Audio Analyzer R&S UPL

The solution for the budget-conscious

- For all interfaces: analog, digital and combined
- Real dual-channel measurements
- Maximum dynamic range
- FFT analysis
- Jitter analysis
- Interface tester
- Freely programmable filters
- Versatile functions
- Compact unit with integrated PC
- Automatic test sequences
- Extensive online help

New options:
- 3G Mobile Phone Test (R&S UPL-B9)
- LAN Interface (R&S UPL-B11)
- Coded Audio Signal Generation (R&S UPL-B23)
Audio analysis today and tomorrow

Analog and digital

Audio signal processing without digital technology is no longer conceivable. Yet, analog technology is still present and constantly being improved. State-of-the-art measuring instruments must therefore be able to handle both analog and digital signal processing.

The Audio Analyzer R&S UPL performs virtually every type of analog measurement: frequency response measurements; externally controlled sweeps with reference traces; determination of 3rd order difference frequency distortion; or spectral display of demodulated wow and flutter signals. In contrast to many other audio analyzers, the R&S UPL can perform real dual-channel measurements in the audio-frequency range, i.e. there is no need for switchover between two inputs and this type of measurement is not limited to a few special cases.

The generator is equally versatile: it supplies any conceivable signal whether sinewave, noise signals, or multi-sinewave signals comprising up to 7400 frequencies. In addition, the R&S UPL features excellent technical data: analog sinewave generation with harmonics of typ. $-120$ dB; spectrum displays with a noise floor below $-140$ dB for analog and $-160$ dB for digital interfaces; and FFT with a maximum frequency resolution of $0.05$ Hz.

The R&S UPL provides signal monitoring via loudspeaker, jitter measurements on digital audio signals, resynchronization of jittered digital audio signals by means of a jitter-free clock signal, and much more.

Superior analysis concept

The R&S UPL performs all measurements using digital signal processing. Analog signals to be tested undergo elaborate preprocessing before they are digitized and measured by means of digital routines. For example, in THD measurements, the fundamental is attenuated by means of a notch filter and the residual signal amplified by $30$ dB before it is digitized. In this way, the dynamic range can be extended beyond that offered by the internal 20-bit converter. This provides sufficient margin for measuring converters of the future, which will be more advanced than those with present-day technology (see graph on the right). This concept ensures performance and flexibility by far superior to instruments providing purely analog or digital measurements.
It also offers many other advantages over analog technology alone:

- The test routines for analog and digital interfaces are identical. This allows, for example, the direct comparison of IMD measurements made ahead of and after a converter.

- In intermodulation measurements, spurious components are measured selectively for all frequencies in accordance with the mathematical formulae of the applicable test standards. This procedure prevents the inclusion of adjacent components in the measurements, which is usually inevitable with analog test methods.

- Measurement speed is usually higher than with analog techniques since digital test routines can adapt their speed to the input frequency.

- And last but not least: Operation is the same for the analog and the digital interfaces – a feature that should not be underestimated.

- In intermodulation measurements, spurious components are measured selectively for all frequencies in accordance with the mathematical formulae of the applicable test standards. This procedure prevents the inclusion of adjacent components in the measurements, which is usually inevitable with analog test methods.

- All test functions are available on the analog and the digital interfaces. This makes it possible to perform measurements at any point along a common analog and digital transmission path, the only way to ensure efficient and complete testing.

- The filters are also implemented digitally, yielding a more or less infinite number of them – and this also holds true for measurements on analog interfaces. To loop a new filter into the test path, you merely have to choose the type of filter (e.g. highpass), cut-off frequency and attenuation.

- Measurement speed is usually higher than with analog techniques since digital test routines can adapt their speed to the input frequency.

- And last but not least: Operation is the same for the analog and the digital interfaces – a feature that should not be underestimated.

A future-proof investment

No one can accurately predict the effects that future developments in digital technology will have on the audio world and the resulting test requirements. Yet this is not a problem for the Audio Analyzer R&S UPL. Since all test functions are implemented digitally, the R&S UPL can be adapted to changing requirements by simply loading the necessary software – and this also applies to analog interfaces.

One more benefit: Rohde & Schwarz is the only manufacturer to equip its audio analyzers with 32-bit floating-point signal processors throughout, thus offering plenty of capacity beyond the limits of today’s common 24-bit technology.

A competent partner

The name Rohde & Schwarz stands for excellent quality – thousands of audio analyzers are already in the hands of satisfied customers and have been operating successfully for many years. Following in the footsteps of the exclusively analog R&S UPA and R&S UPD, which still hold the top position in today’s audio measurement technology, the Audio Analyzer R&S UPL was developed to complement the product line.

As a competent partner we will be happy to advise you on the optimum use of our instruments. Our representatives are available all over the world, and our customer support center and application engineers in Munich can help you find the right solution to your measurement tasks. In addition, a wealth of suggestions and solutions can be found in our application notes and software.

As part of our emphasis on quality, Rohde & Schwarz instruments are certified in compliance with ISO 9001 and ISO 14001.
Test signals – made to order

The generators of the R&S UPL supply an extremely wide variety of analog and — when the options R&S UPL-B2 or R&S UPL-B29 are used — digital test signals:

- **Sinewaves**
  For level and harmonic distortion measurements. The signal can be applied to an equalizer with selectable nominal frequency response, e.g. for compensating the frequency response of the test assembly.

- **Two-tone signal**
  For modulation distortion analysis. Various amplitude ratios can be selected and the frequencies are continuously adjustable.

- **Difference tone signal**
  For intermodulation measurements with continuous setting of both frequencies.

- **Multitone signal**
  Can comprise up to 17 sinewaves of any frequency and with the same or different amplitude; setting the phase is also possible with the R&S UPL-B6.

- **Sine burst signal**
  With adjustable interval and on-time as well as programmable low level, e.g. for testing AGCs.

- **Sine2 burst**
  Also with adjustable interval and on-time, e.g. for testing rms rectifier circuits.

