R&S®UPV
Audio Analyzer
Compact instrument for all audio measurements

ROHDE&SCHWARZ

Test & Measurement

Product Brochure | 05.00

R&S®UPV Audio Analyzer

At a glance

Although audio signals are mainly processed digitally nowadays, analog technology will remain a viable alternative that is continuously being enhanced. Therefore, both analog and digital measurements must be performed. The R&S®UPV audio analyzer is designed precisely for this purpose.

The R&S®UPV enables users to perform virtually all measurements that are necessary in the audio world: frequency response measurement, total harmonic distortion (THD) displays, spectral displays, analysis of digital interfaces, and much more. The generator is just as versatile. It can be used to create any conceivable signal from sinewave and noise signals up to multi-sinewave signals.

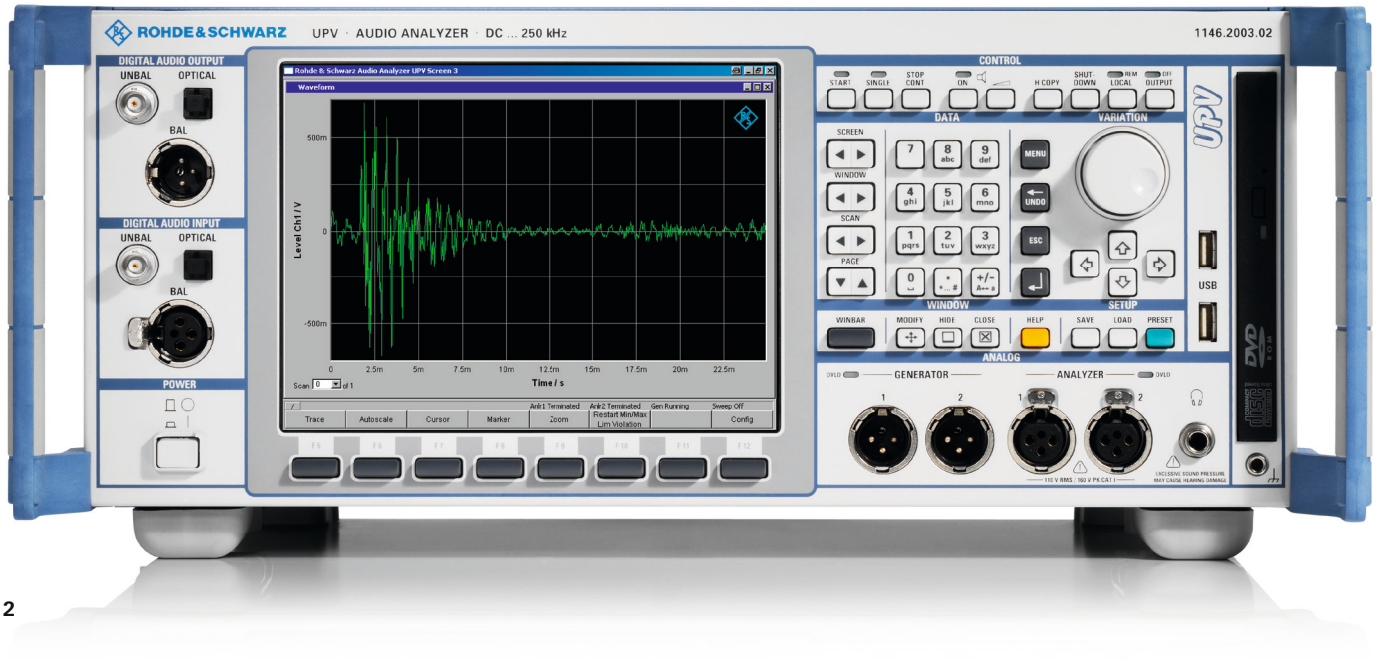
The R&S®UPV is an all-in-one instrument with an integrated control PC, making it easy to transport. Since the instrument comes factory-ready, it merely needs to be unpacked and switched on before being put into operation. Peripherals are therefore not required. Optional modules and software expansions that can be integrated into the instrument open up a broad scope of further applications.

The R&S®UPV features an intuitive user interface (Windows operating system). The large screen plays a key role, not only for displaying measurement results. All settings are made in panels that contain all interrelated functions and settings. Since the operating philosophy is easy to understand and since analog and digital measurements are performed in a similar manner, users can quickly master instrument operation.

The instrument features scalable graphical windows that can be moved around on the screen as needed, providing all measurement results at a glance. Results can be displayed in realtime for one or both channels and can optionally be expanded to a maximum of 16 channels. Multiple measurement functions/graphics are available simultaneously. For example, analyses in the frequency and time domains can be displayed at the same time. With graphics, results can be read off using vertical and horizontal cursors, and limit lines or stored measurement results can be superimposed on them or compared with them.

Key facts

- Suitable for all interfaces (analog, digital and combined)
- Simultaneous display of multiple measurement functions
- Sampling rate up to 400 kHz
- User-programmable filters for analyzer and generator
- Compact instrument with integrated PC
- Slots for future options



R&S®UPV Audio Analyzer

Benefits and key features

All test signals and measurement functions in a single box

- Generation of a wide variety of analog and – by using the R&S®UPV-B2/-B41/-B42 options – digital test signals
- Extensive measurement capabilities, on analog and also – when the R&S®UPV-B2/-B41/-B42 options are installed – digital interfaces
- Efficient as well as multichannel FFT analysis with a resolution down to the mHz range
- User-programmable filters adaptable to the measurement task at hand in a matter of seconds
- Everything included, no peripherals required

▷ page 4

Largest variety of interfaces offered in a single instrument

- Analog generator outputs as standard
- Dual-channel analyzer with analog inputs as standard
- Expansion to 8 or 16 measurement channels (R&S®UPV-B48 option)
- Digital audio interfaces (R&S®UPV-B2 option)
- Digital protocol analysis and generation (R&S®UPV-K21 option)
- Jitter and interface test (R&S®UPV-K22 option)
- Test of audio ICs with I²S interface (R&S®UPV-B41 option)
- Virtually any audio circuit adaptable using the universal serial interface (R&S®UPV-B42 option)
- PDM bitstream analysis (R&S®UP-K421 option)
- For both the generator and analyzer, all interfaces can be adjusted independently of one another, and they may be used together in any combination

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Convenient operation throughout

- Owing to the intuitive user interface, operation can be learned in next to no time
- All measurement results at a glance
- Effective online help functions

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Powerful and fast

- High measurement speed throughout the system
- Especially suitable for use in production
- R&S®UPV-K1 universal sequence controller for entire measurement sequences

▷ page 14

Options for further applications

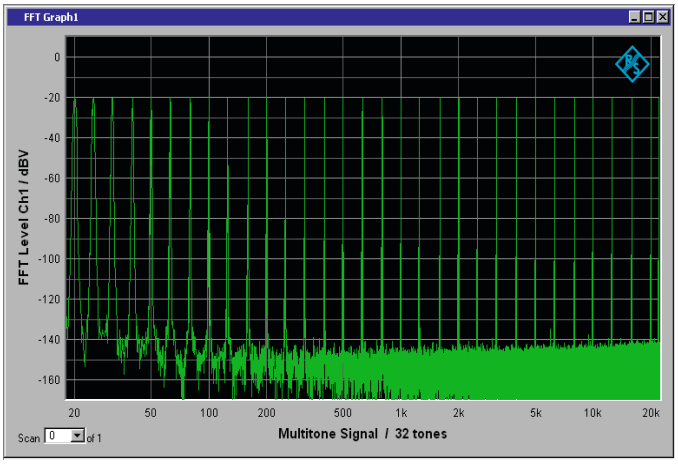
- R&S®UPV-B1 low distortion generator for extremely pure analog sinewave signals and for expanding the frequency range
- Second analog generator (R&S®UPV-B3) for generating different sinewave signals on the two analog output channels
- Simultaneous pickup of measurement values for up to 16 analog channels with the R&S®UPV-B48 option (eight channels each)
- 192 kHz R&S®UPV-B2 digital audio I/O with digital audio interfaces in line with AES/EBU and in consumer format
- Universal digital interfaces (R&S®UPV-B42) or in I²S format (R&S®UPV-B41) for connecting digital audio circuits
- PDM bitstream analysis (R&S®UPV-K421) as an add-on to the R&S®UPV-B42 option
- Expanded analysis functions with the R&S®UPV-K6 option
- PESQ® measurement [1] (R&S®UPV-K61 option) for analyzing speech signals in line with psycho-acoustic methods
- PEAQ® measurement [1] (R&S®UPV-K62 option) for analyzing broadband audio signals in line with psycho-acoustic methods
- POLQA® measurement [1] (R&S®UPV-K63 option) for analyzing broadband speech quality in line with psycho-acoustic methods
- Standard-compliant measurement of hearing aids using the R&S®UPV-K7 and R&S®UPV-K71 options
- R&S®UPV-K9/-K91/-K92/-K98/-K101 option package for acoustic measurements on mobile phones
- R&S®UPV-K4 remote control option for remote control of the R&S®UPV audio analyzer
- R&S®UPV-K1 universal sequence controller for creating and executing measurement sequences
- Change of the source impedance from 200 Ω to 150 Ω (R&S®UPV-U1 option)
- BNC monitoring outputs (R&S®UPV-U2 option)
- XLR/BNC adapter set (R&S®UP-Z1MF option)
- R&S®UPZ audio switcher for switching up to 128 channels to the inputs and outputs

▷ page 16

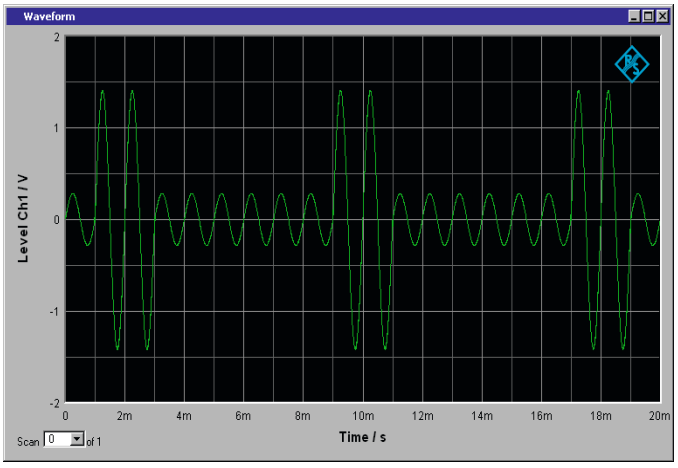
[1] PESQ®, PEAQ® and POLQA® are registered trademarks of OPTICOM Dipl.-Ing. M. Keyhl GmbH, Germany.

All test signals and measurement functions in a single box

The generator of the R&S®UPV audio analyzer generates a variety of signals, here a 32-tone signal: Frequency, amplitude and phase can be adjusted.



The waveform function shows the time characteristic of the measured signal (in this case, a sine burst).



The generators of the R&S®UPV can generate a wide variety of analog and digital test signals

Sinewave signal...
...for level and THD measurements

Dual-channel sinewave signals
Different signals are always possible on both digital output channels; for the analog interfaces, the R&S®UPV-B3 option is required

Two-tone signal...
...for modulation distortion analysis; various amplitude ratios can be selected; continuous frequency adjustment is possible

Difference-frequency distortion...
...for intermodulation measurements with continuous adjustment of both frequencies

DIM test signal
Squarewave signal with superimposed sinewave (R&S®UPV-B3 required in analog applications)

Multitone signals...
...from up to 7400 frequencies with either identical or user-selectable amplitude and phase; the frequency spacing can be linked to the resolution used for the fast Fourier transform (FFT), which allows the frequency response of a DUT to be determined quickly and precisely in one shot

Sine burst signal and sine2 burst...
...with adjustable interval time and "on" time as well as user-programmable low level, e.g. for testing automatic gain control devices

Noise...
...with various amplitude distribution functions, e.g. for acoustic measurements

Arbitrary signals
Any voltage characteristic from up to 256k points can be generated

With the play function...
...any test signals can be output from the hard disk, e.g. speech or music signals provided as a WAV file

AM and FM...
...for sinewave signals

DC voltage...
...also with sweep function

Squarewave signal
(R&S®UPV-B3 option required in analog applications)

A user-programmable filter and/or equalizer with user-selectable nominal frequency response can be inserted with most signals in order to compensate for the frequency response of the test setup, for example.

An offset can also be added to the signals; plus, a dither with an adjustable level and different amplitude distribution can be added to the digital audio signals.

The R&S®UPV can perform a broad scope of measurements on both analog and – optionally – digital interfaces

Level or S/N measurement...
...with RMS, peak or quasi-peak weighting; integration times that are automatically adapted to the input signal produce high measurement speeds

Selective level measurement
The center frequency of the bandpass can be swept or coupled to the generator frequency or to the input signal

SINAD or THD+N measurement
Measurement of the sum of all harmonics, including noise

Measurement of total harmonic distortion (THD)
Analysis of the harmonics, either individual ones, all of them, or any combination of them

Modulation distortion analysis in line with IEC 60268-3
Second- and third-order intermodulations are measured

Intermodulation measurement...
...in line with the difference-frequency distortion method with measurement of the second- or third-order inter-modulations

Dynamic intermodulation measurement...
...in line with the DIM standard

DC voltage measurement

Frequency, phase and group delay measurement

Polarity test...
...to check for any polarity reversal of a signal path

Crosstalk measurement

Waveform function...
...for displaying the measurement signal in the time domain; displays of slow time sequences can be compressed, e.g. in order to determine the settling of compander or AGC circuits

FFT analysis...
...with a wide variety of capabilities
(described in detail on page 6)

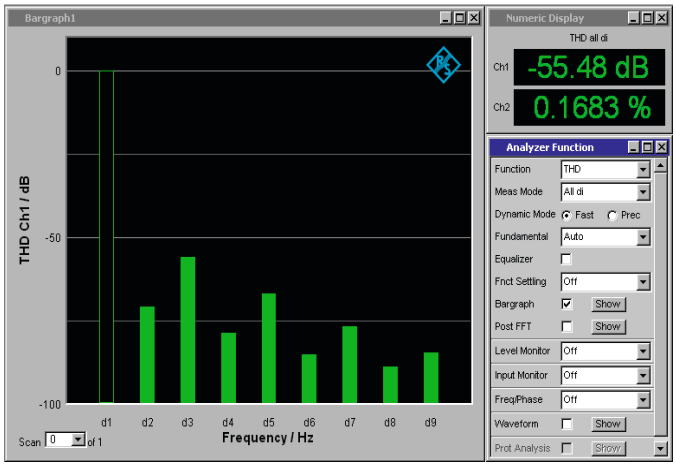
Record function...
...permits the long-term recording of a signal on the hard disk so that it may be analyzed in detail at a later time

Measurement of time difference...
...between output and input signal; this capability enables users to determine the delays of equalizers, mixing consoles, etc.

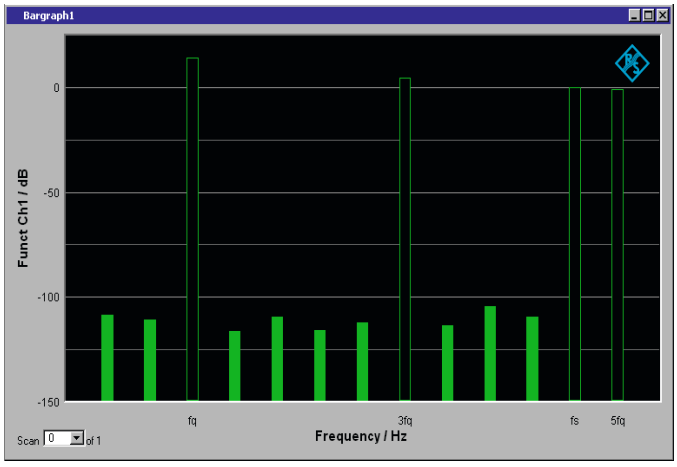
R&S®UPV-K6 expanded analysis function
Third-octave analysis and 1/n octave analysis for acoustic measurements; rub&buzz, transfer and coherence functions, as well as impulse response and interchannel delay, expand the range of applications (see page 17)

Psycho-acoustic measurement methods
PESQ, PEAQ and POLQA in line with ITU recommendations are described on page 17

During the THD measurement, all, individual or any combination of harmonics can be measured.



Even less common measurement functions such as the measurement of the dynamic intermodulation (as seen here) can be performed using the R&S®UPV audio analyzer.



Efficient as well as multichannel FFT analysis with a resolution down to the mHz range

The R&S®UPV offers several FFT capabilities; each of them is designed for two- or multichannel applications and can be applied to the filtered input signal.

