-peak weighting
- Selective level measurement with adjustable bandwidths
- DC voltage measurement
- THD+N or SINAD measurement: measurement of the sum of the harmonics, including noise
- THD measurement with selection of the weighted harmonics
- Modulation distortion analysis and difference frequency distortion measurement
- Frequency and phase measurement
- Polarity test for checking for possible reversed polarity of a signal path
- FFT analysis for displaying the spectrum with a resolution of <3 Hz

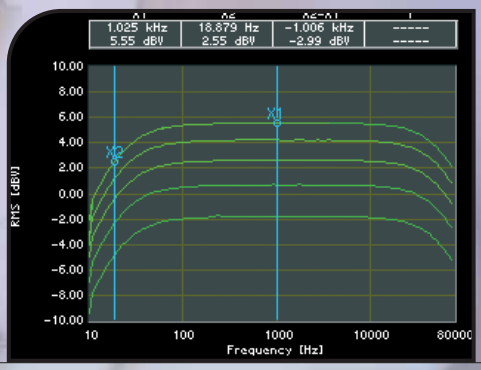
Diverse high-quality test signals

The generators in the Audio Analyzers R&S®UP300 and R&S®UP350 set new standards in the lower price segment. By providing a wide variety of sinewave signals, two-tone and multitone signals, bursts and noise, the instruments offer the ideal test signals for measurements in the lab, in service and in production, as well as in university education. Because the audio analyzers have inherent distortion of less than –90 dB, even high-end audio devices can be measured.



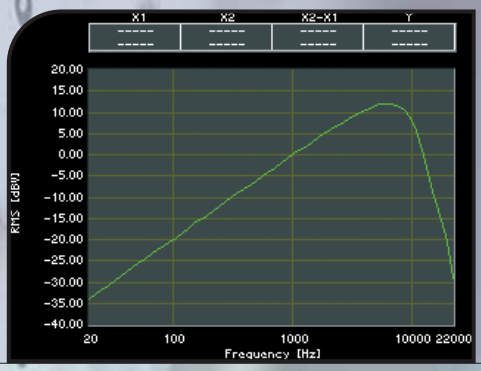
High-end measurement characteristics

The audio analyzers offer bandwidths of up to 80 kHz, enabling the user to perform measurements even on broadband audio equipment such as DVD players. The R&S®UP350 is capable of sampling rates up to 192 kHz – unprecedented in this class of instruments.



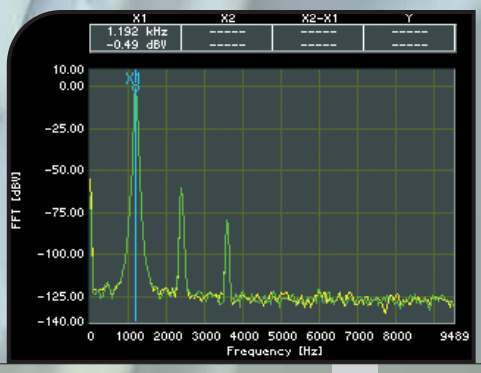
Extensive selection of filters

The R&S®UP300 and R&S®UP350 contain a wide variety of weighting, third-octave and octave filters. As many as three filters can be combined.



Powerful FFT analysis

The FFT analysis capability of the R&S®UP300/350 also sets new standards in this class of instruments. This capability supports up to 16 k points and provides numerous window functions, which enables it to display the spectral composition of signals up to 80 kHz in bandwidth.



R&S Smart instruments™

The new instrument family – equipped for the future

Versatile applications

- Desktop use
- Portable for mobile use
- Integration into 19-inch racks

USB interfaces

The USB host interface links the instruments to the PC world. The bus ensures high data transmission rates at low cost. Other peripherals (e.g. printers) can be addressed via another USB interface.

Identical housing

All instruments based on the Family 300 concept have an almost identical "face", a 5.4-inch VGA TFT display, front-panel control elements, protective guards and a handle that can be adjusted to different positions. Only the connectors on the front and rear panel vary depending on the instrument type.

If the protective guards and the handle are removed, the R&S®UP 300/350 can be installed in a 19-inch rack. Owing to their slim design, two instruments of the Family 300 can be placed next to each other.

R&S®UP 300

R&S®UP 350

In addition to its analog interfaces, the R&S®UP 350 has digital BNC interfaces in consumer and professional format on its rear panel.

Specifications

Important: We continuously refine our products. Please check our homepage **www.up300.rohde-schwarz.com** for new applications and features.