- **Special multitone signal**
  Can comprise up to 7400 frequencies with selectable amplitude distribution. The frequency spacing can be linked to the resolution used for the fast Fourier transform, thus enabling rapid and precise single-shot measurements of the frequency response of a DUT.

- **Noise**
  With a variety of probability distributions, e.g. for acoustic measurements; setting of crest factor with the R&S UPL-B6.

- **Arbitrary waveforms**
  For generating any voltage curve of up to 16k points. Test signals can be output in different file formats, e.g. voice and music signals stored as WAV files.

- **Two-channel sinewave signals**
  For the two digital output channels when the UPL-B6 is used.

- **AM and FM**
  For sinewave signals.

- **DC**
  Also with sweep function.

Signals can be generated with an offset. Moreover, digital audio signals can be dithered with adjustable level and selectable amplitude distribution.
Versatile test functions

The R&S UPL offers a wealth of measurement functions both for analog and – when the option R&S UPL-B2/-B29 is used – for digital interfaces.

- **Level or S/N**
  This function includes rms, peak or quasi-peak weighting and ensures high measurement speeds due to automatic adaptation of integration time to the input signal.

- **Selective level**
  The center frequency of the bandpass filter can be swept or coupled to the generator frequency, to the frequencies of a multitone signal (e.g. for fast frequency response measurements) or to the input signal.

- **SINAD or THD+N**
  The sum of all harmonics and noise is measured (Fig. 1).

- **Total harmonic distortion (THD)**
  Individual harmonics, all harmonics or any combination of harmonics can be measured (Fig. 2).

- **Modulation distortion**
  This measurement complies with DIN-IEC 268-3. 2nd and 3rd order intermodulation is measured.

- **Difference Frequency Distortion**
  This intermodulation measurement uses the difference tone method. 2nd and 3rd order intermodulation is measured.

- **Wow and flutter**
  This measurement uses the DIN IEC, NAB, JIS or 2-sigma method in accordance with DIN IEC and also displays the demodulated-signal spectrum.

- **DC voltage**

- **Frequency, phase and group delay**

- **Polarity**
  Signal paths are checked for reversed polarity.

- **Crosstalk**

- **Waveform function**
  This function is used to represent the test signal in the time domain (Fig. 3). Waveforms can be smoothed by interpolation. Slow sequences can be displayed compressed, e.g. for analyzing the transient response of compander or AGC circuits (Fig. 4).

- **Extended Analysis Functions**
  R&S UPL-B6
  The coherence and transfer functions determine the transfer characteristics of complex test signals; third octave analysis is used mainly for acoustic measurements; rub & buzz is measured in loudspeaker production.

Tests on hi-fi components call for increasingly complex measurement techniques. Results obtained in the test lab must be verified in production, which usually requires economical solutions for handling large batches rather than the use of all available functions. The R&S UPL is an ideal choice for this task. It optimally complements its "bigger brother", the Audio Analyzer R&S UPD, which is mainly employed in development. The two units share the exact same IEC/IEEE bus commands, which means they have the same operating concept and can be used together.
**Spectrum analysis**

With its FFT analyzer, the R&S UPL is also capable of spectrum analysis. The number of samples for fast Fourier transform can be selected between 256 and 16k in binary steps [Fig. 5]. A special feature is zoom FFT. The signal to be measured is digitally pre-processed to increase the frequency resolution by a factor of 2 to 128 over a selectable range. In this way, a maximum resolution of 0.05 Hz is attained. This is not merely a scale expansion, the measurement is actually performed at a higher resolution [Fig. 6].

**Programmable filters**

The filters of the R&S UPL are software-implemented, allowing the user to define any number of filters. The most common weighting filters are provided as standard. Additional filters can be programmed in a few seconds by entering the type (lowpass, highpass, bandpass, bandstop, notch, third octave or octave), frequency and attenuation [Fig. 7]. The instrument’s open architecture reveals its strength particularly where special requirements have to be met: special filters can be implemented by using commercial filter design programs. The data is transferred to the R&S UPL and the required filter is looped into the signal path.

**A variety of sweep functions**

For continuous variation of the test signals, the R&S UPL offers amplitude and frequency sweeps; in the case of bursts, it is also possible to perform sweeps of intervals and on-time. Sweeps are defined either by means of a table or via parameters such as start value, number of steps, linear/ log stepping or time interval. It is also possible to sweep two variables simultaneously.

If external signals are applied during measurement, they can be used for analyzer sweeps (external sweeps). Many different start conditions can be set, allowing measurements to be triggered by a variety of events. Even if the DUT has an unknown or unstable transient response, the settling function will yield stable results.

**Multichannel measurements with Audio Switcher R&S UPZ**

The Audio Switcher R&S UPZ is used either to measure surround sound decoders or in production if several DUTs/channels have to be cabled. It is directly connected to the Audio Analyzer R&S UPL and panel-controlled via an RS-232-C interface. The 8-channel R&S UPZ is available as an input and output model and can be cascaded to up to 128 channels. *)

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*) For more information, refer to data sheet PD 0757.6985, Multichannel audio measurements on surround sound decoders.
Everything in one package

The Audio Analyzer R&S UPL is a compact unit with an integrated controller. It avoids the disadvantages of external PC control found in other audio analyzers. The instrument is easy to transport as it requires no external equipment such as keyboard, monitor or other PC peripherals.

The R&S UPL is supplied ready for use. Installation merely consists of unpacking the unit and switching it on to start the measurement. The user is not burdened with problems that cropped up in the past with the installation of interface cards or PC software.

With audio analyzers controlled from an external PC, interference may be radiated from the PC, the monitor or interface connections, which distorts measurement results. Not so with the R&S UPL: the instrument has specified EMC characteristics which also include the internal PC. In contrast to conventional PCs, the R&S UPL provides elaborate screening features such as magnetically shielded power transformers and a coated filter pane in front of the display.

And the icing on the cake: the price of the R&S UPL includes the internal PC.
Interfaces, protocol analysis, jitter

Analog interfaces
- Balanced inputs with high common-mode rejection and various types of impedance commonly used in the studio. Measurements can be made on lines with phantom feed.
- Balanced outputs, floating (e.g. to prevent hum loops).
- The generator outputs can be internally connected to the analyzer inputs so that different types of measurement can be performed without changing the cabling.