FFT

The FFT measurement function is used when high requirements are placed on the dynamic range. Up to 256k points can be selected in binary steps, where the points are evaluated in double precision mode.

Post FFT

The post FFT can be used, for example, in THD and intermodulation measurements to analyze the distortion products in greater detail.

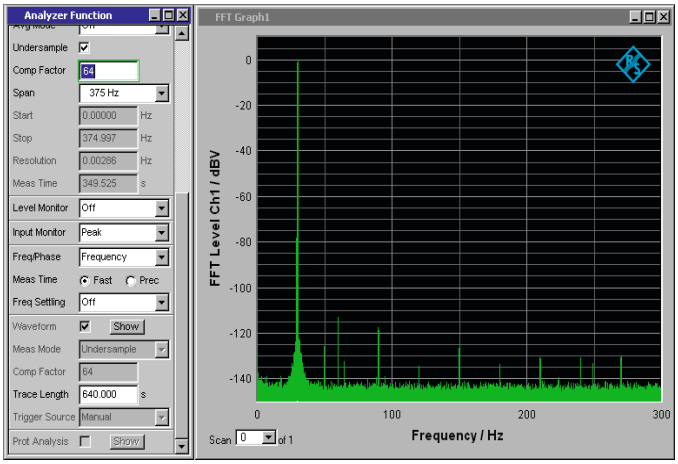
Undersample FFT

A special feature is the undersample FFT (R&S®UPV-K6 option required). Here, digital preprocessing of the measurement signals, which reduces the bandwidth, is used to increase the frequency resolution by a factor of 2 to 1024. This yields a resolution of down to 0.2 mHz. It should be noted that this does not involve a zoomed graphical display, but instead a measurement with true higher resolution.

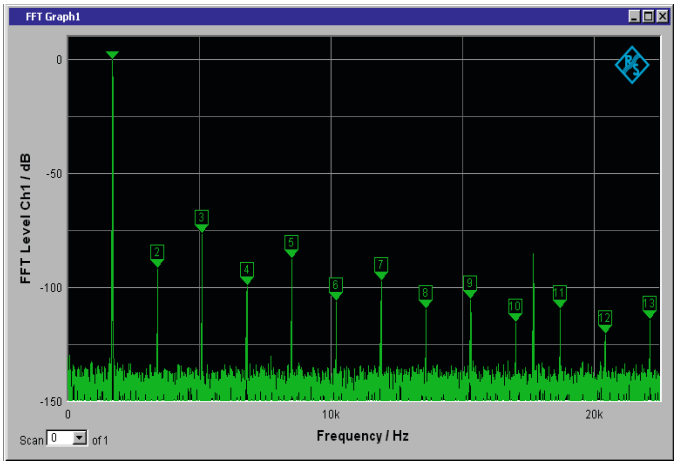
1/n octave analysis

A further special case is the 1/n octave analysis (R&S®UPV-K6 option required), which is primarily used for acoustic measurements. In fractions of an octave, the bins of an FFT are combined in each case to yield a measurement value, where the fraction may be selected with an "n" value of 1, 3, 6, 12 or 24.

Up to 256k points can be evaluated with the FFT analysis function; in the undersample mode, a frequency resolution of down to 0.2 mHz can be achieved.



The FFT analysis function expands the THD+N measurement in this case; the automatic marking of the harmonics makes nonharmonic parts visible at a glance.



User-programmable filters adaptable to the measurement task at hand in a matter of seconds

The filters of the R&S®UPV are implemented as software. This enables the user to define as many as necessary, which is also beneficial for analog applications. The most common weighting filters are already included as standard. Additional filters can be programmed in only a few seconds after the type (lowpass, highpass, bandpass, bandstop, notch, third-octave or octave filter), frequency and attenuation have been entered.

Particularly in the case of special requests, the strengths of the instrument concept become readily apparent: Special filters can be calculated using commercially available filter design programs. The data record is transferred to the R&S®UPV and the required filter can be looped into the signal path.

As many as four filters can be combined.

Everything included: no peripherals required

The R&S®UPV audio analyzer is a compact instrument that already contains an integrated PC. The disadvantages of audio analyzers that are controlled from an external PC can therefore be avoided.

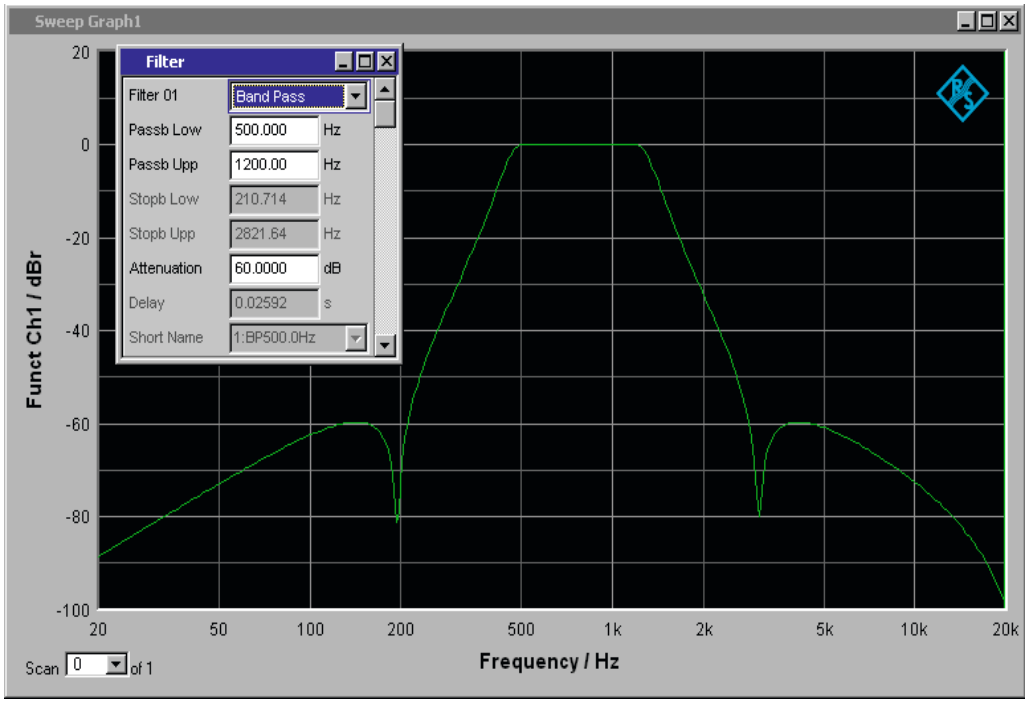
The instrument is easy to transport, and no additional keyboard, monitor or other PC peripherals are needed.

The R&S®UPV comes ready to use right out of the box. Users only need to unpack it, switch it on and start measuring.

When an audio analyzer is operated using an external PC, the computer itself, the monitor or the interface connections can emit a level of disturbance that impedes the measurement of the audio DUT. In contrast, the R&S®UPV's EMC properties, including the integrated PC, have been tested and therefore meet all requirements placed on a measuring instrument. No conventional PC offers such extensive shielding measures, which include magnetically shielded AC power transformers or filter plates in front of the display.

Another aspect worth mentioning: The PC is included in the purchase price of the R&S®UPV

- Integrated hard disk and CD/DVD combo drive
- Connectors for keyboard, mouse, monitor and printer
- Four USB connectors
- LAN interface for connecting to networks
- Remote control via IEC/IEEE bus, USB or LAN
- Further processing of measurement data with standard software possible (Windows XP)
- All measurement results are available in common data formats, making the transfer of graphics, documents, etc., an easy task
- Easy addition of functions and software expansions in the future
- Automatic execution of measurement sequences or measurement routines by means of the universal sequence controller (see page 15)



Filters can be programmed simply by entering a few parameters, which takes only a few seconds; they can be used both in the analyzer and the generator.

Largest variety of interfaces offered in a single instrument

Analog generator outputs as standard

- Balanced outputs, floating (e.g. for avoiding hum loops)
- The generator outputs can be connected internally to the analyzer inputs so that changes in measurement tasks can frequently be handled without any external recabling being necessary

Dual-channel analyzer with analog inputs as standard

- Dual-channel, balanced inputs with high common-mode rejection and various impedances that are common in studio equipment; lines with phantom powering can be measured
- Due to the wide dynamic range and the powerful autorange function, tests are possible even on class-D amplifiers without inserting expensive external filters, as is necessary with conventional audio analyzers

The analog analyzer can be expanded to 8 or 16 measurement channels (R&S®UPV-B48 option)

If the R&S®UPV-B48 eight-channel card is installed in one of the two slots on the rear, the R&S®UPV audio analyzer is transformed into a fast multichannel analyzer for surround-sound applications. Since this option can be installed in the other slot as well, up to 16 analog channels can be measured simultaneously.

With this option, it is also possible to perform measurements directly on class-D amplifiers without using expensive external filters.

Digital components with different data formats and clock rates are common in the world of professional audio equipment, which requires a measuring instrument that provides maximum performance at all interfaces.

Digital audio interfaces for professional studio operation and for the consumer electronics market (R&S®UPV-B2 option)

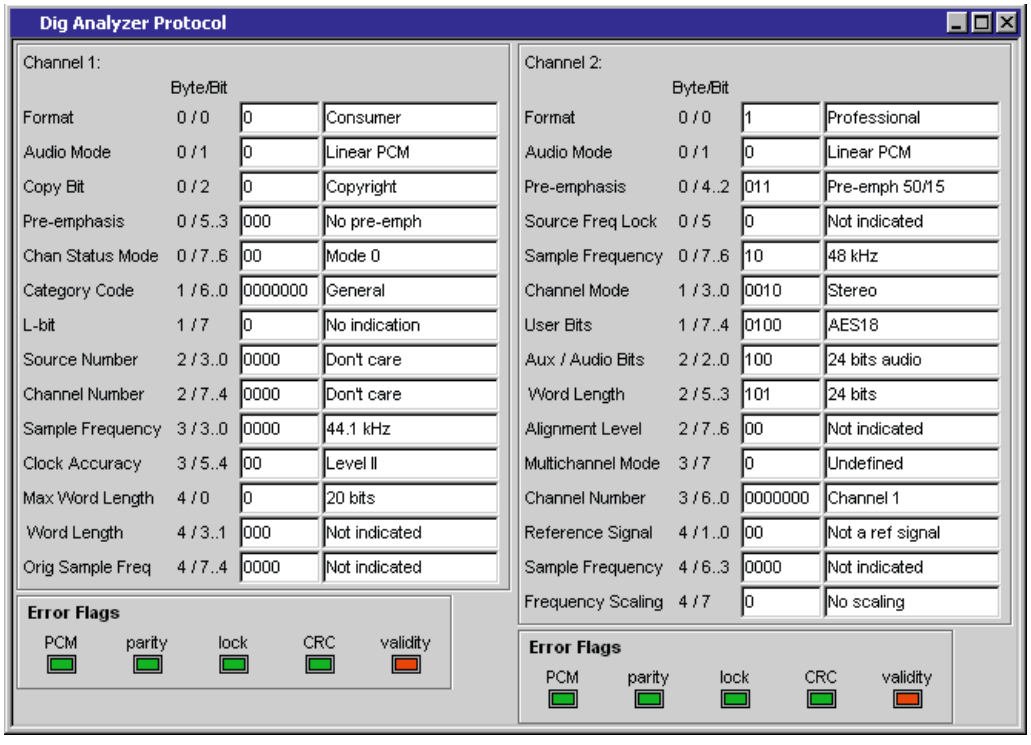
Digital audio equipment can be interconnected via standardized interfaces. With professional equipment, the AES/EBU format has become standard; with consumer equipment, the S/P DIF interface is used. The R&S®UPV-B2 option supports both areas:

- Balanced (XLR), unbalanced (BNC) and optical (TOSLINK) inputs and outputs for connecting consumer electronics equipment and professional studio equipment
- The level of the balanced and of the unbalanced output can be adjusted so that the sensitivity of digital audio inputs can be determined
- Simulation of long cable lengths by using an integrated cable simulator
- Adjustable phase shifting between digital audio and reference output
- The format of the generated channel status data can be selected independently of the selected interface, where the choices are “professional” and “consumer”
- Reference (XLR) and synchronization input (BNC) at the rear of the instrument; this allows the generator to be synchronized with the digital audio reference signal (DARS) in line with AES11, or with a word clock
- Bit- or word-synchronous sync signals are generated that permit an accurate representation of the digital audio signal on an oscilloscope (preamble, eye pattern, signal symmetry, superimposed noise, etc.)
- Generator and analyzer can be operated with clock rates of 32 kHz to 192 kHz; the generator can also generate these clocks internally
- The clock rates of the analyzer and the generator are independent of each other, which allows clock rate converters to be analyzed
- Audio words of 8 bit to 24 bit can be selected independently for the generator and the analyzer

Digital protocol analysis and generation (R&S®UPV-K21 option)

This software option expands the functions of the R&S®UPV-B2 option to include a conclusive analysis and the generation of additional digital data:

- Analysis of the channel status data; the data is output in binary format and evaluated on the basis of the professional or consumer format in line with AES3 or IEC60958
- Generation of channel status data and of the validity bit; the channel status data can be entered either in binary format, hex format, or in the professional or consumer format in line with AES3 or IEC60958
- Simultaneous measurement of the clock rate and display of interface errors that occur, e.g. parity errors
- Protocol analysis can be carried out simultaneously with other measurement functions



The generation and analysis of protocol data in the digital data stream is extremely easy:
In addition to the binary data, the evaluated data is output in either professional or consumer format.

Jitter and interface test (R&S®UPV-K22 option)

This option enables the user to analyze the physical parameters of the digital audio interface. The R&S®UPV-K22 option expands the functionality of the R&S®UPV-B2 option.

Analysis

- Measurement of the jitter amplitude and display of the jitter signal in the frequency and time domains
- Measurement of the input pulse amplitude and of the sampling frequency
- Measurement of the phase between audio input and reference input
- Analysis of the common-mode signal of the balanced input (frequency, amplitude, spectrum, etc.)

Generation

- The clock of the output signal can be "jittered" by applying a sine or noise signal with variable amplitude
- A common-mode signal can be superimposed on the balanced output
- If digital audio data is generated, jitter or common-mode interferences can be superimposed on this data stream
- An input signal with jitter superimposed can be output jitter-free

Test of audio ICs with I²S interfaces (R&S®UPV-B41 option)

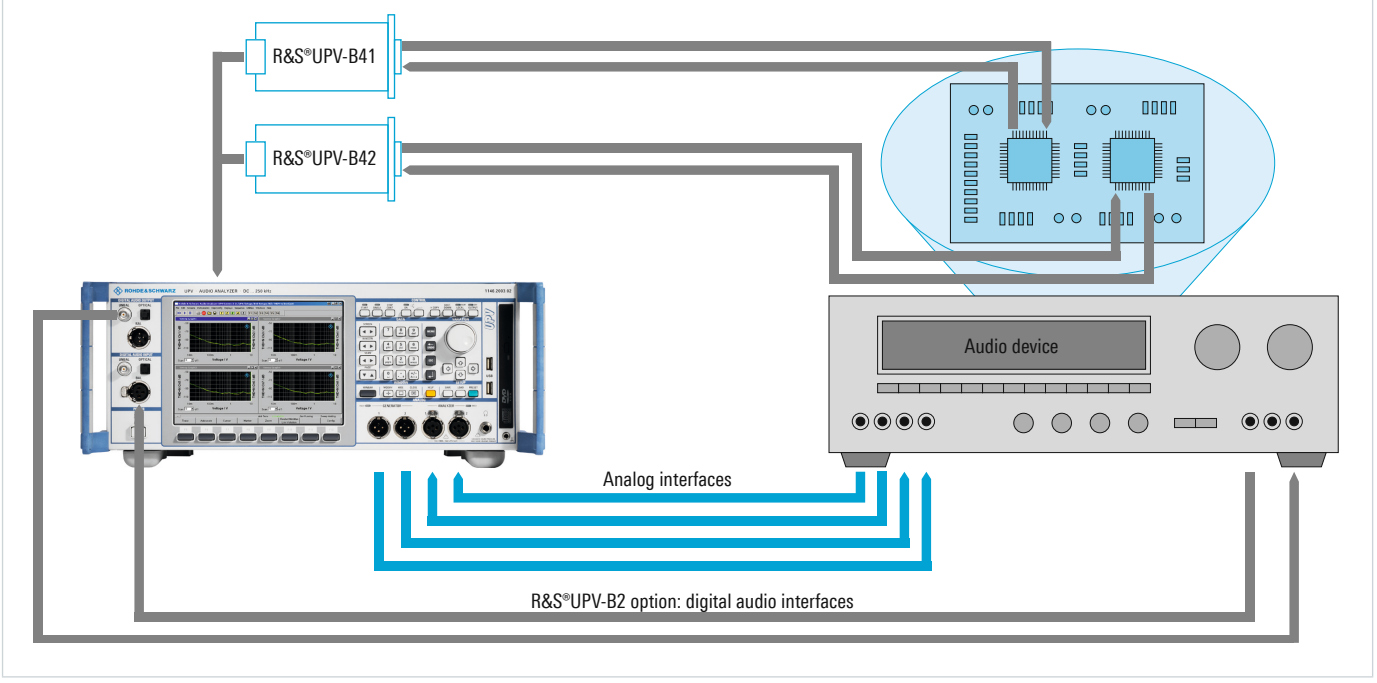
A close look at how the various modules and chips are interconnected inside such audio equipment reveals primarily serial digital data interfaces. For several years now, the inter-IC sound bus (I²S bus) has found widespread use.