Specifications apply under the following conditions: specified environmental conditions met, calibration cycle adhered to and total calibration performed.

Analyzer

Analog audio inputs

Frequency range		DC/10 Hz to 80 kHz
Frequency response	10 Hz to 20 Hz	±0.1 dB
(referenced to 1 kHz)	20 Hz to 22 kHz	±0.05 dB
	22 kHz to 40 kHz	±0.1 dB
	40 kHz to 80 kHz	±0.25 dB
BNC connectors	2 channels, floating, selectable AC/DC coupling, channel 1 on front panel, channel 2 on rear panel	
Maximum input voltage	rms, sinewave	33 V
Measurement ranges	in steps of 6 dB	390 mV to 50 V (max. input 33 V)
Input impedance	inner/outer conductor to ground	100 kΩ
Crosstalk attenuation	frequency <20 kHz, 600 Ω source impedance	>100 dB
Common-mode rejection	at 50 Hz, V_{in} < 3 V	>80 dB
	at 1 kHz, V_{in} < 3 V	>75 dB
	at 16 kHz, V_{in} < 3 V	>60 dB
Generator output	each input channel switchable to the other generator output channel	

Digital audio inputs (model R&S®UP350 only)

BNC connector	unbalanced, grounded, on rear panel	
Impedance		75 Ω
Input level (V_{pp})		100 mV to 5 V
Optical input		TOSLINK
Channels		1, 2, or both
Audio bits		16 to 24
Sampling rate		32 kHz, 44.1 kHz, 48 kHz, 96 kHz, 192 kHz
Format		professional and consumer

Measurement functions

RMS value, wideband		
Error limits	measurement speed AUTO, at 1 kHz sine, AC coupling	±0.1 dB, additional error with DC coupling
	measurement speed AUTO FAST	±0.1 % of measurement range
		±0.1 dB additional error
Integration time	AUTO FAST/AUTO	5 ms/50 ms, at least 1 cycle
	VALUE	1 ms to 10 s
Noise	with A filter, 600 Ω source impedance	<2 µV
	with CCIR unweighting filter, 600 Ω source impedance	<4 µV
Filters	weighting filters and sets of predefined octave and third-octave filters; up to 3 filters can be combined	
RMS value, selective		
Error limits		±0.2 dB
Bandwidth (–0.1 dB)	fixed bandwidth filters	3 Hz, 10 Hz, 30 Hz, 100 Hz or 300 Hz
Selectivity		100 dB
Frequency setting		fixed through entered value
Peak value		
Measurement		pos. peak, neg. peak, peak-to-peak, absolute peak
Error limits	at 1 kHz	±0.2 dB
Interval		20 ms to 10 s
Filters	weighting filters and sets of predefined octave and third-octave filters; up to 3 filters can be combined	
Quasi-peak		
Measurement		in accordance with CCIR 468-4
Error limits	analyzer bandwidth 22 kHz	in accordance with CCIR 468-4
Noise	with CCIR weighting filter, 600 Ω source impedance	<12 µV
Filters	weighting filters and sets of predefined octave and third-octave filters; up to 3 filters can be combined	
DC voltage		
Voltage range		0 V to ±33 V
Error limits		± (1 % of measured value + 0.5 % of measure-
		ment range)
Total harmonic distortion (THD)		
Fundamental		20 Hz to 20 kHz
Frequency tuning	fixed through entered value, auto-tuning to input signal	
Weighted harmonics	up to 80 kHz	any combination of d2 to d9
Error limits	harmonics <50 kHz	±0.7 dB
	harmonics <80 kHz	±1 dB
Inherent distortion	fundamental 1 kHz	<–100 dB
	fundamental 20 Hz to 5 kHz	<–90 dB
	fundamental 5 kHz to 15 kHz	<–85 dB
	fundamental 15 kHz to 20 kHz	<–80 dB
Spectrum	bargraph showing signal and distortion	