Digital audio interfaces (options R&S UPL-B2 and R&S UPL-B29)
- Balanced (XLR), unbalanced (BNC) and optical (TOSLINK) inputs and outputs for connecting consumer electronics and professional studio equipment are provided.
- The levels of the balanced and unbalanced outputs are adjustable so that the sensitivity of digital audio inputs can be determined.
- The format of the generated channel status data may be professional or consumer regardless of the selected interface.
- A reference (XLR) and a synchronization (BNC) input provided on the rear panel allow both the analyzer and the generator to be synchronized to the digital audio reference signal (DARS) in line with AES 11; in addition the generator can be synchronized to wordclock, video sync signals (PAL/SECAM/NTSC) and 1024 kHz reference clocks.
- Both generator and analyzer can be operated at clock rates of 35 kHz to 106 kHz. The clock signal can also be produced internally by the generator.
- The clock rates of the analyzer and generator are independent of each other. This allows measurements on sample rate converters.
- The word length can be selected independently for generator and analyzer between 8 and 24 bits.

Digital protocol analysis and generation (option R&S UPL-B21)
This software option extends the functions of options R&S UPL-B2 and R&S UPL-B29 by an in-depth analysis and generation of additional digital data:
- Analysis of channel status and user data. The data is output in binary form, as hexadecimal numbers, or as ASCII characters, or in the case of channel status data, it is evaluated in the professional or consumer format in line with AES 3 or IEC 958 (Fig. 12).
Generation of channel status data, user data and validity bits. Channel status data can be entered in binary form or via panel in line with AES 3 or IEC 958 using the professional or consumer format.

Any bits can be combined under a symbolic name. In this way, data input and representation can easily be adapted to customer requirements.

Simultaneous measurement of clock rate and display of interface errors (such as parity error).

**Jitter and Interface Tests (option R&S UPL-B22)**

The physical parameters of digital audio interfaces can be evaluated with this option. The R&S UPL-B22 extends the functions of options R&S UPL-B2 and R&S UPL-B29.

**Signal analysis:**
- Measurement of jitter amplitude and display of jitter signal in the frequency and time domain (Figs 9 and 10).
- The R&S UPL generates bit- or word-synchronous sync signals that allow the accurate display of digital audio signals on an oscilloscope (preamble, eye pattern, signal symmetry, superimposed noise, etc).
- Measurement of input pulse amplitude and sampling frequency.
- Measurement of phase difference between audio and reference input signal.
- Measurement of time difference between output and input signal. This allows delay times of equalizers, audio mixers, etc to be measured.
- Analysis of common-mode signal of balanced input (frequency, amplitude, spectrum).

**Signal generation:**
- The clock of the output signal can be “jittered” by superimposing a sine-wave or noise signal of variable amplitude.
- When generating digital audio data — with option R&S UPL-B1 installed — jitter and common-mode interference can be added to the data stream.
- An input signal with jitter can be output jitter-free.
- A common-mode signal can be superimposed on the balanced output signal.
- Long cables can be simulated by means of a switchable cable simulator.
- The phase shift between the digital audio output and the reference output can be varied.

**Generation of coded audio signals (option R&S UPL-B23)**

With this option, the Audio Analyzer R&S UPL is able to generate AC-3-coded test signals (other data formats soon available) directly with the integrated generator, e.g. to measure surround sound decoders.

The number of channels, frequency or level sweep, start and stop frequency/level as well as the number of sweep points can be set, thus allowing flexible test sequence combinations.

The measurements are automatically synchronized between generator and analyzer.

The R&S UPL-B23 requires options R&S UPL-B2 or R&S UPL-B29. For more information refer to data sheet PD 0757.6985, Multichannel audio measurements on surround sound decoders.

Digital components of various data formats and clock rates are the stock-in-trade of professional users, who need a measuring instrument offering top performance on all interfaces with high accuracy and over a wide dynamic range. Operation is identical for analog and digital interfaces, which enhances operator convenience. Fast fault diagnosis is possible by means of stored test routines, allowing the elimination of problems immediately before transmission.
Efficient online help

The R&S UPL offers a variety of help features:

HELP function
HELP information in German or English can be called up for each input field.

SHOW I/O key
If results cannot be displayed, e.g. because an input signal is either missing or incorrect, information on possible causes will appear upon pressing SHOW I/O. Moreover, the input and output configuration will be displayed.

Info boxes
These highlighted boxes indicate any incorrect settings.

Online help
The permissible range of values is indicated for each menu item requiring the entry of a numeric value. This range takes into account any limitations resulting from related parameters, e.g. the sample rate in the case of measurements on digital interfaces.

Protection against invalid entries
The R&S UPL will not accept entries outside the permissible range. An alarm tone will be issued and the value changed to the permissible minimum or maximum value.

A wealth of functions – yet easy to operate

◆ Related functions and settings are combined in panels that can be called up at a keystroke. Up to three panels can be displayed at a time.
◆ The operator is not burdened with unnecessary information. Only the parameters and settings needed for a specific application are displayed – the others are available in the background. (For example, the sweep parameters are transferred to the generator panel and displayed only when the sweep function is activated.)
◆ Fast access to frequently used instrument setups and a comprehensive library of standard measurements make the instrument easy to learn.
◆ Straightforward data entry: the user simply needs to open a menu and make an entry or selection.
◆ Continuously updated status information on generator, analyzer and sweep.
◆ Quick operating sequences through the use of softkeys, e.g. for graphical representations.
◆ The user can choose between operation via mouse, external keyboard or front panel. This choice is important since the working space required by a mouse is not always available.
◆ Short learning time due to an easy-to-understand operating concept that treats analog and digital measurements in the same manner.
Results at a glance

- Realtime display of results for one or both channels and several test functions.
- Simultaneous display of frequency and phase.
- With graphics, results can be read off with vertical and horizontal cursors. Tolerance curves or stored results can be added for comparison.
- Sets of traces can be displayed, stored and evaluated for both channels.
- Graphics options include traces and bargraphs, spectrum display, and three-dimensional waterfalls.