It is used throughout the world for dual-channel, device-internal audio data transmission; numerous audio A/D and D/A converters support this format.

The R&S®UPV-B41 option, which is inserted at the rear of the base unit, provides the R&S®UPV audio analyzer with I²S interfaces for generator and analyzer. The transmit chip uses either internal (master) or external (slave) synchronization. This is important because in more complex systems with multiple transmitters and receivers, it must be possible to centrally generate the system clock to ensure interference-free data transmission. Depending on the application, I²S formats with different word lengths are used. The R&S®UPV-B41 option can be adjusted to all common word lengths of 16 bit, 24 bit and 32 bit, where the number of audio bits used can be adjusted independently of the word length. In addition to the standard I²S format, special formats are also supported.

The R&S®UPV-B41 is connected to the DUT via a 25-pin D-Sub male connector. A cable with a junction to seven BNC male connectors is available as the R&S®UP-Z3 option.

R&S®UPV-B41 option: I²S interface; R&S®UPV-B42 option: universal serial interface



Virtually any audio circuit adaptable using the universal serial interface (R&S®UPV-B42 option)

Although numerous digital audio applications can use dual-channel data transmission, there is a strong trend toward formats that transmit more than two data channels. At the same time, numerous data formats are being developed. To accommodate all of these applications, the R&S®UPV-B42 universal serial interface option was developed. It can be inserted into one of the two slots on the rear of the R&S®UPV audio analyzer.

The generator and analyzer can be configured independently of each other, and they can be synchronized both internally and externally (master or slave mode). Up to four data lines can be handled; they can contain up to 256 audio data packets (slots) per frame in time multiplex. One or two test signals can be output simultaneously in any number of user-selectable slots, and up to eight audio signals from any number of user-selectable slots can be analyzed simultaneously. Data formats up to 32 bit can be processed with sampling rates of 1 kHz to 400 kHz. The bit sequence, slopes and offset can be flexibly adjusted. A detachable probe permits short, low-reflection connections directly to the chips to be tested; all common logic levels are supported. In summation, the user enjoys flexible digital audio interfaces that can be connected to practically all audio chips currently in use.

The R&S®UPV-B42 consists of plug-in card, connecting cable and probe (see figure).

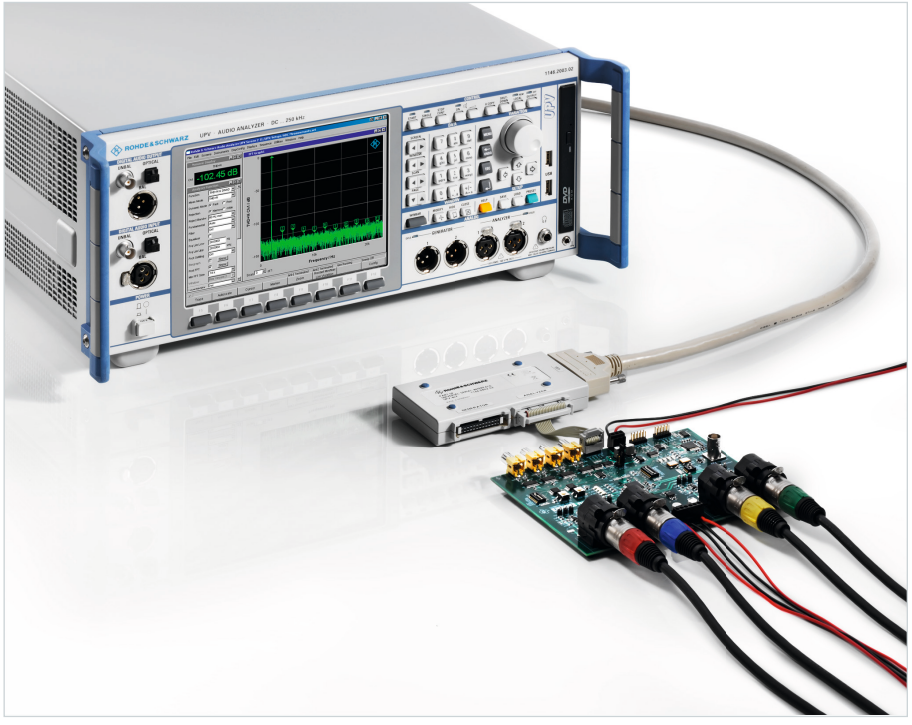
PDM bitstream analysis (R&S®UPV-K421 option)

This software package expands the R&S®UPV-B42 option to include the measurement of digital audio signals that are transmitted in line with pulse density modulation. This transmission mode is used, for example, for operating MEMS microphones; sigma delta converters also use this 1 bit data stream.

For both the generator and analyzer, all interfaces can be adjusted independently of one another, and they may be used together in any combination

The interfaces for the R&S®UPV generator and analyzer can be adjusted independently of one another. Therefore, DUTs with virtually any combination of interfaces can be tested. A/D and D/A converters can be directly connected. This is also true for complicated DSPs or format converters which, for example, require a 384 kHz clocked I^2S format at the input and supply an AES/EBU signal with a sampling rate of 96 kHz to the analyzer.

In addition to the analog interfaces that are always present and the optional standard digital interfaces on the front panel of the R&S®UPV audio analyzer, two further interface cards can be plugged into the slots at the rear of the instrument. Therefore, up to four different interfaces can be made available in one instrument without any additional equipment being necessary.



Ever more complex chips demand a measuring instrument that can easily be adapted to a wide variety of data formats. The R&S®UPV audio analyzer, when used with the R&S®UPV-B42 option installed, is optimally designed for this requirement.

Convenient operation throughout

Operation can be learned in next to no time

The R&S®UPV features an intuitive user interface (with Windows as the operating system).

The large screen plays a key role, not only for displaying measurement results. All settings on the large screen are made in panels containing all interrelated functions and settings.

Five different screen displays are available. The user can switch between these "screens" merely by pressing a key. Each panel can therefore be quickly accessed without jamming the screen.

Panel size can be changed, and the panels may be moved to any position on the screen.

Basic settings of the instrument, such as audio interface configuration, are grouped in separate panels; once the settings are made, they can be hidden for the remaining measurement.

To make the user's task easier, only function blocks that are currently required are displayed; all other function blocks remain in the background. Example: Sweep parameters are not displayed in the generator panel until the sweep function has been selected.

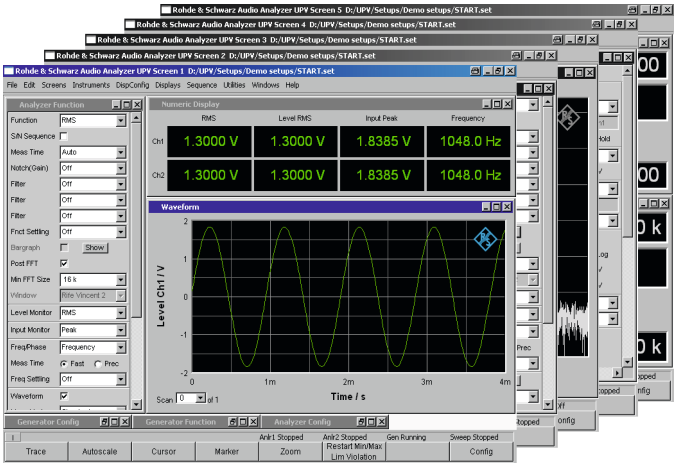
The entire instrument can be operated from its front panel. The rotary knob plays a major role here. Users can move the cursor around inside a panel on the screen with only one hand and select a function by pressing the rotary knob. Numeric values can be varied directly by using the rotary knob, which is of enormous advantage when making adjustments.

Softkeys at the bottom of the screen permit fast access to changing functions, e.g. with graphical display.

The R&S®UPV can also be operated using an external keyboard and/or mouse.

The easy-to-understand operating concept (using the familiar Windows functions from the PC world) and the similar handling of analog and digital measurements allow users to quickly master instrument operation.

The large screen provides a straightforward display of all important settings and states of the R&S®UPV audio analyzer. Five virtual displays (screens) are available for better arrangement of the large number of possible panels and display windows.



All measurement results at a glance

The measurement results for one or both channels and multiple measurement functions are displayed in realtime.

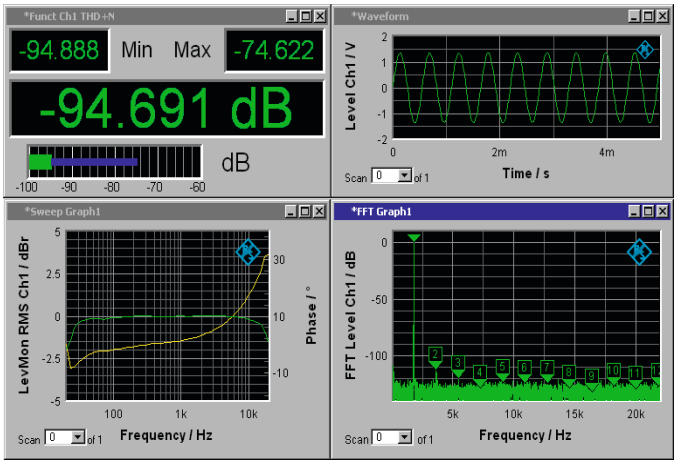
Scalable graphical windows can be arranged anywhere on the screen. When their size is changed, the labels, font sizes, grid lines, etc., are automatically adapted.

Multiple measurement diagrams are simultaneously available so that analysis in the frequency and time domains can be displayed simultaneously, for example.

With graphics, results can be read off using vertical and horizontal cursors, and limit lines or stored measurement results can be superimposed on them or compared with them. The graphical capabilities range from trace displays and bargraphs through to spectrum graphics.

By using color profiles, the user can determine the look of the measurement diagrams: The settings can be different for screen, printer and file output so that, for example, a black-and-white printer can be used alongside a screen with color display.

Everything at a glance: Multiple measurement diagrams can be arranged in any manner preferred on the screen; analysis in the frequency and time domains can be displayed simultaneously.



Effective online help functions

The R&S®UPV offers various help functions:

Context-sensitive help

HELP information either in German or English can be called up for any entry field by pressing a key.

When detailed information about a function is needed, the integrated user manual is available. The user can quickly navigate to the term in question by using the rotary knob or mouse.

Warning boxes

These boxes, which are clearly marked, alert the user to settings that may be incorrect.

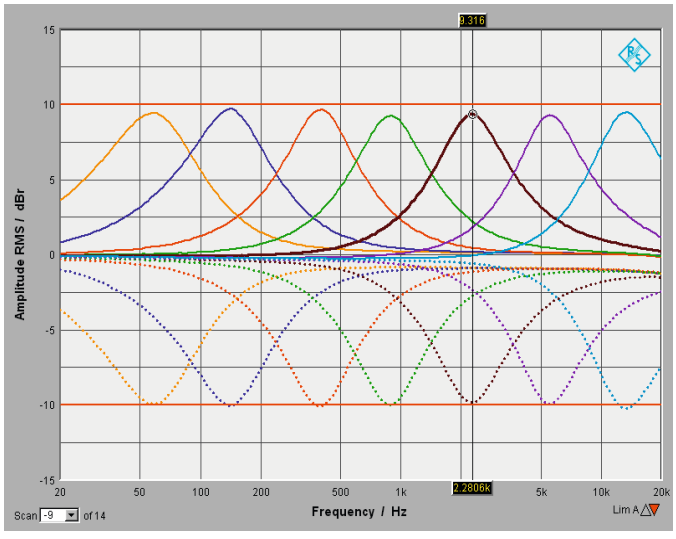
Entry help

The permissible value range is displayed for every menu that may require the entry of a number. Furthermore, all higher-level parameters are taken into account, e.g. the sampling rate for measurements on digital interfaces.

Protection against operating errors

Entries outside the permissible value range are not accepted; such entries are automatically changed to their permissible minimum or maximum value.

Graphics can be sized with vertical and horizontal cursors; markers and limit traces make evaluation easier. Multiple traces can be superimposed in user-defined colors; background colors, etc., can be selected to meet any requirement.



Powerful and fast

High measurement speed throughout the system

When the R&S®UPV audio analyzer was designed, special attention was paid to the speed of the overall measurement system:

- Time-critical and computation-intensive process steps are carried out by digital signal processors; the PC is largely used for instrument operation and to display results
- The R&S®UPV can also perform the complex measurement functions simultaneously on both channels; this alone cuts the time required for stereo measurements in half as compared with other analyzers on the market
- The digitally implemented measurement routines optimally adapt the measurement time to the input frequency; this yields a significant increase in measurement speed, particularly in the case of frequency sweeps
- Owing to digital signal processing, the internal setting and settling times can be kept shorter than with exclusively analog instruments. In addition, they are taken into consideration in the measurement routine. This yields stable measurements even without having to activate a settling function [1)]

[1)] Settling function: Repetition of measurements until the measurement value consistently remains within a tolerance band.

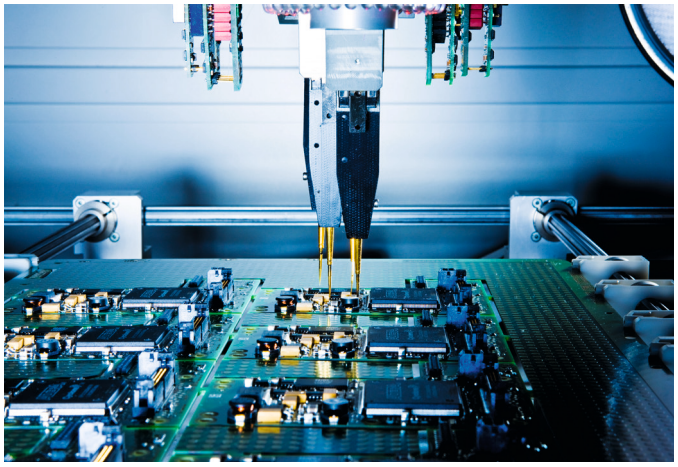
The R&S®UPV66 – the special model for use in production systems – offers the full flexibility of the standard model.

Especially suitable for use in production

Measuring instruments for production tests must meet a large number of requirements:

- High measurement speed is crucial in order to achieve high production throughput. By making appropriate use of the instrument functions, Go/NoGo decisions can already be made in the R&S®UPV audio analyzer. This reduces the turnaround time for the DUT even further. Even complete parts of the analysis (macros) can be processed by the R&S®UPV
- Dual-channel measurements can, for example, also be used to determine input and output characteristics simultaneously, therefore saving time
- Up to 16 analog channels can be measured simultaneously. This saves a significant amount of time, such as when testing multichannel amplifiers
- The fast frequency response measurement achieved by using FFT analysis provides a critical edge particularly during the highly time-critical frequency response measurement (example: measurement of a frequency response with approx. 900 frequency values in 150 ms)
- Long calibration intervals owing to the large portion of digital T&M engineering contribute to high instrument availability
- Remote control capability over the IEC/IEEE bus is particularly indispensable in large production facilities. In the R&S®UPV audio analyzer, special attention was also paid to data traffic via the IEC/IEEE bus
- Especially in production scenarios, the R&S®UPV66 model is the optimum solution. The omission of a display, keypad and CD/DVD drive definitely saves money, yet the instrument can be manually operated at any time by attaching a monitor, PC keyboard and mouse. Therefore, the source of errors can be quickly located if any problems arise in production

High measurement speed, multichannel measurements and remote control capability are indispensable in production lines. The long calibration intervals of the R&S®UPV assure high availability and reduce operating costs.



In the measurement of electro-acoustical converters, the test setup frequently includes measurement microphones and loudspeakers whose specific frequency response must be compensated for during the measurement. In this case, the filters and equalizer in the R&S®UPV are used.