Measurement functions

THD+N and SINAD		
Fundamental		20 Hz to 20 kHz
Frequency tuning	fixed through entered value, auto-tuning to input signal	
Bandwidth	weighting filters and sets of predefined octave and third-octave filters; up to 3 filters can be combined	
Error limits	bandwidth <22 kHz	±0.8 dB
	bandwidth <80 kHz	±1.4 dB
Inherent distortion	bandwidth 20 Hz to 22 kHz, fundamental 1 kHz	<–95 dB + 4 µV
	bandwidth 20 Hz to 22 kHz, fundamental 20 Hz to 5 kHz	<–90 dB + 4 µV
	bandwidth 20 Hz to 80 kHz, fundamental 20 Hz to 20 kHz	<–80 dB + 8 µV
Spectrum	post-FFT of filtered signal	
Difference frequency distortion (DFD)		
Measurement method		in accordance with IEC 268-3 or IEC 118
Frequency range	difference frequency	80 Hz to 2 kHz
	center frequency	200 Hz to 80 kHz
Error limits	f_{center} < 20 kHz	±0.5 dB
Inherent distortion	DFD d2, f_{center} < 20 kHz	<–105 dB
	DFD d3, 5 kHz < f_{center} < 20 kHz	<–90 dB
Spectrum	bargraph showing signal and distortion	
Modulation distortion (MOD DIST)		
Frequency range	lower frequency	30 Hz to 2.7 kHz
	upper frequency	8 × f_{lower} to 20 kHz
Error limits		±0.5 dB
Inherent distortion	f_{lower} = 60 Hz, 4 kHz < f_{upper} < 15 kHz	<–85 dB
	f_{lower} = 60 Hz, 15 kHz < f_{upper} < 20 kHz	
	input voltage ≤4 V	<–80 dB
	input voltage >4 V	<–75 dB
Spectrum	bargraph showing signal and distortion	
Frequency		
Frequency range		20 Hz to 80 kHz
Error limits	measurement time 10 s	±10 ppm
	measurement time 1 s	±100 ppm
Phase		
Frequency range	analyzer bandwidth 22 kHz	20 Hz to 22 kHz
	analyzer bandwidth 80 kHz	80 Hz to 80 kHz
Error limits	f < 20 kHz, both channels with same range	±1°
Polarity test		
Measurement		polarity of unsymmetrical input signal
Display		positive/negative

Filters

For all analog and digital analyzers. Up to three filters can be combined. All filters are digital filters with a coefficient accuracy of 32 bit floating point.

Weighting filters	A weighting	
	C message	
	CCIR	
	CCIR unweighted	
	CCIR 1k weighted	
	CCIR 2k weighted	
	deemphasis 50/15, 50, 75, J. 17	
	IEC/IEEE tuner	
Set of third-octave and octave filters		

FFT analyzer

Frequency range		DC to 80 kHz
FFT size		1 k, 2 k, 4 k, 8 k, 16 k points
Window functions		rectangular, Hann, Blackman-Harris, Rife-Vincent 1 to 3, Hamming, flat top, Kaiser ($\beta = 12$)
Resolution	16 k points, bandwidth 22 kHz	2.93 Hz
Averaging	exponential or normal	1 to 256

Generator

Analog audio outputs

BNC connectors	2 channels, electronic, floating (max. 0.2 V peak referenced to ground) or grounded, short-circuit-proof, max. current 120 mA with external feed channel 1 on front panel, channel 2 on rear panel	
Voltage range	sine, open-circuit	0.1 mV to 7.5 V (V_{rms})
Source impedance		27 Ω
Crosstalk attenuation	f < 20 kHz	>100 dB
Load impedance		>200 Ω
Common-mode rejection	at 1 kHz	>50 dB

Digital audio outputs (model R&S®UP 350 only)

Frequency limits specified for the signals apply to a sampling rate of 48 kHz. For other sampling rates, limits are calculated in accordance with the following formula: $f_{new} = f_{48kHz} \times$ sampling rate/48 kHz.

BNC connector	unbalanced, transformer coupling, on rear panel	
Impedance		75 Ω, short-circuit-proof
Output level (V_{pp})	into 75 Ω	0.5 V
Optical output		TOSLINK
Channels		1, 2, or both
Audio bits		16 to 24
Sampling rate		32 kHz, 44.1 kHz, 48 kHz, 96 kHz, 192 kHz
Format		professional and consumer