In many cases only a few parameters need to be modified after a measurement sequence has been started. Therefore, entry lines can be selected from the input panels for the generator, analyzer, etc, by means of a checkmark. They are then transferred to a status panel. The status panel thus gives a summary of parameters for a measurement routine, which offers the following advantages:

- Instrument settings can be displayed together with graphical and numerical results.
- All important information can be printed on a single hardcopy.
- Instrument settings can be modified quickly without changing panels as the R&S UPL can also be operated from the status panel.
High measurement speed

In designing the Audio Analyzer R&S UPL, particular emphasis was placed on optimizing the measurement speed of the test system as a whole:

◆ All operations involving extensive number crunching are carried out by digital signal processors. The PC is merely used for controlling the unit and displaying results.
◆ The R&S UPL can perform even complex test functions simultaneously on both channels. This feature alone reduces the time for stereo measurements by 50% compared to most analyzers available on the market.
◆ The digital test routines adapt their speed optimally to the input frequency. This enhances measurement speed especially in the case of frequency sweeps.
◆ The R&S UPL performs harmonic distortion and IMD measurements using patented, digital test procedures that combine high accuracy with high measurement speed.
◆ Digital signal processing reduces setting and transient times achievable with purely analog instruments. These times are also taken into account in the test routines, yielding stable measurements without the need for activating settling functions (these are understood to be repeated measurements until results are within a tolerance band).

Use in production

Instruments to be used in production tests must satisfy a variety of requirements:

◆ High measurement speed is vital for achieving a high production throughput. By making appropriate use of the instrument functions, go/no-go decisions can already be made in the audio analyzer, thus reducing the run time of a DUT (Fig. 8).

Fast and efficient

◆ The user interface was tailored to the requirements of a test environment, not an office one.
◆ Display windows not needed can be switched off, which also reduces the processing time. When all displays are switched off and results are output via the IEC/IEEE bus, more than 100 level measurements per second can be performed.

◆ Two-channel measurements allow the simultaneous and thus time-saving determination of input and output characteristics.
◆ The use of FFT analysis provides a decisive advantage especially in the case of frequency response measurements, which are particularly time-critical (example: approx. 900 frequency values in 150 ms).
◆ Long calibration intervals, resulting from the extensive use of digital circuits, make for high availability of the instrument.
◆ The R&S UPL66 model is specially tailored to the requirements of production. It comes without a display and keypad, thus holding down costs. Yet the unit can be operated manually by connecting a PC keyboard and a VGA monitor, enabling fast fault localization in the event of production problems.

The R&S UPL66 – special model for use in test systems, with the full flexibility of the standard model.
Remote-control capability via the IEC/IEEE bus is a must in large-scale production systems. In the design of the Audio Analyzer R&S UPL, special importance was attached to data transfer via the IEC/IEEE bus. The logging mode can be used to speed up the generation of control programs for the IEC/IEEE bus. With the program generator provided in the R&S UPL-B10, it is no longer necessary to look up IEC/IEEE bus commands.

**Universal Sequence Controller R&S UPL-B10**

The R&S UPL-B10 is used to generate and execute measurement sequences, thus turning the R&S UPL into an automatic test system.

Measurement sequence programming is greatly facilitated by the built-in program generator: Each manual control step is recorded in the logging mode and translated into a complete line of the sequence program with correct syntax, i.e. test sequences can be programmed without the user typing a single line. The generated program does not just specify the sequence of keys to be pressed but contains the instructions in easy-to-read IEC/IEEE bus syntax according to SCPI.

BASIC commands can then be used to modify the program, e.g. for branching or graphic outputs.

Complete application programs based on the universal sequence controller are available for measurements on CD players, tuners, etc.

The universal sequence controller can also be used for remote control of external equipment via the IEC/IEEE bus or the RS-232-C interface. Moreover, programs generated on the R&S UPL can be transferred to an external controller after slight modifications for the remote control of the R&S UPL. This greatly facilitates the generation of remote-control programs.

Test assemblies for electroacoustic converters frequently consist of microphones and loudspeakers, whose frequency response must be compensated. The equalizer function of the R&S UPL furnishes tailor-made solutions for such tests. Comprehensive test routines can be implemented with the aid of the universal sequence controller.
Options and further applications

**Low Distortion Generator R&S UPL-B1**
This option is essential for all applications requiring extremely pure analog signals or an extended frequency range up to 110 kHz.

When digital audio data is produced by the universal generator, the low distortion generator may generate an analog signal or be used for superimposing jitter or common-mode interference.

**Digital Interfaces R&S UPL-B2/-B29**
These options contain the digital audio interfaces (balanced, unbalanced and optical) for the standard sampling rates 44.1 kHz and 48 kHz, and the R&S UPL-B29 also covers the extended rates up to 96 kHz. Either the R&S UPL-B2 or the R&S UPL-B29 can be installed. A detailed description of these options and their software extensions (Digital Audio Protocol R&S UPL-B21, Jitter and Interface Tester R&S UPL-B22 as well as the Coded Audio Signal Generation R&S UPL-B23) can be found on pages 8 and 9.

**Audio Monitor R&S UPL-B5**
This option adds a headphone output and a built-in loudspeaker to the R&S UPL. The input signal and — in the case of level, THD+N and rub & buzz measurements — the filtered or weighted signal can be monitored.

**Extended Analysis Functions R&S UPL-B6**
In modern audio systems, the transfer characteristics are dynamically adapted to the input signals. When conventional, static test signals are used as input signals, the dynamic processes are not activated and thus the signals cannot be analyzed. The coherence and transfer functions are the solution to this problem:

speech, music, noise, etc, are used as test signals, and the transfer characteristic is represented by analyzing the output spectrum referenced to the input spectrum (Fig. 13). The required complex test signals stored in various formats can be directly called from the R&S UPL hard disk.