R&S®UPV-K1 universal sequence controller

This option enables users to create and execute measurement sequences, turning the R&S®UPV into an automatic tester. As a result, small test systems can be implemented cost-effectively, since no additional control is required.

Every manual operating step is recorded in SCPI recording and then translated into a complete, syntactically correct command line. The command lines generated in this manner contain the instructions in a form that can be read (IEC/IEEE bus syntax in line with SCPI) and is not simply a sequence of pressed keys. This enables the user to set up user-defined measurement routines without having to look up the command syntax each time. This significantly reduces the effort necessary to create remote control routines and internally executed macros.

Options for further applications

R&S®UPV-B1 low distortion generator

The low distortion generator is required for all applications where extremely pure analog signals are necessary, or when an extended frequency range up to 185 kHz is needed. Its inherent distortion is lower than the excellent values for the universal generator.

R&S®UPV-B3 second analog generator

This hardware option provides the R&S®UPV with a second analog output amplifier. This also allows dual-channel sinewave signals to be output on the two analog output channels. Furthermore, this option is required in order to generate the DIM signal and the squarewave signal, as well as to play stereo WAV files for PEAQ measurements.

Simultaneous pickup of measurement values for up to 16 analog channels with the R&S®UPV-B48 option (eight channels each)

This option can be installed in one or both of the slots at the rear. This makes the R&S®UPV audio analyzer a fast multichannel analyzer that can pick up as many as 16 analog channels simultaneously.

Two plug-in cards of the R&S®UPV-B4x option series can be operated simultaneously in the R&S®UPV, e.g. for measuring digital audio chips. In fact, two R&S®UPV-B48 options can be installed to process up to 16 analog measurement channels at the same time.

Fields of use include surround sound applications or multichannel amplifiers in the automotive sector. Simultaneous testing of multiple DUTs can also increase throughput in production.

The measurement channels are connected via a 25-pin D-Sub male connector to which conventional cable whips can be connected. A cable with a junction to eight XLR female connectors is available as the R&S®UPV-Z48 option.

R&S®UPV-B2 digital audio interface

This option contains the digital audio interfaces (balanced, unbalanced and optical) for the standard sampling rates of 32 kHz to 192 kHz. Pages 9 and 10 describe the option and its software expansions (R&S®UPV-K21 digital audio protocol and R&S®UPV-K22 jitter and interface test) in greater detail.

R&S®UPV-B41 I²S interfaces

The R&S®UPV-B41 option, which can be inserted at the rear of the base unit, provides the R&S®UPV with I²S interfaces for generator and analyzer. For further information, see page 10.

R&S®UPV-B42 universal digital interfaces

The R&S®UPV-B42 option expands the R&S®UPV audio analyzer by adding universal, digital audio interfaces with which the parameters of the digital formats can be set with great flexibility. Virtually all common audio chips can be connected.

R&S®UPV-K421 PDM bitstream analysis

The PDM bitstream analysis option makes it possible to analyze the audio contents of digital 1 bit data streams in PDM format.

For further information about R&S®UPV-B42 and R&S®UPV-K421, see page 11.

R&S®UPV-K6 extended analysis functions

The rub&buzz measurement enables users to determine production errors in loudspeakers in next to no time by measuring the interference signals in the frequency range above the usual distortion products.

The third-octave analysis and 1/n octave analysis are important measurements throughout the field of acoustics. The levels are determined simultaneously in up to 32 third-octave bands and 128 single-tone bands in line with the requirements of class 0 of IEC 1260. The undersample FFT (see page 6) is also part of this option.

The transfer and coherence functions are used to determine the transmission behavior of a DUT with the aid of music, speech or noise signals. The impulse response display is based on these functions.

These functions can also be used for measuring the interchannel delay – for example, to determine the time delay of two channels during active transmission.

Speech and audio quality measurements: PESQ (R&S®UPV-K61 option), PEAQ (R&S®UPV-K62 option) and POLQA (R&S®UPV-K63 option)

Psycho-acoustic coding methods use the characteristics of the human ear and remove signal sections that have no effect on auditory perception before transmission. To develop suitable test methods, a large number of recorded audio samples with various speech and music examples were used.

These recordings were compressed using a variety of coders – and therefore different quality levels – and degraded by introducing typical network transmission interferences. A large number of test listeners rated these samples in a series of acoustic tests based on the standard scale for audio quality ranging from 1 (poor) to 5 (excellent).

The development of PESQ for speech signals and PEAQ for broadband audio signals provides methods that compare the original undegraded signals (reference signals) with the degraded signals (measurement signals) and then output objective measured values that correlate very well with the average of the listening test results. The latest method, POLQA, was developed primarily to handle the advanced coding and transmission methods for mobile phones. The R&S®UPV offers all these measurements in line with the methods licensed by the Opticom GmbH company in Erlangen, Germany.

Standard-compliant testing of hearing aids using the R&S®UPV-K7 and R&S®UPV-K71 options.

The measurement method referred to as the perceptual evaluation of speech quality (PESQ) was published in 2001 as Recommendation ITU-T P.862 by the International Telecommunication Union. It is used to measure the quality of speech signals that are transmitted at a low bit rate using high-compression psycho-acoustic coding methods (R&S®UPV-K61 option).

The measurement method referred to as the perceptual evaluation of audio quality (PEAQ) was published in 1998 as Recommendation ITU-R BS.1387 by the International Telecommunication Union. It is used to measure the quality of broadband audio signals (e.g. music) that are transmitted at a low bit rate using high-compression psycho-acoustic coding methods (R&S®UPV-K62 option). To measure dual-channel analog signals, the R&S®UPV-B3 option is additionally required.

Equipped with the R&S®UPV-K63 option, the R&S®UPV audio analyzer now also offers the measurement method referred to as the perceptual objective listening quality analysis (POLQA), which was published in 2011 as Recommendation ITU-T P.863 by the International Telecommunication Union. POLQA, a technology update to PESQ, was developed to meet the voice quality testing requirements of mobile network services. It offers measurements for higher transmission bandwidths and is also certified for acoustic measurements.

R&S®UPV-K7/-K71 software for hearing aid tests

After the R&S®UPV-K7 option has been installed in the R&S®UPV, the audio analyzer can test hearing aids in compliance with standards. The tests conform to IEC 60118 parts 0, 1, 2 and 7 as well as ANSI S3.22, therefore covering all specified tests.

If, in addition, measurements with speechlike test signals in line with IEC 60118 part 15 need to be performed, R&S®UPV-K7 can be extended with the R&S®UPV-K71 program package.

When necessary, the R&S®UPV-Z7 cable set for connecting the audio analyzer with an acoustic measurement chamber is available.

Further information is provided in the "Hearing aid measurements using the R&S®UPV Audio Analyzer" (PD 5214.5878.92) application brochure.

Acoustic measurements on mobile phones using the R&S®UPV-K9/-K91/-K92 option package

The acoustic transmission and reproduction quality of a mobile phone is the most important task in daily use. Therefore, this quality must be checked as part of quality assurance or sample checks during production, as well as for type approval.

The R&S®UPV audio analyzer and options described here determine the acoustic characteristics of these phones as specified by the bodies responsible for acoustic tests in the type approval of mobile phones. The tests are checked and validated by an independent test house.

The package of options for mobile phone measurements with the R&S®UPV audio analyzer consists of the R&S®UPV-K9 base software package and modules for the individual standards (R&S®UPV-K9x or R&S®UPV-K10x).

The R&S®UPV-K91 option covers all tests for UMTS and GSM phones in line with 3GPP TS 26.132. The R&S®UPV-K92 option is required when measuring CDMA2000® phones in line with the TIA-1042 and 3GPP2 C.S0056-0 standards.

The R&S®UPV also supports measurements on mobile phones using background noise in line with ETSI ES 202 396-1. The following components are required:

- The R&S®UPP-B8 eight-channel generator in the R&S®UPP audio analyzer (see R&S®UPP product brochure, PD 5214.3846.12) processes the necessary noise signals for each individual loudspeaker to obtain the required homogeneous sound field
- The R&S®UPV-K98 option allows the R&S®UPV audio analyzer to control and measure the sound field
- The 3QUEST method (R&S®UPV-K101 option) enables analyses in line with ETSI TS 103 106 and EG 202 396-3 and is used for measurements on mobile phones

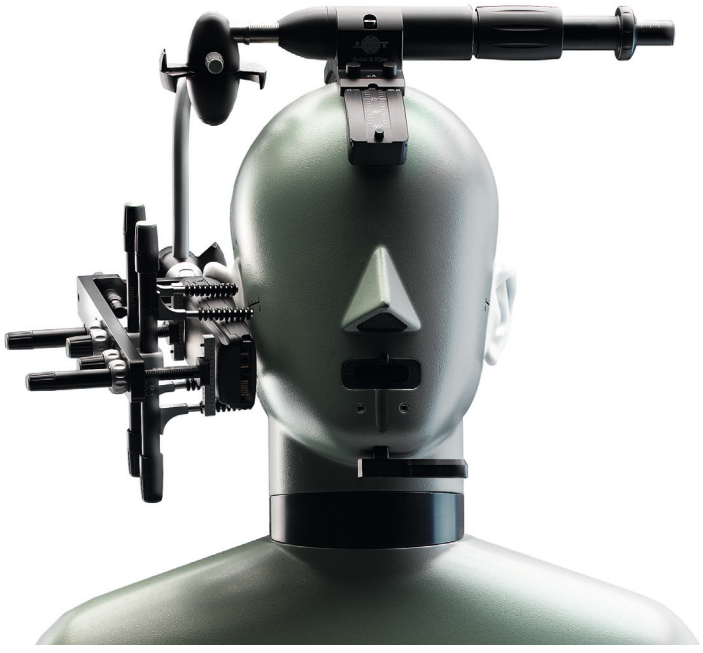
Operation always requires a combination of R&S®UPV-K9 and at least one of the R&S®UPV-K91/-K92 options; for detailed information, refer to the "Acoustic Measurements on Mobile Phones" (PD 5214.5884.92) application brochure.

R&S UPV-K4 remote control option

This option enables users to operate the R&S®UPV by remote control over either a LAN, USB or IEC/IEEE bus interface in line with IEC 625/IEEE 488. The commands used conform to the SCPI guidelines to the extent possible.

R&S®UPV-K1 universal sequence controller

This option enables users to create and execute measurement sequences, turning the R&S®UPV into an automatic tester. As a result, small test systems can be implemented cost-effectively, since no additional control PC is required. For further information, refer to page 15.



Validated options enable users to perform acoustic measurements of mobile phones in line with standards that are applicable worldwide.

R&S®UP-Z1MF XLR/BNC adapter set.

R&S®UPV-Z48 and R&S®UP-Z3 connecting cables.

R&S®UP-Z9 cable set.

The R&S®UPZ audio switcher can be controlled directly from the R&S®UPV.

R&S®UPV-U1 150 Ω modification

The modification changes the source impedance of the analog generators from 200 Ω to 150 Ω.

BNC monitoring outputs

The standard audio monitoring output includes a headphone output and an integrated loudspeaker via which the input signal as well as filtered or weighted signals can be monitored. Optionally, the available connectors can be expanded to include two BNC female connectors by adding the R&S®UPV-U2 option. It then becomes possible to connect an oscilloscope, for example.

R&S®UP-Z1MF XLR/BNC adapter set

Two XLR male to BNC and two XLR female to BNC adapters make the use of unbalanced cables easier.

Connecting cables

The R&S®UPV-B41 and R&S®UPV-B48 options are fitted with 25-pin D-Sub connectors.

- The R&S®UP-Z3 I²S cable routes the RX Data, RX BitClk, RX FSync, TX Data, TX BitClk, TX FSync and TX MasterClk lines from the D-Sub connector to separate BNC male connectors
- The R&S®UPV-Z48 cable for connecting the eight analog measurement channels of the R&S®UPV-B48 provides the junction from D-Sub to eight XLR female connectors
- Modern mobile phones are often connected to the audio analyzer via the phone's headset jack. The R&S®UP-Z9 cable set covers all common pin assignments for different connection requirements

Audio switcher

If multiple DUTs/channels have to be connected by means of cables such as during production, the R&S®UPZ audio switcher is the solution. The switcher is connected directly to the R&S®UPV audio analyzer and is operated from the control panel via an USB interface. The eight-channel R&S®UPZ is available as an input version and output version, and it can be cascaded to support up to 128 channels.

Further information is provided in the "R&S®UPZ Audio Switcher" (PD 0758.1170.32) data sheet.

Specifications in brief

Specifications in brief		
Dual-channel analog analyzer		
Inputs, 2 channels	XLR female, balanced (unbalanced measurements possible with R&S®UP-Z1MF XLR/BNC adapter) XLR pin 1 floating/grounded slectable, AC/DC coupling selectable	
Frequency range	bandwidth 22 kHz/40 kHz/80 kHz/250 kHz	DC/10 Hz to 21.76 kHz/40 kHz/80 kHz/250 kHz
Voltage range	RMS, sine	0.1 µV to 110 V
Measurement functions	base unit	RMS wideband, RMS selective, peak, quasi-peak, S/N, DC, FFT, THD, THD+N, SINAD, Mod Dist, DFD, DIM, polarity, waveform, frequency, phase, group delay
	R&S®UPV-K6 option	rub&buzz, 1/n octave analysis, undersample FFT, impulse response, transfer and coherence, inter-channel delay
	R&S®UPV-K61 option	PESQ
	R&S®UPV-K62 option	PEAQ
	R&S®UPV-K63 option	POLQA
Eight-channel analog inputs (R&S®UPV-B48 option)		
Inputs, 8 channels		25-pin D-Sub female balanced, AC/DC coupling selectable
Frequency range		DC/20 Hz to 40 kHz
Voltage range	RMS, sine	0.1 µV to 50 V
Measurement functions		RMS wideband, RMS selective, peak, S/N, DC, FFT, THD, THD+N, SINAD, Mod Dist, DFD, DIM, polarity, waveform, frequency, phase, group delay
Analog generator		
Outputs, 2 channels	XLR male, floating/grounded, balanced/unbalanced, short-circuit-proof	
Voltage	balanced, RMS, sine, open circuit	0.1 mV to 20 V
	unbalanced, RMS, sine, open circuit	0.1 mV to 10 V
Frequency range	base unit, sine	0.1 Hz to 80 kHz
	R&S®UPV-B1 option, sine	10 Hz to 185 kHz
Output signals	base unit	sine, multisine, sine burst, sine² burst, Mod Dist, DFD, noise, arbitrary waveform, polarity, FM, AM, DC, play WAVE files
	R&S®UPV-B3 option	stereo sine, DIM, square
Digital analyzer/generator		
Digital audio interfaces (R&S®UPV-B2 option)		
Connectors	balanced	XLR female/male, transformer coupling, 110 Ω
	unbalanced	BNC, grounded, 75 Ω
	optical	TOSLINK
Channels		1, 2 or both
Number of audio bits		8 to 24
Sampling rate		30 kHz to 200 kHz
Format		professional format (AES3) and consumer format (IEC 60958)
Output signals/measurement functions	R&S®UPV-B2 option	same as with analog device
	R&S®UPV-K21 option	digital audio protocol
	R&S®UPV-K22 option	jitter, common mode
I²S interface (R&S®UPV-B41 option)		
Connector		25-pin D-Sub male, BNC for external sync clock signal
Channels		1, 2 or both
Word length		16/24/32 bit per channel
Number of audio bits		8 to 32
Sampling rate		6.75 kHz to 400 kHz
Output signals/measurement functions		same as with analog device