Signals

Sine		
Frequency range		2 Hz to 80 kHz
Error limits	at 1 kHz	±0.1 dB
Frequency response (ref. to 1 kHz)	20 Hz to 20 kHz	±0.05 dB
Inherent distortion THD+N	measurement bandwidth 20 Hz to 22 kHz	<–90 dB
Sweep parameters		frequency, level
MOD DIST	for measuring modulation distortion	
Frequency range	lower frequency	30 Hz to 2700 Hz
	upper frequency	$8 \times f_{lower}$ to 39.95 kHz
Level ratio (LF:UF)	selectable	from 10:1 to 1:1
Error limits		±0.5 dB
Inherent distortion	at 60 Hz, 7 kHz, level ratio 4:1	<–90 dB
	other settings; $f_{upper} < 20$ kHz	<–84 dB
DFD	for measuring difference frequency distortion	
Frequency range	difference frequency	80 Hz to 2 kHz
	center frequency	200 Hz to 39.95 kHz
Error limits		±0.5 dB
Inherent distortion	DFD d2, 7 kHz < $f_{center} < 20$ kHz	<–105 dB
	DFD d3, 7 kHz < $f_{center} < 20$ kHz	<–90 dB
Multisine		
Frequency range		2.4 Hz to 80 kHz
Minimum frequency spacing	bandwidth 22 kHz	2.4 Hz
Dynamic range	referenced to peak value	100 dB
Characteristics		1 to 17 spectral lines, level, start phase and frequency selectable for each line
Sine burst		
Burst time		1 signal period up to 60 s
Interval time		burst time up to 60 s
Low level		zero to burst level, absolute or relative to burst
Noise		
Distribution		Gaussian, triangular, rectangular
Polarity test signal		
$SINE^2$ BURST signal		1.2 kHz
ON-TIME		1 cycle
INTERVAL		2 cycles

Sweep

Parameters	frequency and/or level	
Sweep	linear, logarithmic, single, continuous	

Display of results

Units

Level (analog)	V, dBu, dBV, dBm and dBr (ratio to reference value)	
Level (digital)	FS, %FS, dBFS and dBr (ratio to reference value)	
Distortion	% or dB	
Frequency	Hz	
Phase	deg	

Graphical display of results

Display modes	spectrum plot	
	curve plot	
	bargraph	
	lists of results	
Display functions	autoscale	
	x-axis zoom	
	full-screen and part-screen mode	
	2 vertical, 2 horizontal cursor lines	
	search function for max. values	

Audio monitor

Headphone connector		3.5 mm jack
Output voltage		<2 V
Output current		<20 mA
Source impedance		10 Ω, short-circuit-proof
Recommended headphone impedance		600 Ω

Digital audio protocol (model R&S®UP 350 only)

Generator		
Validity bit		NONE, L+R
Channel status data		predefined masks for professional or consumer format in acc. with IEC 60958
Analyzer		
Display of protocol bits	validity bit	L or R
	channel status bits	mnemonic display of data fields, predefined settings for professional or consumer format in acc. with IEC 60958; automatically detected
	error indication	block errors, sequence errors, preamble errors
Clock rate measurement	error limits	±50 ppm

General specifications

Interfaces		
USB host	printer; USB stick	A plug, protocol version 1.1
USB device	device-specific command set, remote control via	B plug, protocol version 1.1
	supplied Windows driver (Windows XP/2000)	
Connector for external monitor (VGA)		15-pin D-Sub female
Keyboard connector		PS/2 female
Display		
Type		5.4" active TFT color display
Resolution		320 × 240 pixels
Max. refresh rate		10 pictures/s, nominal
Power supply		
Input voltage range	autoranging	100 V to 240 V (AC), 50 Hz to 60 Hz
Power consumption		<120 VA
Ambient conditions		
Operating temperature range	meets EN 60068-2-1/2	+5 °C to +45 °C
Storage temperature range		–20 °C to +70 °C
Relative humidity	meets EN 60068-2-3 (non-condensing)	95 % at +40 °C
Mechanical resistance		
Sinusoidal vibration	meets EN 60068-2-6, EN 61010-1 and	5 Hz to 150 Hz, max. 2 g at 55 Hz,
	MIL-T-28800D class 5	55 Hz to 150 Hz: 0.5 g constant
Random vibration	meets EN 60068-2-64	10 Hz to 500 Hz: 1.9 g
Shock	meets EN 60068-2-27 and MIL-STD-810	shock spectrum
Electromagnetic compatibility		meets EN 55011 class B and EN 61326
		(EMC Directive of EU (89/336/EEC))
EMI field strength		10 V/m
Safety		EN 61010-1/IEC 61010-1, UL 3111-1;
		CSA C22.2 No. 1010.1
Dimensions (W × H × D)		219 mm × 147 mm × 350 mm
Weight		9 kg

Ordering information

Designation	Type	Order No.
Audio Analyzer (analog interfaces)	R&S®UP300	1147.2494.03
Audio Analyzer (analog and digital interfaces)	R&S®UP350	1147.2507.03
Rack Adapter	R&S®ZZA-300	1147.1281.00
Carrying Case	R&S®ZZK-300	1147.2542.02
Accessories supplied with the R&S®UP300/350		
Operating manual (German/English), USB interface cable for connection to PC, power cable		

ROHDE&SCHWARZ

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