With the rub & buzz measurement, manufacturing defects of loudspeakers can be found in no time by measuring the unwanted signals in the frequency range above that of typical distortion products (Fig. 14).

The third-octave analysis is an important measurement in acoustics. The levels of up to 32 third-octave bands are simultaneously measured in compliance with class 0 of IEC 1260 (Fig. 15).

In multitone signal generation, the R&S UPL-B6 also allows the phase and crest factor to be set. The R&S UPL-B6 is also required for generating two-channel sine-wave signals at the digital outputs (Fig. 16).

Further functional extensions of the R&S UPL-B6 are currently being developed.

**Hearing Aids Test Accessories R&S UPL-B7**
The Audio Analyzer R&S UPL with the option R&S UPL-B7 forms a complete test system for all standard measurements on hearing aids. The R&S UPL merely needs to be equipped with options R&S UPL-B5 and R&S UPL-B10. The R&S UPL-B7 includes an acoustic test chamber as well as all accessories required for measurements on hearing aids such as battery adapters, connecting cables and acoustic
couplers. The associated software enables complete measurements in accordance with IEC60118 or ANSI S3.22. *)

**Acoustic measurements on GSM mobile phones with the R&S UPL16 or option R&S UPL-B8/-B9**

The acoustic transmission and reproduction quality of a mobile phone is the most important characteristic in everyday use. The **Audio Analyzer R&S UPL16** was developed for conformance tests on GSM mobiles. It performs all audio measurements in line with chapter 30 of GSM 11.10 and 3GPP TS 51.010 Release 99, phase 2. Access to the internal digital signals of special test mobile phones is via the standard digital audio interface (DAI).

Network operators, consumer test institutes, etc, are particularly interested in measuring and comparing acoustic characteristics of commercial mobiles. A highly accurate test method is also required for quality assurance and sampling inspection in the production of mobile phones.

The **Mobile Phone Test Set R&S UPL-B8** is available for these applications. With the aid of this option all necessary audio measurements can be performed on GSM mobile phones without the DAI interface. The **3G Mobile Phone Tests R&S UPL-B9** provide the same functionality, but expanded to 3G mobile phones and to the latest 3GPP specifications TS26.131 and 132. These tests are validated and can therefore be used for type approvals. R&S UPL-B8 and -B9 require options R&S UPL-B6 and -B10. For further information refer to data sheet PD 0757.5889, Acoustic Test of GSM Mobiles.

The **Automatic Audio Line Measurement to ITU-T O.33, R&S UPL-B33** performs automatic measurements of all relevant parameters of broadcast links according to ITU-T O.33. The generator and analyzer are normally located at different sites. Operators may utilize the standard sequences defined by ITU-T O.33 or prepare their own. Option R&S UPL-B10 is needed for the use of the R&S UPL-B33.

The **Remote Control R&S UPL-B4** enables remote control of R&S UPL via the RS-232-C interface or IEC625/IEEE 488 interface. The commands largely meet SCPI standards.

The **Universal Sequence Controller R&S UPL-B10** allows measurement sequences to be generated and executed. For detailed information see page 13.

With option **LAN Interface R&S UPL-B11**, the Audio Analyzer R&S UPL can be connected to Novell networks in line with 10/100 BASE-T standard in order, for example, to exchange data or access the network printer (not for R&S UPL16).

The **150 Ω Modification R&S UPL-U3** changes the source impedance of the analog generator from 200 Ω to 150 Ω.

*) For further information on this application refer to data sheet PD 0757.2696, Test System R&S UPL + R&S UPL-B7 for Hearing Aids.
Specifications

**Analog analyzers**

For analog measurements two analyzers with different bandwidths, specifications and measurement functions are available:

<table>
<thead>
<tr>
<th>Analyzer</th>
<th>Bandwidth</th>
<th>Frequency response (ref. to 1 kHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANLG 22 kHz</td>
<td>DC/10 Hz to 21.90 kHz&lt;sup&gt;31&lt;/sup&gt;</td>
<td>±0.05 dB</td>
</tr>
<tr>
<td>ANLG 110 kHz</td>
<td>DC/20 Hz to110 kHz&lt;sup&gt;32&lt;/sup&gt;</td>
<td>±0.1 dB</td>
</tr>
</tbody>
</table>

**Level measurements (rms)**

- Measurement range: 18 mV to 100 V, in steps of 5 dB
- Accuracy: ±0.5 dB at 1 kHz, ±0.1 dB at 10 Hz to 20 Hz, ±0.1 dB at 22 kHz to 50 kHz, ±0.2 dB at 50 kHz to 110 kHz

**Inputs**

- **XLR connectors**
- 2 channels, balanced (unbalanced measurements possible with XLR/CGC: Adapter R&S UPL-Z1), floating or grounded and AC/DC coupling switchable
- **Voltage range** 0 V to 110 V (rms, sine)
- **Measurement range** 100 mV to 100 V, in steps of 5 dB
- **Input impedance** 100 kΩ ±<sup>0.5</sup>% each, <sup>33</sup>P<sub>max</sub> 1 W
- **Crosstalk attenuation** >120 dB (20 Hz to 22 kHz, >105 dB at 50 Hz, >80 dB at 1 kHz, >80 dB at 16 kHz each input channel switchable to the other output channel, input impedance balanced ±200 kΩ, unbalanced ±100 kΩ
- **Common-mode rejection** (V<sub>i</sub> < 3 V)
- DC/AC coupling
- >20 Hz to 22 kHz
- 10 Hz to 20 Hz
- 22 kHz to 50 kHz
- 50 kHz to 110 kHz

**Generator output**

- **Frequency range** DC/10 Hz to 21.90 kHz<sup>31</sup> or DC/20 Hz to 110 kHz<sup>32</sup>
- Accuracy at 1 kHz ±0.05 dB
- Frequency setting
  - automatic to input signal
  - coupled to generator
  - fixed through entered value
- **Accuracy** ±0.2 dB + ripple of filters
- **Peak value**
  - Measurement: peak max, peak min, peak-to-peak, peak absolute
  - ±0.2 dB at 1 kHz
  - 20 ms to 10 s
- **S/N measurement**
  - weighting filters and user-definable filters, up to 3 filters can be combined
- **DC voltage**
  - Measurement range: ±110 V
  - ±1% of measured value + 0.1% of measurement range
  - 100 mV to 100 V, in steps of 10 dB