Specifications in brief

Universal serial interface (R&S®UPV-B42 option)		
Interface		probe with female connector strips
Data lines		1 to 4
Channels		1 or 2 signals in up to 256 slots per frame
Slot length		8 bit to 256 bit
Number of audio bits		8 to 32
Sampling rate		0.85 kHz to 400 kHz
Operating modes		master, slave with numerous sync modes
Output signals/measurement functions		same as with analog instrument, plus jitter generation
Universal serial interfaces with PDM bitstream analysis (R&S®UPV-K421 option)		
Measurement channels	channel mode: mono	1 to 4 mono channels (data lines 1 to 4)
	channel mode: stereo	1 to 2 stereo channels (data lines 1 and 2)
Bitstream clock rate		512 kHz to 12.8 MHz
Bitstream clock duty cycle		40 % to 60 %
Downsampling factor		1/4/8/16/32/64/128/256
Sampling rate		2 kHz to 200 kHz
Number of audio bits		8 to 32
Measurement functions		same as with analog analyzer
FFT analysis		
Frequency range	digital	DC to 0.5 × sampling rate
	analog, bandwidth 22 kHz/40 kHz/80 kHz/250 kHz	DC to 22.5 kHz/43.5 kHz/87 kHz/250 kHz
Dynamic range	digital, R&S®UPV-B2 option	170 dB
	digital, R&S®UPV-B41/-B42 option	220 dB
	analog, bandwidth 22 kHz/40 kHz/80 kHz	120 dB
	analog, bandwidth 250 kHz	100 dB
Noise floor	digital, R&S®UPV-B2 option	–170 dB
	digital, R&S®UPV-B41/-B42 option	–220 dB
	analog, bandwidth 22 kHz/40 kHz/80 kHz	–140 dB
	analog, bandwidth 250 kHz	–120 dB
FFT length		512, 1k, 2k, 4k, 8k, 16k, 32k, 64k, 128k, 256k points
Window functions		rectangle, Hann, Blackman-Harris, Rife-Vincent 1-3, Hamming, flat-top
Filters		
Weighting filters	A weighting, C weighting, CCIR 1k weighted, CCIR 2k weighted, CCIR unweighted, CCITT, C message, DC noise highpass, deemphasis J.17, 50/15, 50, 75, preemphasis 50/15, 50, 75, IEC tuner, jitter weighted, rumble weighted, unweighted, highpass 22 Hz, 400 Hz, lowpass 22 kHz, 30 kHz, 80 kHz, AES 17	
User-definable filters	design parameters	8th order elliptical type C (for highpass and lowpass also 4th order selectable), stopband attenuation up to approx. 120 dB selectable
	types of filters	highpass, lowpass, bandpass, bandstop, notch, third-octave and octave filter
	file-defined filters	any 8th order filter cascaded from 4 biquads, defined in the z plane by poles/zeroes or coefficients
General data		
Rated voltage		100 V/120 V/220 V/230 V, 50 Hz to 60 Hz, 300 VA
Dimensions	W × H × D	465 mm × 197 mm × 495 mm (18.31 in × 7.76 in × 19.49 in)
Weight	with all options	15.0 kg (33.07 lb)

For data sheet, see 0758.1306.22 and www.rohde-schwarz.com

Ordering information

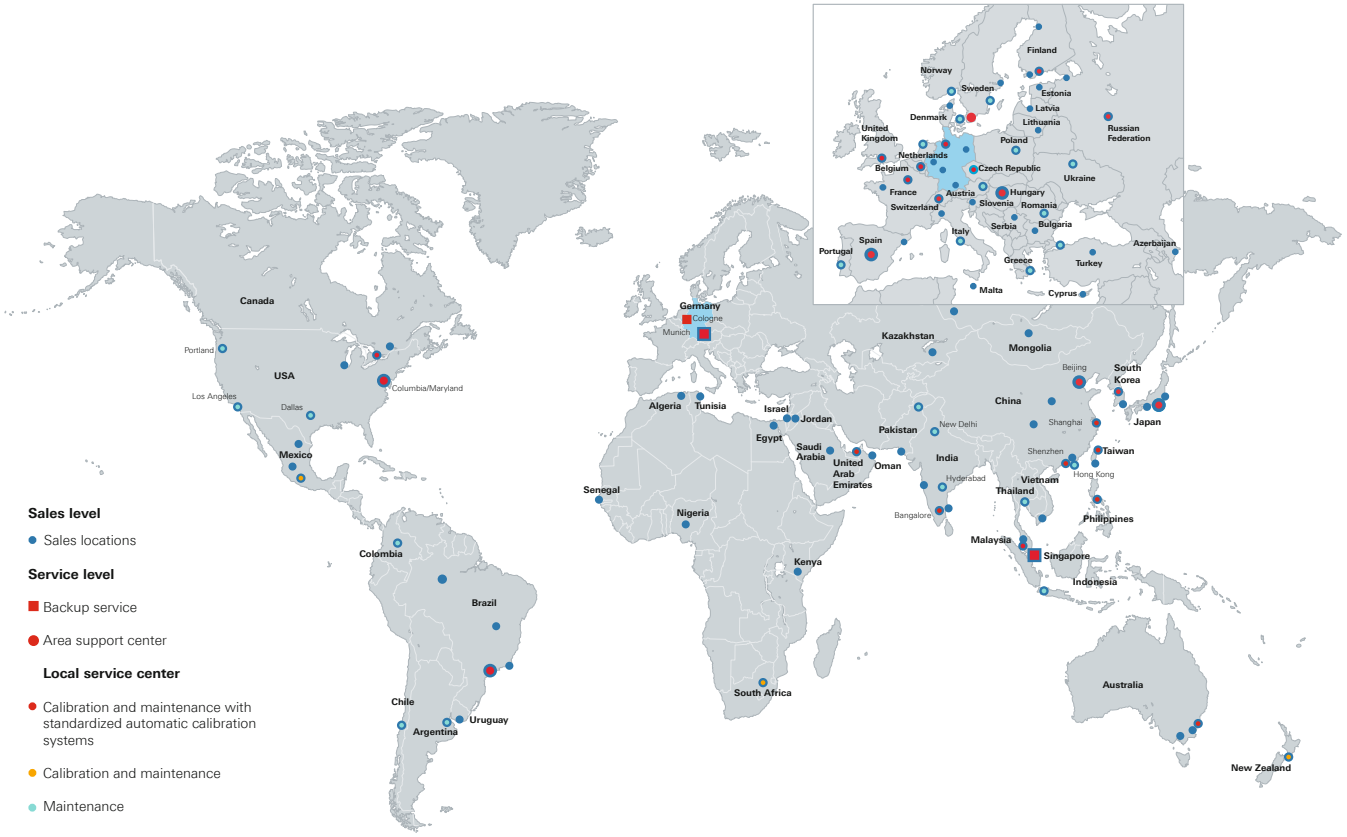
Designation	Type	Order No.
Base unit		
Audio Analyzer	R&S®UPV	1146.2003.02
Audio Analyzer, without display	R&S®UPV66	1146.2003.66
Accessories supplied		
Power cable		
Compact manual		
CD with operating manual/service manual		
Hardware options		
Low Distortion Generator	R&S®UPV-B1	1146.5202.02
Digital Audio Interfaces AES/EBU, S/P DIF	R&S®UPV-B2	1146.4306.02
Second Analog Generator	R&S®UPV-B3	1146.4806.02
I²S Interface	R&S®UPV-B41	1146.5402.02
Universal Serial Interface	R&S®UPV-B42	1146.5802.02
Eight-Channel Analog Inputs	R&S®UPV-B48	1402.2200.02
Modification 150 Ω	R&S®UPV-U1	1146.1507.02
BNC Phone Out	R&S®UPV-U2	1402.1704.02
Software options		
Universal Sequence Controller	R&S®UPV-K1	1401.7009.02
Digital Audio Protocol	R&S®UPV-K21	1401.7809.02
Jitter and Interface Test Software for R&S®UPV-B2	R&S®UPV-K22	1401.7909.02
Remote Control	R&S®UPV-K4	1401.9001.02
PDM Bitstream Analysis	R&S®UPV-K421	1402.1104.02
Extended Analysis Functions	R&S®UPV-K6	1401.9201.02
Software for PESQ® Measurement	R&S®UPV-K61	1401.7309.02
Software for PEAQ® Measurement	R&S®UPV-K62	1401.7750.02
Software for POLQA® Measurement	R&S®UPV-K63	1402.1156.02
Software for Hearing Aid Measurements	R&S®UPV-K7	1401.9301.02
Hearing Aid Speech Tests	R&S®UPV-K71	1402.1004.02
Base Software for Mobile Phone Tests	R&S®UPV-K9	1402.0008.02
UMTS/GSM Mobile Phone Tests	R&S®UPV-K91	1402.0108.02
CDMA2000® Mobile Phone Tests	R&S®UPV-K92	1402.0608.02
Background Noise Control Software for R&S®UPV-K91/92	R&S®UPV-K98	1424.2003.02
Background Noise Measurements for R&S®UPV-K91/92	R&S®UPV-K101	1424.2203.02
System components		
Cable Set for R&S®UPV-K7	R&S®UPV-Z7	1401.7609.02
Cable for R&S®UPV-B48	R&S®UPV-Z48	1401.7709.02
XLR/BNC Adapter Set, 2 male, 2 female	R&S®UP-Z1MF	1411.3306.02
I²S Cable for R&S®UPP-B2/UPV-B41	R&S®UP-Z3	1411.3458.02
Mobile Phone Headset Cable Set to R&S®UPV	R&S®UP-Z9	1411.3106.02
19" Rack Adapter	R&S®ZZA-411	1096.3283.00
Audio Switcher (Input)	R&S®UPZ	1120.8004.12
Audio Switcher (Output)	R&S®UPZ	1120.8004.13

Service options		
Extended Warranty, one year	R&S®WE1	Please contact your local Rohde&Schwarz sales office.
Extended Warranty, two years	R&S®WE2	
Extended Warranty, three years	R&S®WE3	
Extended Warranty, four years	R&S®WE4	
Extended Warranty with Calibration Coverage, one year	R&S®CW1	
Extended Warranty with Calibration Coverage, two years	R&S®CW2	
Extended Warranty with Calibration Coverage, three years	R&S®CW3	
Extended Warranty with Calibration Coverage, four years	R&S®CW4	

From pre-sale to service. At your doorstep.

The Rohde&Schwarz network in over 70 countries ensures optimum on-site support by highly qualified experts. User risks are reduced to a minimum at all stages of the project:

- Solution finding/purchase
- Technical startup/application development/integration
- Training
- Operation/calibration/repair



Service that adds value

- Worldwide
- Local and personalized
- Customized and flexible
- Uncompromising quality
- Long-term dependability

About Rohde&Schwarz

Rohde&Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established more than 75 years ago, Rohde&Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

Environmental commitment

- Energy-efficient products
- Continuous improvement in environmental sustainability
- ISO 14001-certified environmental management system

Certified Quality System
ISO 9001

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PD 0758.1306.12 | Version 05.00 | December 2013 (fi)
R&S®UPV Audio Analyzer

0758130612

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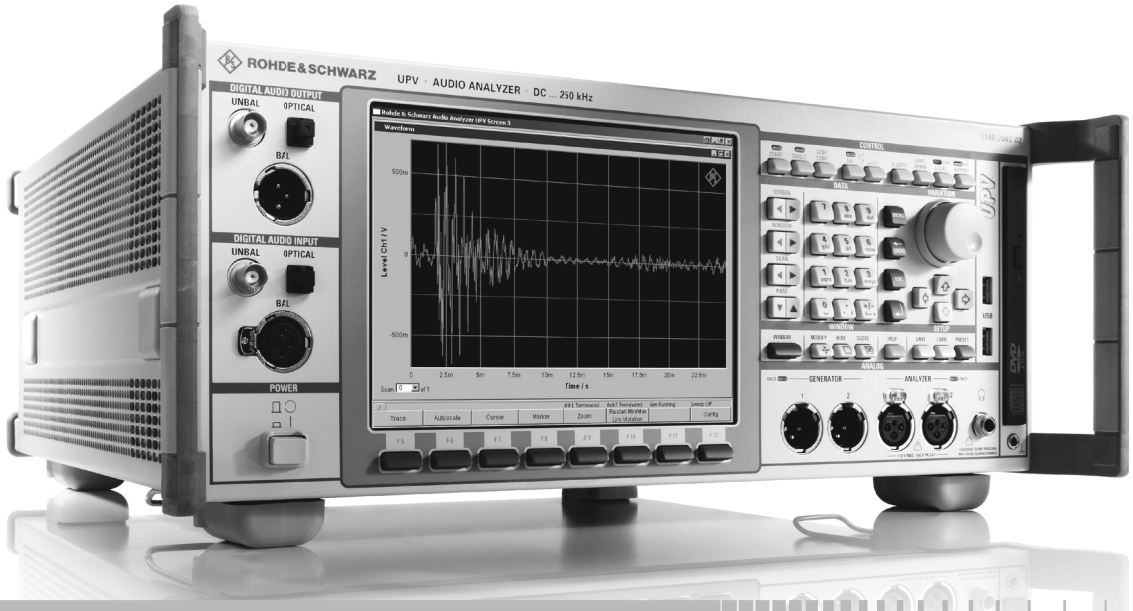
R&S®UPV
Audio Analyzer
Specifications



ROHDE&SCHWARZ

Test & Measurement

Data Sheet | 04.00

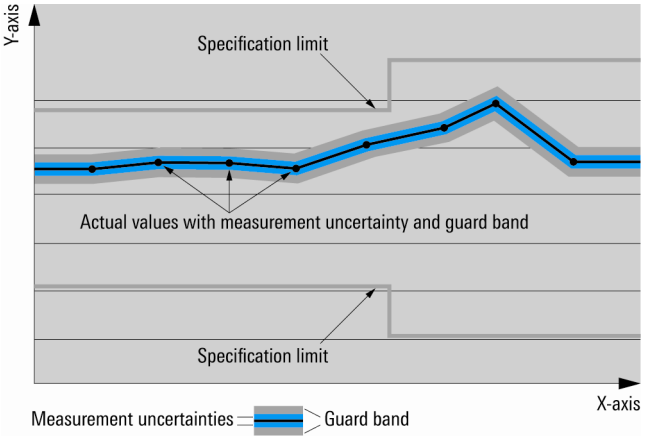
CONTENTS

Definitions

General
Product data applies under the following conditions:

- Three hours storage at ambient temperature followed by 30 minutes warm-up operation
- Specified environmental conditions met
- Recommended calibration interval adhered to
- All internal automatic adjustments performed, if applicable

Specifications with limits
Represent warranted product performance by means of a range of values for the specified parameter. These specifications are marked with limiting symbols such as <, ≤, >, ≥, ±, or descriptions such as maximum, limit of, minimum. Compliance is ensured by testing or is derived from the design. Test limits are narrowed by guard bands to take into account measurement uncertainties, drift and aging, if applicable.



Specifications without limits
Represent warranted product performance for the specified parameter. These specifications are not specially marked and represent values with no or negligible deviations from the given value (e.g. dimensions or resolution of a setting parameter). Compliance is ensured by design.

Typical data (typ.)
Characterizes product performance by means of representative information for the given parameter. When marked with <, > or as a range, it represents the performance met by approximately 80 % of the instruments at production time. Otherwise, it represents the mean value.

Nominal values (nom.)
Characterize product performance by means of a representative value for the given parameter (e.g. nominal impedance). In contrast to typical data, a statistical evaluation does not take place and the parameter is not tested during production.

Measured values (meas.)
Characterize expected product performance by means of measurement results gained from individual samples.

Uncertainties
Represent limits of measurement uncertainty for a given measurand. Uncertainty is defined with a coverage factor of 2 and has been calculated in line with the rules of the Guide to the Expression of Uncertainty in Measurement (GUM), taking into account environmental conditions, aging, wear and tear.

Device settings and GUI parameters are indicated as follows: "parameter: value".

Typical data as well as nominal and measured values are not warranted by Rohde & Schwarz

Analog analyzers

Analog measurements are available with different bandwidths, specifications and measurement functions.

Dual-channel inputs

Analyzer		
Bandwidth 22 kHz		DC/10 Hz to 21.76 kHz [1]
Bandwidth 40/80 kHz		DC/10 Hz to 40/80 kHz [1]
Bandwidth 250 kHz		DC/10 Hz to 250 kHz [1]

Level measurements (RMS)		
Level error	at 1 kHz	±0.05 dB, ±0.025 dB (typ.)
Frequency response (referenced to 1 kHz)	20 Hz to 20 kHz	±0.01 dB, ±0.003 dB (typ.), V_{in} < 3 V [2]
	20 kHz to 50 kHz	±0.03 dB, V_{in} < 3 V [2]
	50 kHz to 100 kHz	±0.1 dB
	100 kHz to 250 kHz	±0.3 dB

XLR connectors	2 channels, balanced (unbalanced measurements possible with the R&S®UP-Z1MF XLR/BNC adapter set), XLR pin 1 floating/grounded selectable, AC/DC coupling selectable	
Voltage range	RMS, sinewave	0.1 µV to 110 V
Measurement ranges		18 mV to 100 V, in steps of 5 dB
Input impedance		100 kΩ ± 1 % shunted by 120 pF (230 pF for ranges ≥ 6 V), each pin against ground
		300 Ω ± 0.5 %, P_{max} 2 W
		600 Ω ± 0.5 %, P_{max} 1 W
Crosstalk attenuation	frequency < 22 kHz, 600 Ω	> 120 dB
Common-mode rejection (V_{in} < 3 V)	at 50 Hz	> 90 dB
	at 1 kHz	> 86 dB
	at 20 kHz	> 80 dB
Generator output	each input channel switchable to any output channel	
	input impedance	200 kΩ balanced
		100 kΩ unbalanced

Dual-channel analog analyzer measurement functions

RMS, wideband		
Level error	measurement speed: auto	±0.05 dB, ±0.025 dB (typ.), at 1 kHz, sinewave
	measurement speed: auto fast	±0.1 dB additional error
Integration time	auto fast/auto	min. 200/4000 sample, at least 1 cycle
	gen track	min. 100 sample, at least 1 cycle
	value	0.1 ms to 100 s
Noise (input shorted)	22/40/80 kHz bandwidth	
	A weighted	< 1 µV, 0.7 µV (typ.)
	CCIR unweighted	< 1.4 µV, 1 µV (typ.)
	80 kHz bandwidth (no filter)	< 2.8 µV
	250 kHz bandwidth (no filter)	< 7 µV
Spectrum		post FFT

DC voltage		
Voltage range		0 V to ±110 V
Level error [3]		±(1 % of measured value + 0.1 % of measurement range)
Measurement ranges		100 mV to 100 V, in steps of 10 dB

FFT analysis		see FFT analyzer section

[1] DC/AC coupling.

[2] Additionally ±0.02 dB from 5 kHz to 50 kHz when V_{in} ≥ 3 V.

[3] Not valid for bandwidth 250 kHz.

Total harmonic distortion (THD)		
Fundamental		10 Hz to 110 kHz
Frequency tuning		automatic to input or generator signal or fixed through entered value
Weighted harmonics		any combination of d_2 to d_9, up to 250 kHz
Error limit	harmonics < 50 kHz	±0.5 dB
	harmonics < 100 kHz	±0.7 dB
	harmonics < 250 kHz	±1 dB
Inherent distortion (bandwidth 22 kHz) [4, 5]	fundamental 20 Hz to 10.95 kHz	< –110 dB, –115 dB (typ.)
	fundamental 10 Hz to 20 Hz	< –100 dB
Inherent distortion (bandwidth 40/80/250 kHz) [4, 5]	fundamental 50 Hz to 20 kHz	< –100 dB, –105 dB (typ.)
	fundamental 20 kHz to 50 kHz	< –90 dB, –95 dB (typ.)
	fundamental 50 kHz to 110 kHz	< –80 dB, –85 dB (typ.)
Spectrum		bargraph showing signal and distortion post FFT

THD+N and SINAD			
Fundamental			10 Hz to 110 kHz
Frequency tuning			automatic to input or generator signal or fixed through entered value
Input voltage			> 100 µV (typ.) with automatic tuning
Bandwidth			upper and lower frequency limit selectable, plus one weighting filter (selectable)
Error limit	bandwidth		
	< 50 kHz		±0.5 dB
	< 100 kHz		±0.7 dB
	< 250 kHz		±1 dB
Inherent distortion (analyzer bandwidth 22 kHz) [4]	fundamental	meas. bandwidth	typ. –110 dB at 1 kHz, 2.5 V; < –105 dB + 2 µV [6], typ. –108 dB + 1.5 µV
	up to 22 kHz	20 Hz to 22 kHz	
Inherent distortion (analyzer bandwidth 40/80/250 kHz) [4]	fundamental	meas. bandwidth	
	up to 20 kHz	20 Hz to 22 kHz	< –95 dB + 2.5 µV, typ. –100 dB + 1.75 µV
	up to 20 kHz	20 Hz to 80 kHz	< –90 dB + 5 µV, typ. –95 dB + 3.5 µV
	up to 50 kHz	20 Hz to 250 kHz	< –84 dB + 10 µV, typ. –90 dB + 7 µV
Spectrum			post FFT

Time domain display (WAVEFORM)		
Trigger		rising/falling edge
Trigger level		–100 V to +100 V
Trace length		max. 480 ksample per channel
Pretrigger		max. 19200 sample
Standard mode		each sample recorded
Compressed mode		peak value of up to 1024 recorded samples (envelope)
Undersample mode		undersampling factor up to 1024

Frequency		
Frequency range		20 Hz to 250 kHz
Frequency error		±10 ppm

Phase		
Frequency range		20 Hz to 250 kHz
Phase error	20 Hz to 22 kHz	±0.4°
	22 kHz to 50 kHz	±0.6°
	50 kHz to 100 kHz	±1.0°
	100 kHz to 250 kHz	±1.5°

[4] Total inherent distortion of analyzer and generator (with R&S®UPV-B1 option), analyzer with dynamic mode precision.

[5] 3 dB (typ.) less when > 3.5 V; sensitivity reduced by inherent noise when < 0.5 V.

[6] At full-scale level of measurement range (< –100 dB + 2 µV with autoranging), < –100 dB for input voltage > 3.5 V.

Eight-channel analog input (R&S®UPV-B48 option)

Two R&S®UPV-B48 options can be installed to provide 16 analog input channels.

8 analog input channels		25-pin D-Sub, balanced, TASCAM pinning
Bandwidth		DC, 20 Hz to 40 kHz
Level range	RMS, sinewave	1 µV to 50 V
Measurement ranges		200 mV to 50 V in steps of 12 dB autoranging or fixed, selectable for each channel, or coupled
Input impedance	each pin to ground	100 kΩ ±1 % ‖ 220 pF
AC/DC coupling		selectable for each channel, or coupled

Level error (RMS)	at 1 kHz	±0.05 dB, ±0.025 dB (typ.)
Frequency response (referenced to 1 kHz)	20 Hz to 20 kHz	±0.1 dB
	20 Hz to 40 kHz	±0.2 dB
Noise (RMS, input shorted)	A weighted	< 1.5 µV
	CCIR unweighted	< 2.0 µV
THD+N [7]	20 Hz to 20 kHz	typ. –100 dB at 1 kHz, 2.5 V <–94 dB + 2 µV
Frequency error	20 Hz to 40 kHz	±10 ppm
Phase error	20 Hz to 20 kHz	±0.5°
	20 kHz to 40 kHz	±1.0°
Level error (DC)		±(1 % of measured value + 0.2 % of measurement range)
Crosstalk attenuation	up to 20 kHz	> 100 dB (100 Ω)
Common-mode rejection (V_{in} < 3 V, DC coupling)	up to 20 kHz	> 50 dB

Measurement functions		RMS wideband, RMS selective, peak, S/N, DC, FFT, THD, THD+N, Mod Dist, DFD, DIM, polarity
Audio monitor		not available

[7] Total inherent distortion of analyzer and generator (with R&S®UPV-B1 option).

Analog generators

Outputs

XLR connectors (pin 1 not connected), 2 channels, floating/grounded selectable, balanced/unbalanced selectable, short-circuit-proof; max. current < 120 mA with external feed.

Balanced			
Voltage	RMS, sinewave, open circuit		0.1 mV to 20 V
Crosstalk attenuation	frequency < 20 kHz		> 115 dB
Source impedance			10 Ω (typ.)
			200 Ω (150 Ω with R&S®UPV-U1) ± 0.5 %
			600 Ω ± 0.5 %
Load impedance	incl. source impedance		> 400 Ω
Output balance	at 1 kHz		> 75 dB
	at 20 kHz		> 60 dB

Unbalanced			
Voltage	RMS, sinewave, open circuit		0.1 mV to 10 V
Crosstalk attenuation	frequency < 20 kHz		> 115 dB
Source impedance			5 Ω (typ.)
Load impedance			> 200 Ω

Signals

Sinewave			
Frequency range			0.1 Hz to 80 kHz
Frequency error			±10 ppm
Level error	at 1 kHz		±0.05 dB
Frequency response (referenced to 1 kHz)	20 Hz to 20/70/80 kHz		±0.01 dB/ ±0.05dB /±0.1 dB
Inherent distortion (THD+N)	level < 3 V		
	fundamental	meas. bandwidth	
	20 Hz to 20 kHz	22 kHz	< –103 dB + 2.5 µV, –107 dB (typ.)
	20 Hz to 20 kHz	80 kHz	< –90 dB + 5 µV
Sweep parameters			frequency, level

Sinewave (with R&S®UPV-B1 low distortion generator option)			
Frequency range			10 Hz to 185 kHz
Frequency error	10 Hz to 100 kHz		±0.5 %
	100 kHz to 185 kHz		±0.75 %
Level error	at 1 kHz		±0.05 dB
Frequency response (referenced to 1 kHz)	20 Hz to 20 kHz		±0.01 dB
	10 Hz to 100 kHz		±0.05 dB
	100 kHz to 150 kHz		±0.15 dB
	150 kHz to 185 kHz		±0.25 dB
Harmonics	measurement bandwidth 20 Hz to 20 kHz, voltage 1 V to 5 V		< –115 dB (typ.), < –120 dB at 1 kHz
Inherent distortion (THD)	fundamental		
	1 kHz, 1 V to 10 V		< –120 dB (typ.)
	20 Hz to 7 kHz		< –110 dB, –115 dB (typ.)
	7 kHz to 20 kHz		< –105 dB, –110 dB (typ.)
	20 kHz to 50 kHz		< –88 dB
	50 kHz to 100 kHz		< –80 dB
Inherent distortion (THD+N) [8]	fundamental	meas. bandwidth	
	1 kHz, 2.5 V	22 kHz	–110 dB (typ.)
	20 Hz to 20 kHz	22 kHz	< –100 dB + 2 µV
	20 Hz to 20 kHz	100 kHz	< –88 dB + 5 µV
Sweep parameters			frequency, level

[8] Total inherent distortion of analyzer and generator, analyzer with dynamic mode precision.

Stereo sinewave (only with R&S®UPV-B3 second analog generator option)		
Frequency range		0.1 Hz to 80 kHz
Frequency		adjustable for each channel
Phase	same frequency in both channels	–360° to +360°
Level		adjustable for each channel or channel ratio 2/1
Sweep parameters		frequency, level of channel 1

Mod Dist	for measuring the modulation distortion in line with IEC 60268-3	
Frequency range	lower frequency (LF)	30 Hz to 2700 Hz
	upper frequency (UF)	8 × LF to 21.75 kHz
Level ratio (LF:UF)		selectable from 10:1 to 1:1
Level error		±0.5 dB
Inherent distortion	level ratio LF:UF = 4:1	
	at 7 kHz, 60 Hz	< –96 dB, –108 dB (typ.)
		< –90 dB, –103 dB (typ.)
Sweep parameters		upper frequency, level

DFD	for measuring the difference frequency distortion in line with IEC 60268-3 or IEC 60118	
Frequency range	difference frequency	80 Hz to 2 kHz
	mean frequency	200 Hz to 20.75 kHz
Level error		±0.5 dB
Inherent distortion [9]	DFD d_2	< –115 dB, –120 dB (typ.)
	DFD d_3	< –94 dB, –103 dB (typ.)
Sweep parameters		mean frequency, level

DIM (only with R&S®UPV-B3 second analog generator option)	for dynamic intermodulation distortion (DIM) measurements in line with DIN IEC 60268-3	
Waveform	squarewave/sinewave frequency	3.15/15 kHz or 2.96/14 kHz or 2.96/8 kHz
	squarewave/sinewave amplitude ratio	4:1
	bandwidth (3 dB)	30/100 kHz selectable
Max. level (peak-to-peak)		50 V (25 V unbalanced)
Level error		±0.5 dB
Inherent distortion [10]	level < 3 V RMS	< –95 dB, –105 dB (typ.)
	level > 3 V RMS	< –90 dB, –100 dB (typ.)
Sweep parameters		level

Sine burst, sine² burst		
Burst time		1 sample up to 60 s, 1-sample resolution
Interval		burst time up to 3600 s, 1-sample resolution
Low level		0 to burst level, absolute or relative to burst level (0 for sine² burst)
Bandwidth		80 kHz
Sweep parameters		burst frequency, level, time, interval

Noise		
Distribution		Gaussian, triangular, rectangular

Arbitrary waveform		
Memory depth		max. 256 ksample
Clock rate	with bandwidth set to 22 kHz/40 kHz/80 kHz	48 kHz/96 kHz/192 kHz
File format		*.arb

[9] Mean frequency > 5 kHz, difference frequency < 1 kHz, DFD d_2 –100 dB (typ.) with DC offset.

[10] Level > 0.5 V. Typical values apply from 0.5 V to 6 V.

Polarity test signal		asymmetrical two-tone signal (fundamental + 2nd harmonic)
Fundamental frequency		0.1 Hz to 32 kHz

FM signal		
Carrier frequency		0.1 Hz to 80 kHz
Modulation frequency		1 µHz to 80 kHz
Modulation		0 % to 100 %

AM signal		
Carrier frequency		0.1 Hz to 80 kHz
Modulation frequency		1 µHz to 80 kHz
Modulation		0 % to 100 %

DC voltage		
Level range	balanced	0 V to ±10 V
	unbalanced	0 V to ±5 V
Level error		±2 %
Sweep parameters		level

DC offset [11]		
Level range	balanced	0 V to ±10 V
	unbalanced	0 V to ±5 V
Level error		±2 %
Residual offset		±1 % of RMS value of AC signal

[11] No DC offset for DIM signal or sinewave with low distortion generator on. With DC offset, the AC voltage swing will be reduced; specified inherent distortion values valid for DC offset = 0.

Digital analyzers

Digital audio inputs (R&S®UPV-B2 option)

Balanced input		XLR connector, transformer coupling
Impedance		110 Ω
Level	peak-to-peak	200 mV to 12 V
Unbalanced input		BNC, grounded
Impedance		75 Ω
Level	peak- to-peak	100 mV to 5 V
Optical input		TOSLINK
Channels		1, 2 or both
Audio bits		8 to 24
Clock rate		30 kHz to 200 kHz
Format		professional format (AES3) and consumer format (IEC 60958)
Reclocking		input signal sampled with low-jitter clock signal and available at AUX output (XLR connector on rear panel)

I²S input (R&S®UPV-B41 option)

Input		25-pin D-Sub connector (male)
Level	low	< 0.8 V (min. –5 V)
	high	> 2 V (max. 10 V)
Impedance	level –0.5 V to +5.5 V	10 kΩ
	level –5 V to –0.5 V and +5 V to +10 V	100 Ω
Channels		1, 2 or both multiplexed
Word length		16 bit/24 bit/32 bit per channel
Audio bits		8 to 32
Word clock rate		6.75 kHz to 400 kHz

Universal serial interface input (R&S®UPV-B42 option)

Interface format		
Connector		26-pin connector strip, 2.54 mm (female)
Input data lines		4
Data routing		any input data line to any measurement channel
Input measurement channels	dual-channel analyzer mode	1 or 2
	eight-channel analyzer mode	1 to 8
Samples per frame	single-sample format	1
	multisample format	2 to 32
Number of slots	single-sample format	1 to 256
	multisample format	up to 32
Slot length		8 bit to 256 bit
Frame length	slot length × number of slots	8 bit to 2048 bit
Lead bits		0 to (slot length – audio bits)
Audio bits		8 to 32
Audio bit order		MSB or LSB first
Audio bit decoding mode		linear PCM, A-law, µ-law
Clock mode		continuous clock, gated clock
Synchronization	internal	internal clock source
	external	frame sync, frame sync and bit clock, master clock

Clocks		
Sampling frequency		0.84375 kHz to 400 kHz
Mixed sampling frequencies ratio	with multisample format only	2, 3, 4, 5, 6
Frame sync	frequency	0.84375 kHz to 400 kHz
	width	1 to (slot length × number of slots) – 1
	slope	rising/falling
	offset (relative to frame)	–(number of slots × slot length) to (number of slots × slot length) – 1
Bit clock	frequency	6.75 kHz to 55.296 MHz
	slope	rising/falling
Master clock	frequency	13.5 kHz to 110.592 MHz
	ratio to frame sync	16 to 768
Timing		
Sampling delay	sync mode: frame sync and bit clock	–9 ns to +8 ns
	other sync modes	–12 ns to +5 ns
Data and frame sync to bit clock (relative to bit clock)	setup time	–1.3 ns
	hold time	4.6 ns
Measurement functions	dual-channel analyzer mode	same as for digital audio analyzer
	eight-channel analyzer mode	RMS wideband, RMS selective, peak, S/N, DC, FFT, THD, THD+N, Mod Dist, DFD, DIM, polarity

Outputs		
Logic voltage	CMOS	0.9 V, 1.2 V, 1.5 V, 1.8 V, 2.5 V
	LVTTL	3.3 V
Impedance	short-circuit-proof	50 Ω
Maximum reverse voltage		–3 V to selected logic voltage + 3 V

Inputs		
Logic voltage	CMOS	0.9 V, 1.2 V, 1.5 V, 1.8 V, 2.5 V
	LVTTL	3.3 V
Impedance	–0.3 V to selected logic voltage + 0.3 V	10 kΩ
	–4 V to –0.3 V or selected logic voltage + 0.3 V to selected logic voltage + 4 V	100 Ω
Maximum input voltage		–4 V to selected logic voltage + 4 V

Clock I/O configuration					
Synchronization	Internal clock	External master clock	External frame sync	External frame sync (audio monitor)	External frame sync and bit clock
Master clock output	●		●		
Master clock input		●			
Bit clock output	●	●	●	●	
Bit clock input					●
Frame sync output	●	●	●	●	
Frame sync input			●	●	●

Unused outputs are tristated.