**FFT analysis**

**Total harmonic distortion (THD)**

- Fundamental: 10 Hz to 22 kHz
- Frequency tuning: automatic to input or generator signal or fixed through entered value
- **Weighted harmonics**: any combination of d<sub>1</sub> to d<sub>9</sub>, up to 110 kHz
- **Accuracy**
  - Harmonics <50 kHz ±0.5 dB
  - <110 kHz ±0.7 dB
- **Inherent distortion**
  - Analyzer ANLG 22 kHz
  - Fundamental 20 Hz to 10.95 kHz
  - Weighted harmonics <50 kHz ±0.5 dB
  - <110 kHz ±0.7 dB
- **Spectrum**
  - THD+N and SINAD
    - Fundamental: 10 Hz to 22 kHz
    - Frequency tuning: automatic to input or generator signal or fixed through entered value
    - Input voltage: type >100 μV with automatic tuning

**Audio Analyzer R&S UPL**

- With R&S UPL B29 only in base rate mode.
- Total inherent distortion of analyzer and generator (with option R&S UPL-B1), analyzer with dynamic mode precision.
- >3.5 V: typ. 3 dB les; <0.5 V: sensitivity reduced by inherent noise (typ. 0.25%/0.25 μV with analyzers 22/110 kHz).

Special thanks to the Audio Analyzer R&S UPL team for providing this information.
**Accuracy**
- Bandwidth: less than 50 kHz ±0.5 dB, less than 100 kHz ±0.7 dB
- Inherent distortion:
  - Analyzer ANLG 22 kHz: typ. –110 dB at 1 kHz, 2.5 V
  - Analyzer ANLG 22 kHz: typ. –105 dB at 2 µV
  - Bandwidth: 20 Hz to 22 kHz: typ. –108 dB at 1.5 µV
- Spectrum: 20 Hz to 22 kHz: typ. –95 dB at 2.5 µV, typ. –100 dB at 1.75 µV
  - Analyzer ANLG 110 kHz: typ. –88 dB at 5 µV, typ. –95 dB at 3.5 µV

**Modulation factor (MOD DIST)**
- Measurement method: selected to DIN IEC 268-3
- Frequency range: lower frequency 30 Hz to 2700 Hz, upper frequency 8 x LF to 100 kHz
- Accuracy: ±0.5 dB

**Difference frequency distortion (DFD)**
- Measurement method: selected to DIN IEC 268-3 or 118
- Frequency range: difference frequency 80 Hz to 2 kHz
- Accuracy: ±0.50 dB, center frequency 200 Hz to 10 kHz
- Inherent distortion:
  - Analyzer ANLG 22 kHz: typ. –112 dB, typ. –125 dB
  - Analyzer ANLG 110 kHz: typ. –96 dB, typ. –105 dB
- Spectrum: 20 Hz to 22 kHz: bar chart showing signal and distortion with analyzer ANLG 22 kHz only
  - Bandwidth: 20 Hz to 22 kHz
  - Accuracy: ±0.5 dB

**Distortion measurements**
- With analyzer ANLG 22 kHz only, analyzer with dynamic mode precision (DFD d2), center frequency 7 kHz to 20 kHz.

**Outputs**
- Balanced Voltage: 0.1 mV to 5 V, frequency <2 kHz
  - Source impedance: typ. 10 Ω, 200 Ω (150 Ω with R&S UPL-U3)
  - Load impedance: >400 Ω (incl. source impedance)
  - Output bandwidth: >75 dB at 1 kHz, >60 dB at 20 kHz
- Unbalanced Voltage: 0.1 mV to 10 V, frequency <2 kHz
  - Source impedance: 5 Ω
  - Load impedance: >200 Ω

**Signals**
- Sine
  - Frequency range: 2 Hz to 21.75 kHz
- Frequency accuracy: ±50 ppm
  - Level accuracy: ±0.1 dB at 1 kHz
  - Frequency response (ref. to 1 kHz):
    - 20 Hz to 20 kHz: ±0.05 dB
    - 20 Hz to 100 kHz: ±0.86 dB
  - Sweep parameters: frequency, level
- Sine (with low distortion generator option)
  - Frequency range: 10 Hz to 110 kHz
  - Frequency accuracy:
    - ±0.5% at 15°C to 30°C
    - ±0.75% at 5°C to 45°C
  - Level accuracy: ±0.1 dB at 1 kHz
  - Frequency response (ref. to 1 kHz):
    - 20 Hz to 20 kHz: ±0.05 dB
    - 10 Hz to 110 kHz: ±0.1 dB
  - Harmonics:
    - typ. –96 dB at <120 dB at 1 kHz, measurement bandwidth 20 Hz to 20 kHz, voltage 1 V to 5 V

**Analog generators**
- An 18-bit, ΔΣ D/A converter is used for analog signal generation. The characteristics of the basic generator can be improved and extended with a low-distortion RC oscillator (Low Distortion Generator R&S UPL-B1):
  - with sine with reduced distortion
  - frequency range up to 110 kHz

**Accuracy**
- Bandwidth: 2 Hz to 21.75 kHz
- Frequency accuracy: ±50 ppm
- Level accuracy: ±0.1 dB at 1 kHz
- Frequency response (ref. to 1 kHz):
  - 20 Hz to 20 kHz: ±0.05 dB
  - 10 Hz to 110 kHz: ±0.1 dB
- Harmonics:
  - typ. –96 dB at <120 dB at 1 kHz, measurement bandwidth 20 Hz to 20 kHz, voltage 1 V to 5 V

**Display**
- Measurement polarity of unsymmetrical input signal
  - polarity of unsymmetrical input signal

**Polarity test**
- Measurement bandwidth: >120 mA with external feed

**Audio Analyzer R&S UPL**
Typical spectrum of low distortion generator at 1 kHz, 1 V

**MOD DIST**

- **Frequency range**
  - lower frequency:
  - upper frequency:
  - selectable from 10:1 to 1:1

- **Level accuracy**: ±0.5 dB

- **Inherent distortion**: <–94 dB (typ. 60 Hz), <–95 dB (typ. 7 kHz)

- **Sweep parameters**
  - upper frequency, level

**DFD**

- **Frequency range**
  - difference freq.:

- **Level accuracy**: ±0.5 dB

- **Inherent distortion**: DFD d2: <–100 dB (typ.), DFD d3: <–90 dB (typ.)

**Sweep parameters**

- Center frequency, level

**Multi-sine**

- **Frequency range**: 2.93 Hz to 21.75 kHz

- **Frequency spacing**: adjustable from 2.93 Hz

- **Frequency resolution**: <0.01% or matching FFT frequency spacing

- **Dynamic range**: 100 dB, referred to total peak value

**Sine burst, sine² burst**

- **Frequency range**: 1.2 kHz

- **On-time**: 1 cycle (0.8333 ms)

- **Interval**: 2 cycles (1.6667 ms)

**FM signal**

- **Carrier frequency**: 2 Hz to 21.75 kHz

- **Modulation frequency**: 1 mHz to 21.75 kHz

- **Modulation**: 0% to 100%

**AM signal**

- **Carrier frequency**: 2 Hz to 21.75 kHz

- **Modulation frequency**: 3 kHz to 21.75 kHz

- **Modulation**: 0% to 100%

**DC voltage**

- **Level range**: 0 V to ±10 V (±5 V unbalanced)

- **Accuracy**: ±2%

**DC offset**

- **Level range**: 0 V to ±10 V (±5 V unbalanced)

- **Accuracy**: ±2%

**Residual offset**: <1% of rms value of AC signal

Digital analyzer (option R&S UPL-B2 or -B29)

- **Frequency limits**

**Inputs**

- **Balanced input**
  - Impedance: 110 Ω
  - Unbalanced input
  - Impedance: 75 Ω

- **Unbalanced input**
  - Level (Vpp): min. 200 mV, max. 12 V

- **Unbalanced input**
  - Level (Vpp): min. 100 mV, max. 5 V

**Audio bits**: 8 to 24

**Clock rate**: 35 kHz to 55 kHz with R&S UPL-B2 or R&S UPL-B29 in base rate mode

**Input format**: professional and consumer format to AES3 or IEC-958 as well as user-definable formats at all inputs

**Measurement functions**

**All measurements at 24 bit, full scale**

**RMS value, wideband**

- **Measurement bandwidth**: up to 0.5 times the clock rate

- **Accuracy**
  - AUTO: ±0.1 dB
  - FAST: ±0.01 dB
  - FIX: ±0.001 dB

- **Integration time**
  - AUTO: 4.2 ms, at least 1 cycle
  - FAST: 2.1 ms, at least 1 cycle

- **Filter**
  - weighting filters and user-definable filters, up to 3 filters can be combined

- **Spectrum**: post-FFT of filtered signal

Polarity test signal

- **Sine burst with following characteristics:**
  - Frequency: 1.2 kHz
  - On-time: 1 cycle (0.8333 ms)
  - Interval: 2 cycles (1.6667 ms)

- **FM signal**
  - Carrier frequency: 2 Hz to 21.75 kHz
  - Modulation frequency: 1 mHz to 21.75 kHz
  - Modulation: 0% to 100%

- **AM signal**
  - Carrier frequency: 2 Hz to 21.75 kHz
  - Modulation frequency: 3 kHz to 21.75 kHz
  - Modulation: 0% to 100%

- **DC voltage**
  - Level range: 0 V to ±10 V (±5 V unbalanced)
  - Accuracy: ±2%

- **DC offset**
  - Level range: 0 V to ±10 V (±5 V unbalanced)
  - Accuracy: ±2%

- **Residual offset**: <1% of rms value of AC signal

1) Center frequency >5 kHz, difference frequency <1 kHz; DFD d2: <100 dB (typ.) with DC offset.

2) With R&S UPL-B29 only in base rate mode.

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1) Center frequency >5 kHz, difference frequency <1 kHz; DFD d2: <100 dB (typ.) with DC offset.

2) With R&S UPL-B29 only in base rate mode.
**Weighted harmonics any combination of \( d_2 \) to \( d_9 \),
Frequency tuning automatic to input or generator signal or
Fundamental 10 Hz to 21.90 kHz

Total harmonic distortion (THD)
see FFT analyzer section

FFT analysis

S/N measurement routine
available for measurement functions:
- rms, wideband
- peak, quasi-peak
indication of S/N ratio in dB, no post-FFT
see FFT analyzer section

**Fundamental**
10 Hz to 21.90 kHz
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

Accuracy
±0.1 dB

**Inherent distortion**

Fundamental
-4 Hz to 21.90 kHz
4 Hz to 21.90 kHz
28 Hz to 21.90 kHz
28 Hz to 24 Hz
24 Hz to 24 Hz

Spectrum
bar chart showing signal and distortion

**THD-N and SINAD**
Fundamental
10 Hz to 21.90 kHz
automatic to input or generator signal or
fixed through entered value
fundamental ±28 Hz
max. up to 2nd harmonic
upper and lower frequency limit selectable,
one weighting filter in addition

Accuracy
±0.3 dB

**Modulation factor (MOD DIST)**
Measurement method
selective to DIN IEC 268-3

Frequency range
Lowest frequency
Upper frequency
8 x LF3 to 21.25 kHz
Accuracy
±0.2 dB

**Inherent distortion**

Level LF-LF
1:1
4:1
10:1

Spectrum
bar chart showing signal and distortion

Digital generator (option R&S UPL-B2 or -B29)

Frequency limits specified for the signals apply to a sampling rate of 48 kHz. For other sampling rates limits are calculated according to the formula:

\[ f_{\text{new}} = f_{\text{sam}} \times f_{\text{rate}} / 48 \]