PDM bitstream analyzer (R&S®UPV-K421 option)

Universal serial interface (R&S®UPV-B42 option) required.

Interface format		
Connector		26-pin connector strip, 2.54 mm (female)
Input data lines		4
Input measurement channels	channel mode: mono	1 to 4 mono channels (data lines 1 to 4)
	channel mode: stereo	1 to 2 stereo channels (data lines 1 and 2)
Data alignment (relative to bitstream clock)	channel mode: mono	rising/falling
	channel mode: stereo	ch1 rising/ch2 falling, ch1 falling/ch2 rising, ch1 high/ch2 low, ch1 low/ch2 high
Downsampling factor		1/4/8/16/32/64/128/256 [12]
Audio bits		8 to 32
Clock source	internal	channel mode: mono or stereo
	external	channel mode: mono only

Clocks		
Bitstream clock frequency	internal, external	1 kHz to 12.800 MHz
Bitstream clock duty cycle	internal clock > 1 MHz	40 % to 60 % adjustable
	external clock > 1 MHz	40 % to 60 %
Sampling frequency	depends on bitstream clock frequency and downsampling factor	4 Hz to 400 kHz

Timing		
Sampling delay		–9.323 ns to +9.323 ns
Data to bitstream clock (relative to bitstream clock)	setup time	–1.3 ns
	hold time	4.6 ns

Measurement functions		same as for digital audio analyzer

Output (clock)		
Logic voltage	CMOS	0.9 V, 1.2 V, 1.5 V, 1.8 V, 2.5 V
	LVTTL	3.3 V
Impedance	short-circuit-proof	50 Ω
Maximum reverse voltage		–3 V to selected logic voltage + 3 V

Inputs (data and clock)		
Logic voltage	CMOS	0.9 V,1.2 V,1.5 V,1.8 V,2.5 V
	LVTTL	3.3 V
Impedance	–0.3 V to selected logic voltage + 0.3 V	10 kΩ
	–4 V to –0.3 V or selected logic voltage + 0.3 V to selected logic voltage + 4 V	100 Ω
Maximum input voltage		–4 V to selected logic voltage + 4 V

[12] With downsampling factor 1 measurement functions are restricted to FFT, waveform and frequency. No filters.

Digital audio analyzer measurement functions

All measurements at 24 bit, full scale.

RMS, wideband		
Measurement bandwidth		up to 50 % of sampling rate
Level error	auto fast	±0.1 dB
	auto	±0.01 dB
	gen track	±0.001 dB
Integration time	auto fast/auto	min. 200/4000 sample, at least 1 cycle
	gen track	min. 100 sample, at least 1 cycle
	value	0.1 ms to 100 s
Spectrum		post FFT

DC voltage		
Measurement range		0 to ±1 FS
Level error		±1 %

FFT analysis		see FFT analyzer section

Total harmonic distortion (THD)		
Fundamental		10 Hz to 23.9 % of sampling rate
Frequency tuning		automatic to input or generator signal or fixed through entered value
Weighted harmonics		any combination of d_2 to d_9, up to 21.90 kHz
Error limit		±0.3 dB
Inherent distortion [13]		< –155 dB
Spectrum		bargraph showing signal and distortion post FFT

THD+N and SINAD		
Fundamental		10 Hz to 47.9 % of sampling rate
Frequency tuning		automatic to input or generator signal or fixed through entered value
Stopband range		fundamental ± 28 Hz, max. up to 2nd harmonic
Bandwidth		upper and lower frequency limit selectable, plus one weighting filter (selectable)
Error limit		±0.3 dB
Inherent distortion [13]	bandwidth 20 Hz to 21.90 kHz	< –142 dB
Spectrum		post FFT

Time domain display (WAVEFORM)		
Trigger		rising/falling edge
Trigger level		–1 FS to +1 FS
Trace length		max. 480 ksample per channel
Pretrigger		max. 19200 sample
Standard mode		each sample recorded
Compressed mode		peak value of up to 1024 recorded samples (envelope)
Undersample mode		undersampling factor up to 1024

Frequency		
Frequency range		20 Hz to 47.9 % of sampling rate
Frequency error		±10 ppm

Phase		
Frequency range		20 Hz to 47.9 % of sampling rate
Phase error		±0.4°

[13] Total inherent distortion of analyzer and generator.

Digital generators

Digital audio outputs (R&S®UPV-B2 option)

Balanced output		XLR connector, transformer coupling
Impedance		110 Ω, short-circuit-proof
Level (peak-to-peak)	into 110 Ω	0 V to 8 V, in 240 steps
Level error	RMS	±1 dB
Unbalanced output		BNC, transformer coupling
Impedance		75 Ω, short-circuit-proof
Level (peak-to-peak)	into 75 Ω	0 V to 2 V, in 240 steps
Level error	RMS	±1 dB
Optical output		TOSLINK
Channels		1, 2 or both
Audio bits		8 to 24
Clock rate	internal: generator clock or synchronization to analyzer external: synchronization to word clock input, DARS	30 kHz to 200 kHz
Format		professional format (AES3) and consumer format (IEC 60958) as well as user-definable formats at all outputs
Phase (output to reference)		adjustable between –64 UI and +64 UI
Cable simulator		100 m typical audio cable

I²S output (R&S®UPV-B41 option)

Output		25-pin D-Sub connector (male)
Impedance		50 Ω, short-circuit-proof
Level		3.3 V
Channels		1, 2 or both multiplexed
Word length		16 bit/24 bit/32 bit per channel
Audio bits		8 to 32
Word clock rate	word length 16 bit/32 bit	6.75 kHz to 400 kHz
	word length 24 bit	6.75 kHz to 200 kHz
Synchronization		internal clock, external word clock or master clock
Master/word clock ratio [14]	sync to internal clock, external word clock	
	word length: 16 bit	64, 128, 256, 512
	word length: 24 bit	96, 192, 384
	word length: 32 bit	128, 256, 512
	sync to external master clock	
	word length: 16 bit/32 bit	128, 256, 512
	word length: 24 bit	192, 384
Master clock rate		432 kHz to 51.2 MHz
Clock input (TX CLK IN)		BNC
Level	low	< 0.8 V (min. –5 V)
	high	> 2 V (max. +10 V)
Impedance	level: –0.5 V to +5.5 V	10 kΩ
	level: –5 V to –0.5 V or +5 V to +10 V	100 Ω

[14] Master clock max. 51.2 MHz.

Universal serial interface output (R&S®UPV-B42 option)

Interface format		
Connector		26-pin connector strip, 2.54 mm (female)
Output data lines		4
Data routing	to any slot in any data line	signal from generator channel 1 or 2, zero, tristate
Samples per frame	single-sample format	1
	multisample format	up to 32
Number of slots	single-sample format	1 to 256
	multisample format	2 to 32
Slot length		8 bit to 256 bit
Frame length		8 bit to 2048 bit (slot length × number of slots)
Lead bits		0 to (slot length – audio bits)
Audio bits		8 to 32
Audio bit order		MSB or LSB first
Audio bit coding mode		linear PCM, A-law, µ-law
Clock mode		continuous clock, gated clock
Synchronization	internal	internal clock source
	external	frame sync, frame sync and bit clock, master clock

Clocks		
Sampling frequency		0.84375 kHz to 400 kHz
Mixed sampling frequencies ratio	with multisample format only	2, 3, 4, 5, 6
Frame sync	frequency	0.84375 kHz to 400 kHz
	width	1 to (slot length × number of slots) – 1
	slope	rising/falling
	offset (relative to frame)	–(number of slots × slot length) to (number of slots × slot length) – 1
Bit clock	frequency	6.75 kHz to 55.296 MHz
	slope	rising/falling
	jitter frequency (depends on amplitude)	0 Hz to 110 MHz
	jitter amplitude (depends on frequency)	0 UI to 2.5 UI
Master clock	frequency	13.5 kHz to 110.592 MHz
	ratio to frame sync	16 to 768
	jitter frequency (depends on amplitude)	0 Hz to 110 MHz
	jitter amplitude (depends on frequency)	0 UI to 2.5 UI
Slot clock	frequency	0.84375 kHz to 400 kHz
	width	1 to (slot length – 1)
	slope	rising/falling
	offset (relative to frame)	–(slot length – 1) to (slot length – 1)

Timing		
Skew (relative to bit clock)	data line 1/2/3/4	–0.5 ns, –0.7 ns, –0.2 ns, –0.5 ns
	frame sync	–0.3 ns
	slot clock	–0.1 ns
TCO (slave mode)	data line 1/2/3/4	7.3 ns, 7.1 ns, 7.6 ns, 7.3 ns
	frame sync	7.7 ns
	slot clock	7.8 ns

Outputs		
Logic voltage	CMOS	0.9 V, 1.2 V, 1.5 V, 1.8 V, 2.5 V
	LVTTL	3.3 V
Impedance	short-circuit-proof	50 Ω
Maximum reverse voltage		–3 V to selected logic voltage + 3 V

Inputs		
Logic voltage	CMOS	0.9 V, 1.2 V, 1.5 V, 1.8 V, 2.5 V
	LVTTL	3.3 V
Impedance	–0.3 V to selected logic voltage + 0.3 V	10 kΩ
	–4 V to –0.3 V or selected logic voltage + 0.3 V to selected logic voltage + 4 V	100 Ω
Maximum input voltage		–4 V to selected logic voltage + 4 V

Clock I/O configuration						
Synchronization	Internal clock	External master clock	External frame sync	External frame sync (audio monitor)	External frame sync and bit clock	External frame sync and bit clock (gated)
Master clock output	●		●		●	
Master clock input		●				
Bit clock output	●	●	●	●		
Bit clock input					●	●
Frame sync output	●	●	●	●		
Frame sync input			●	●	●	●
Slot clock output	●	●	●	●	●	●

Unused outputs are tristated.

Signals

All signals 24 bit, full scale.

General characteristics		
Dither	for sinewave, stereo sinewave, DFD and Mod Dist	
	distribution	Gaussian, triangular, rectangular
	level	0.5 LSB to 1 FS
Frequency error	internal clock	±10 ppm
	relative to clock rate	±1 ppm
DC offset		0 to ±1 FS adjustable

Sinewave		
Frequency range		0.1 Hz to 49.9 % of sampling rate
Inherent distortion (THD) [15]		< –155 dB
Sweep parameters		frequency, level

Stereo sinewave		
Frequency range		0.1 Hz to 47.9 % of sampling rate
Frequency		adjustable for each channel
Phase	same frequency in both channels	–360° to +360°
Level		adjustable for each channel or channel ratio 2/1
Sweep parameters		frequency and level of channel 1

Mod Dist	for measuring the modulation distortion	
Frequency range	lower frequency (LF)	30 Hz to UF/8
	upper frequency (UF)	8 × LF to 47.9 % of sampling rate
Level ratio (LF:UF)		selectable from 10:1 to 1:1
Inherent distortion [15]	level LF:UF = 4:1 with 1 LSB triangular dither	< –142 dB
Sweep parameters		upper frequency, level

DFD	for measuring the difference frequency distortion	
Frequency range	difference frequency	80 Hz to 2 kHz
	mean frequency	200 Hz to 20.90 kHz
Inherent distortion [15]	DFD d_2, DFD d_3 with 1 LSB triangular dither	< –155 dB
Sweep parameters		mean frequency, level

Sine burst, sine^2 burst		
Burst time		1 sample up to 60 s, 1-sample resolution
Interval		burst time up to 3600 s, 1-sample resolution
Low level		0 to burst level, absolute or referenced to burst level (0 for sine^2 burst)
Sweep parameters		burst frequency, level, time, interval

Noise		
Distribution		Gaussian, triangular, rectangular

Arbitrary waveform		
Memory depth		max. 256 ksample
Clock rate		sampling rate of generator
File format		*.arb

Polarity test signal		asymmetrical two-tone signal (fundamental + 2nd harmonic)
Fundamental frequency		0.1 Hz to 16.6 % of sampling rate

[15] Total inherent distortion of analyzer and generator.

FM signal		
Carrier frequency		0.1 Hz to 49.9 % of sampling rate
Modulation frequency		1 µHz to 49.9 % of sampling rate
Modulation		0 % to 100 %

AM signal		
Carrier frequency		0.1 Hz to 49.9 % of sampling rate
Modulation frequency		1 µHz to 49.9 % of sampling rate
Modulation		0 % to 100 %

DC voltage		
Level range		0 to ±1 FS
Sweep parameters		level

FFT analyzer

Frequency range	digital	DC to 50 % of sampling rate
	analog bandwidth 22/40/80/250 kHz	DC to 22.5/43.5/87/250 kHz
Dynamic range	digital 24 bit/32 bit	170 dBFS/220 dBFS
	analog bandwidth 22 kHz/40 kHz/80 kHz	120 dB [16]
	analog bandwidth 250 kHz	100 dB [16]
Noise floor	digital 24 bit/32 bit	–170 dBFS/–220 dBFS
	analog bandwidth 22 kHz/40 kHz/80 kHz	–140 dB [16]
	analog bandwidth 250 kHz	–120 dB [16]
FFT size		512, 1k, 2k, 4k, 8k, 16k, 32k, 64k, 128k, 256k points
Window functions		rectangular, Hann, Blackman-Harris, Rife-Vincent 1-3, Hamming, flat top

Filter

For all analog and digital analyzers and generators. All filters are digital filters.

Analyzer	prefilter	1 weighting or user-definable filter
	function filter	up to 3 weighting or user-definable filters
Generator		1 weighting or user-definable filter

Weighting filters		A weighting
		C weighting
		CCIR 1k weighted
		CCIR 2k weighted
		CCIR unweighted
		CCITT
		C message
		DC noise highpass
		deemphasis J.17, 50/15, 50, 75
		preemphasis 50/15, 50, 75
		IEC tuner
		jitter weighted
		rumble weighted, unweighted

[16] Relative to the nominal value of the measurement range in V. Valid for measurement ranges ≥ 300 mV and an FFT resolution of 2.93 Hz.

Highpass and lowpass filters		highpass 22 Hz
		highpass 400 Hz
		lowpass 22 kHz
		lowpass 30 kHz
		lowpass 80 kHz
		AES 17 lowpass

User-definable filters		
Design parameters		8th order elliptical, type C (for highpass and lowpass filters also 4th order), passband ripple +0 dB/–0.1 dB, stopband attenuation approx. 20 dB to 120 dB selectable in steps of approx. 10 dB (highpass and lowpass filters: stopband attenuation 40 dB to 120 dB)
Highpass, lowpass filters		passband (–0.1 dB) selectable, stopband indicated
Bandpass, bandstop filters		passband (–0.1 dB) selectable, stopband indicated
Notch		center frequency and width (–0.1 dB) selectable, stopband indicated
Third octave and octave filters		center frequency selectable, bandwidth (–0.1 dB) indicated
File-defined filters		any 8th order filter cascaded from 4 biquads, defined in the z plane by poles/zeroes or coefficients

Analog notch filter		for measurements on signals with high S/N ratio, this filter improves the dynamic range of the analyzer by up to 30 dB to 140 dB for an analyzer bandwidth of 22/40/80 kHz, or 120 dB for an analyzer bandwidth of 250 kHz (typical noise floor of FFT); the filter is also used for measuring THD, THD+N and Mod Dist with dynamic mode precision
Characteristics	available in dual channel analog analyzer with measurement functions	RMS (wideband)
		RMS (selective)
		quasi-peak
		FFT analysis
Frequency range	center frequency (f_c)	10 Hz to 110 kHz
Frequency tuning		automatic to input signal
		coupled to generator
		fixed through entered value
Stopband	f_c ± 0.5 %	> 30 dB (typ.)
Passband	at 0.77 × f_c and 1.3 × f_c	–3 dB (typ.)
	outside 0.5 × f_c to 2 × f_c	+0 dB/–1 dB (typ.)

Sweep

Generator sweep		
Parameters		frequency, level, with bursts also interval and duration, one- or two-dimensional
Sweep		linear, logarithmic, single, continuous
Stepping		automatic after end of measurement
		time delay (fixed or loaded table)

Sweep speed		
Two-channel RMS measurement 20 Hz to 20 kHz, 30-point generator sweep logarithmic (frequency measurement switched off, low distortion generator off)	gen track	1.0 s
	auto fast	1.2 s
	auto	2.0 s

Display of results

Units		
Level (analog)		V, dBu, dBV, W, dBm, difference (Δ), deviation (Δ%) and ratio (without dimension, %, dBr) to reference value
Level (digital)		FS, %FS, dBFS, LSBs, deviation (Δ%) or ratio (dBr) to reference value
Distortion		% or dB, referenced to signal amplitude, THD and THD+N in all available level units (absolute or relative to selectable reference value)
Frequency		Hz, difference (Δ), deviation (Δ%) and ratio (as quotient f/f_{ref}, 1/3 octave, octave or decade) to reference value (entered or stored, current generator frequency)
Phase		°, rad, difference (Δ) to reference value (entered or stored)
Reference value (level)		fixed value (entered or stored)

Graphical display of results		
Monitor (not R&S®UPV66)		8.4" LCD, color
Display of results		numeric display
		combi display with numeric value, bargraph, min./max. and limits (for each numeric result)
		sweep trace
		spectrum
		waveform
		list of results
		bargraph for THD and intermodulation measurements
Display functions		autoscale
		x- and y-axis zoom
		2 vertical and 2 horizontal cursor lines
		search function for max. values
		marker for harmonics (spectrum)
		change of unit and scale also possible for loaded traces

Test reports		
Functions		screen copy to clipboard, file or printer

Audio monitor

Loudspeaker		built in
Headphone connector		6.3 mm jack
Output voltage	peak	max. 7 V
Source impedance		100 Ω, short-circuit-proof
Recommended headphone impedance		600 Ω

150 Ω modification (R&S®UPV-U1 option)

Change of source impedance of analog generator to 150 Ω (instead of factory-set value of 200 Ω).

BNC phone out (R&S®UPV-U2 option)

Two BNC connectors at the rear panel in parallel to the left and right channels of the headphone output.

Digital audio protocol (R&S®UPV-K21 option)

Digital audio I/O 192 kHz (R&S®UPV-B2 option) required.

Generator		
Validity bit		NONE, L+R
Channel status data		mnemonic entry for professional format (AES3) and consumer format (IEC 60958)

Analyzer		
Error flags		PCM, parity, lock, CRC, validity
Channel status display		binary and mnemonic display of data fields in line with AES3 or IEC 60958

Jitter and interface test (R&S®UPV-K22 option)

Digital audio I/O 192 kHz (R&S®UPV-B2 option) required.

Generator

Jitter injection		
Signals	sinewave	0.1 Hz to 80 kHz
	random	12 Hz to 80 kHz
	arbitrary	80 kHz bandwidth, 192 kHz sampling rate, max. 256 ksample
Amplitude (peak)		0 to 2.5 UI
Common mode injection	at balanced output	
Signals	sinewave	0.1 Hz to 80 kHz
	random	12 Hz to 80 kHz
	arbitrary	80 kHz bandwidth, 192 kHz sampling rate, max. 256 ksample
Amplitude (peak)		0 V to +10 V

Analyzer

Jitter measurement		
Analyzer functions	RMS, RMS selective, peak, frequency, FFT, waveform	10 Hz to 250 kHz
3 dB bandwidth		> 150 kHz
Measuring range	48 kHz sampling rate	0.75 UI (typ.) to 80 kHz, decreasing to 25 kHz at 2.5 UI
	96 kHz sampling rate	1.25 UI (typ.) to 80 kHz, decreasing to 40 kHz at 2.5 UI
	192 kHz sampling rate	1.5 UI (typ.) to 80 kHz, decreasing to 50 kHz at 2.5 UI
Level error		±(10 % + 1 ns)
Flatness	300 Hz to 50 kHz	±10 %
	50 kHz to 80 kHz	±20 %
Inherent jitter	700 Hz to 80 kHz	< 0.01 UI (peak)
Spurious jitter	700 Hz to 80 kHz	< –35 dBc or < –50 dBUI, whichever is larger
Common mode test	at balanced input	
Analyzer functions		RMS, RMS selective, peak, frequency, FFT, waveform
Frequency range		10 Hz to 250 kHz
Amplitude range		0 V to 30 V
Input signal		
Amplitude (peak-to-peak)		0 V to 10 V
Sampling rate		30 kHz to 200 kHz

Remote control (R&S®UPV-K4 option)

Enables remote control via IEC 625-2 (IEEE 488), LAN and USB.

Commands largely compliant with SCPI.

Emulation mode for HP8903B audio analyzer commands selectable (see application note 1GA54).

Extended analysis functions (R&S®UPV-K6 option)

Rub & buzz measurement		simultaneous measurement of frequency response, rub & buzz, and polarity
Frequency range		20 Hz to 80 kHz
Tracking highpass filter		2 to 20 times fundamental frequency
Lower/upper frequency limit		selectable

1/n octave analysis		
Frequency range		20 Hz to 20 kHz
Level error	at center frequency	±0.2 dB
	20 Hz to 20 kHz	±1.0 dB (EN 61260, class 0)

Undersample FFT		FFT resolution is improved while reducing the measurement bandwidth
Undersampling factor		up to 1024
Highest resolution	bandwidth 0 Hz to 23 Hz	0.18 mHz

PESQ® measurement (R&S®UPV-K61 option) [17]

Perceptual evaluation of speech quality		in line with ITU-T recommendation P.862, 862.1 and 862.2
Numeric results		PESQ score, MOS-LQO narrowband and wideband, average delay
Graphic displays (versus time)		PESQ score, MOS-LQO, delay, dropouts, reference signal and degraded signal

PEAQ® measurement (R&S®UPV-K62 option) [17]

Perceptual evaluation of audio quality		in line with ITU-R recommendation BS.1387
Numeric results		ODG (objective difference grade), DI (distortion index), average delay

R&S®UPV-B3 option required for dual channel analog signals.

POLQA® measurement (R&S®UPV-K63 option) [17]

Perceptual objective listening quality analysis		in line with ITU-T recommendation P.863
Numeric results	narrowband or super-wideband	MOS-LQO, level, attenuation, SNR (signal to noise ratio), ASR (active speech ratio), delay (average, minimum, maximum)
Graphic displays (versus time)		MOS-LQO, delay, reference signal and degraded signal

[17] PESQ®, PEAQ® and POLQA® are registered trademarks of OPTICOM Dipl.-Ing. M. Keyhl GmbH, Germany.

Hearing aid measurements (R&S®UPV-K7 option)

In line with IEC 60118, parts 0, 1, 2 and 7 and ANSI S3.22.

Hearing aid speech tests (R&S®UPV-K71 option)

In line with IEC 60118-15.

R&S®UPV-K7 option is required for R&S®UPV-K71 hearing aid speech tests.

Base software for mobile phone tests (R&S®UPV-K9 option)

Required to run UMTS/GSM or CDMA2000® mobile phone tests (R&S®UPV-K91 or R&S®UPV-K92 option).

UMTS/GSM mobile phone tests (R&S®UPV-K91 option)

In line with 3GPP TS 26.131 and TS 26.132.

Base software for mobile phone tests (R&S®UPV-K9 option) required.

License keys for R&S®UPV-K98 and R&S®UPV-K101 must be installed to run the background noise testcase (speech quality in the presence of ambient noise).

R&S®UPV-K91 upgrade 01 (R&S®UPV-K9101 option)

Upgrade of UMTS/GSM mobile phone tests to version 2.2.1 of R&S®UPV-K91 option for release-9.

R&S®UPV-K91 upgrade 02 (R&S®UPV-K9102 option)

Upgrade of UMTS/GSM mobile phone tests to version 2.3.1 of R&S®UPV-K91 option for release-10.

R&S®UPV-K91 upgrade 03 (R&S®UPV-K9103 option)

Upgrade of UMTS/GSM mobile phone tests to version 3.0 of R&S®UPV-K91 option for release-11.

License keys for R&S®UPV-K98 and R&S®UPV-K101 must be installed to run the background noise testcase (speech quality in the presence of ambient noise).

CDMA2000® [18] mobile phone tests (R&S®UPV-K92 option)

In line with TIA-1042 and 3GPP2 C.S0056-0.

Base software for mobile phone tests (R&S®UPV-K9 option) required.

Background noise control software (R&S®UPV-K98 option)

Generation and equalization of background noise field in line with ETSI ES 202396-1.

UMTS/GSM mobile phone tests (R&S®UPV-K91 option) or CDMA2000® mobile phone tests (R&S®UPV-K92 option) version 3.0 or higher required.

R&S®UPP 200/400/800 equipped with eight-channel generator (R&S®UPP-B8 option) required.

Background noise measurements (R&S®UPV-K101 option)

Measurements using background noise in line with ETSI TS 103106 and EG 202396-3.

UMTS/GSM mobile phone tests (R&S®UPV-K91 option) or CDMA2000® mobile phone tests (R&S®UPV-K92 option) version 3.0 or higher required.

[18] CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA-USA).

Mobile phone headset cable set (R&S®UP-Z9 option)

Set of two cables with different pin assignments to connect to the headset interface of a mobile phone.

Cable 1 pin assignment		
Jack plug 4-pole 3.5 mm	headset interface signal	XLR connector
Tip	left speaker out	male pin 2
1st ring	right speaker out	not connected
2nd ring	microphone in	female pin 2 (via 10 kΩ)
Sleeve	ground	male/female pin 3

Cable 2 pin assignment		
Jack plug 4-pole 3.5 mm	headset interface signal	XLR connector
Tip	left speaker out	male pin 2
1st ring	right speaker out	not connected
2nd ring	ground	male/female pin 3
Sleeve	microphone in	female pin 2 (via 10 kΩ)

Cable for R&S®UPV-B48 (R&S®UPV-Z48 option)

25-pin D-Sub to eight XLR female connectors	25-pin D-Sub	TASCAM pinning
	XLR female connectors	pin 1 not connected

General data

Environmental conditions		
Temperature	operating temperature range	+5 °C to +45 °C
	storage temperature range	–20 °C to +60 °C
Humidity		+25°C/+40°C, 95% rel. humidity, cyclic, in line with EN 60068-2-30

Mechanical resistance		
Vibration	sinusoidal	5 Hz to 55 Hz, 0,15mm amplitude const., 55 Hz to 150 Hz, 0.5 g const., in line with EN 60068-2-6
	random	10 Hz to 300 Hz, acceleration 1.2 g RMS, in line with EN 60068-2-64
Shock		40 g shock spectrum, in line with MIL-STD-810E, method no. 516.4, procedure I

Power supply		
Nominal voltage	AC	100/120/220/230 V
Nominal frequency		50 Hz to 60 Hz
Nominal power		300 VA

Product conformity		
Electromagnetic compatibility	complies with EMC Directive 2004/108/EC	applied harmonized standards: EN 61326-1 (industrial environment) EN 61326-2-1 EN 55011 (class B) [19] EN 61000-3-2 EN 61000-3-3
Electrical safety	complies with Low Voltage Directive 2006/95/EC	applied harmonized standard: EN 61010-1
	USA	UL 61010-1
	Canada	CAN/CSA-C22.2 no. 61010-1
International safety approvals	VDE – Association for Electrical, Electronic and Information Technologies	GS certificate no. 40009394
	CSA – Canadian Standard Association	CSA_{US} certificate no. 1499441

Dimensions	W × H × D	465 mm × 197 mm × 495 mm (18.31 in × 7.76 in × 19.49 in)
Weight	fully equipped	15.0 kg (33.07 lb)

[19] With installed R&S®UPV-B42 option, the instrument complies with EN 55011 class A.

Ordering information

Designation	Type	Order No.
Base unit		
Audio Analyzer	R&S®UPV	1146.2003.02
Audio Analyzer, without display	R&S®UPV66	1146.2003.66
Accessories supplied		
Power cable, compact manual, CD with operating manual/service manual		
Hardware options		
Low Distortion Generator	R&S®UPV-B1	1146.5202.02
Digital Audio Interfaces AES/EBU, S/P DIF	R&S®UPV-B2	1146.4306.02
Second Analog Generator	R&S®UPV-B3	1146.4806.02
I²S Interface	R&S®UPV-B41	1146.5402.02
Universal Serial Interface	R&S®UPV-B42	1146.5802.02
Eight-Channel Analog Inputs	R&S®UPV-B48	1402.2200.02
Modification 150 Ω	R&S®UPV-U1	1146.1507.02
BNC Phone Out	R&S®UPV-U2	1402.1704.02
Software options		
Universal Sequence Controller	R&S®UPV-K1	1401.7009.02
Digital Audio Protocol	R&S®UPV-K21	1401.7809.02
Jitter and Interface Test Software for R&S®UPV-B2	R&S®UPV-K22	1401.7909.02
Remote Control	R&S®UPV-K4	1401.9001.02
PDM Bitstream Analysis	R&S®UPV-K421	1402.1104.02
Extended Analysis Functions	R&S®UPV-K6	1401.9201.02
Software for PESQ® Measurement	R&S®UPV-K61	1401.7309.02
Software for PEAQ® Measurement	R&S®UPV-K62	1401.7750.02
Software for POLQA® Measurement	R&S®UPV-K63	1402.1156.02
Software for Hearing Aid Measurements	R&S®UPV-K7	1401.9301.02
Hearing Aid Speech Tests	R&S®UPV-K71	1402.1004.02
Base Software for Mobile Phone Tests	R&S®UPV-K9	1402.0008.02
UMTS/GSM Mobile Phone Tests	R&S®UPV-K91	1402.0108.02
R&S®UPV-K91 Upgrade 01	R&S®UPV-K9101	1402.2517.02
R&S®UPV-K91 Upgrade 02	R&S®UPV-K9102	1402.2523.02
R&S®UPV-K91 Upgrade 03	R&S®UPV-K9103	1402.2530.02
CDMA2000® Mobile Phone Tests	R&S®UPV-K92	1402.0608.02
Background Noise Control Software for R&S®UPV-K91/-K92	R&S®UPV-K98	1424.2003.02
Background Noise Measurements for R&S®UPV-K91/-K92	R&S®UPV-K101	1424.2203.02

System components

Designation	Type	Order No.
Cable Set for R&S®UPV-K7	R&S®UPV-Z7	1401.7609.02
Cable for R&S®UPV-B48	R&S®UPV-Z48	1401.7709.02
I²S Cable for R&S®UPP-B2/R&S®UPV-B41	R&S®UP-Z3	1411.3458.02
XLR/BNC Adapter Set, 2 male, 2 female	R&S®UP-Z1MF	1411.3306.02
Mobile Phone Headset Cable Set	R&S®UP-Z9	1411.3106.02
19" Rack Adapter	R&S®ZZA-411	1096.3283.00
Audio Switcher (input)	R&S®UPZ	1120.8004.12
Audio Switcher (output)	R&S®UPZ	1120.8004.13

Service options		
Extended Warranty, one year	R&S®WE1	Please contact your local Rohde & Schwarz sales office.
Extended Warranty, two years	R&S®WE2	
Extended Warranty, three years	R&S®WE3	
Extended Warranty, four years	R&S®WE4	
Extended Warranty with Calibration Coverage, one year	R&S®CW1	
Extended Warranty with Calibration Coverage, two years	R&S®CW2	
Extended Warranty with Calibration Coverage, three years	R&S®CW3	
Extended Warranty with Calibration Coverage, four years	R&S®CW4	

Extended warranty with a term of one to four years (WE1 to WE4)
Repairs carried out during the contract term are free of charge [20]. Necessary calibration and adjustments carried out during repairs are also covered. Simply contact the forwarding agent we name; your product will be picked up free of charge and returned to you in top condition a couple of days later.

Extended warranty with calibration (CW1 to CW4)
Enhance your extended warranty by adding calibration coverage at a package price. This package ensures that your Rohde & Schwarz product is regularly calibrated, inspected and maintained during the term of the contract. It includes all repairs [20] and calibration at the recommended intervals as well as any calibration carried out during repairs or option upgrades.

For product brochure, see PD 0758.1306.12 and www.rohde-schwarz.com

[20] Excluding defects caused by incorrect operation or handling and force majeure. Wear-and-tear parts are not included.

Service that adds value

- Worldwide
- Local and personalized
- Customized and flexible
- Uncompromising quality
- Long-term dependability

About Rohde&Schwarz

Rohde&Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established more than 75 years ago, Rohde&Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

Environmental commitment

- Energy-efficient products
- Continuous improvement in environmental sustainability
- ISO 14001-certified environmental management system

Certified Quality System
ISO 9001

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