**Outputs**
Balanced output
Impedance 110 Ω, short-circuit-proof
Level (\( V_p \) into 110 Ω)
0 V to 8 V in 240 steps
Accuracy
±1 dB (rms)

Unbalanced output
Impedance 75 Ω, short-circuit-proof
Level (\( V_p \) into 75 Ω)
0 V to 2 V in 240 steps
Accuracy
±1 dB (rms)

Optical output
TOSLINK

Channels
1, 2 or both

Audio bits
8 to 24

Clock rate
35 kHz to 55 kHz with R&S UPL-B2 or
R&S UPL-B29 in base rate mode
35 kHz to 108 kHz with R&S UPL-B29 in
high rate mode

Format
professional and consumer format to
AES3 or IEC-958 as well as user-
definable formats at all outputs

### Only for measurement functions RMS, FFT and THD+N, accuracy applies to 8k FFT with zoom factor 2, Rife-Vincent-2 window, S/N ratio > 70 dB. Phase and group delay in high rate mode only with RMS without filter.
Signals

All signals with 24 bit, full scale

General characteristics

Level resolution 2
Audio bits 8 to 24 bits, LSB rounded off for sine, stereo sine, DFD and MOD DIST in high rate mode for sine only
Distribution Gaussian, triangular, rectangular
Level ±50 ppm (internal clock)
Frequency accuracy ±1 ppm relative to clock rate for sine, stereo sine, DFD and MOD DIST
Frequency offset 0 to ±1 FS adjustable

Sine
Frequency range 2 Hz to 21.90 kHz
Total harmonic distortion (THD) <−133 dB

MOD DIST
Frequency range 30 Hz to 2700 Hz
Upper frequency 8 x LF to 21.90 kHz
Level LF:UF selectable from 10:1 to 1:1
Inherent distortion of analyzer and generator

DFD
Frequency range 80 Hz to 2 kHz
Center frequency 200 Hz to 20.90 kHz
Inherent distortion

Multi-sine
Frequency range 2.93 Hz to 21.90 kHz
Frequency spacing adjustable from 2.93 Hz
Frequency resolution <0.01% or matching FFT frequency spacing
Dynamic range >133 dB
Characteristics

Mode 1
1 to 17 spectral lines—level and frequency selectable for each line—phase of each component optimized for minimum crest factor—crest factor selectable with R&S UPL-B6

Mode 2
1 to 7400 spectral lines (noise in frequency domain), distribution: white, pink, 1/3 octave, defined by file; crest factor selectable with R&S UPL-B6

Sine burst, sine² burst
Burst time 1 sample up to 60 s, 1-sample resolution burst time up to 64 s, 1-sample resolution burst level (D for sine² burst)
Interval 0 to burst level, absolute or referred to burst level (D for sine² burst)
Low level burst frequency, level time, interval

Noise
Distribution Gaussian, triangular, rectangular

Arbitrary waveform

File format
*.TTF (internal)
*.WAV (3)
Clock rate
memory depth max. 16 k
reproduction of audio files (mono), duration approx. 10 s per Mbyte RAM
sampling rate of generator

Polarity test signal

Sine² burst with following characteristics:
Frequency 1.2 kHz(1)
On-time 1 cycle
Interval 2 cycles

FM signal
Carrier frequency 2 Hz to 21.9 kHz
Modulation frequency 1 mHz to 21.9 kHz
Modulation 0% to 100%

AM signal
Carrier frequency 2 Hz to 21.9 kHz
Modulation frequency 1 mHz to 21.9 kHz
Modulation 0% to 100%

DC voltage

Level range 0 to ±1 FS, can be swept

Digital audio protocol (option R&S UPL-B21)

Generator
Validity bit NONE, L, R, L+R
Channel status data mnemonic entry with user-definable masks, predefined masks for professional and consumer format to AES3 or IEC-958
User data
loaded from file (max. 384 bits) or set to zero

Analyzer
Display validity bit L and R
Error indication block errors, sequence errors, clock rate errors, preamble errors

Clock rate measurement
user-definable mnemonic display of data fields, predefined settings for professional and consumer format to AES3 or IEC-958,

Channel status display binary and hexadecimal format
User bit display user-definable mnemonic display,
Jitter and interface test (option R&S UPL-B22)

Generator
Jitter injection
Waveform sine, noise
Frequency range 10 Hz to 21.75 kHz (sine to 110 kHz with option R&S UPL-B1)
Amplitude (peak-to-peak) 0 to 5 UI (corresp. to 0 to 800 ns at fA = 48 kHz)
Common mode signal
Waveform for balanced output
Frequency range sine 20 Hz to 21.75 kHz (110 kHz with option R&S UPL-B1)
Amplitude (Vinp) 0 V to 20 V adjustable between −84 and +84 UI
Phase (output to reference) (corresp. to ±50% of frame)
Cable simulator 100 m typical audio cable

(1) Fixed frequency, independent of sampling rate.
(2) Total inherent distortion of analyzer and generator.
(3) With R&S UPL-B29 only in base rate mode.
Analyzer

Input signal
Amplitude $V_{pp}$ 0 V to 10 V

Clock rate
35 kHz to 55 kHz with R&S UPL-B2
35 kHz to 106 kHz with R&S UPL-B29

Jitter measurement
amplitude, frequency, spectrum
8 to 35 UI typ. for f < 500 Hz, decreasing to 0.5 UI for up to 50 kHz

Measurement limit
200 ps (noise floor with 8k FFT)

Reclocking signal
input signal sampled with low-jitter clock signal and available at reference output (XLR connector on rear)

Common mode test
at balanced input

Frequency, spectrum
20 Hz to 110 kHz

Phase (input to reference)
−64 to +64 UI (corresp. to ±50% of frame)

Delay (input to output)
100 µs to 500 ms

Coded Audio Signal Generation
(option R&S UPL-B23)

For specifications, refer to data sheet PD 0757.6985, Multichannel audio measurements on surround sound decoders.

FFT analyzer

Frequency range
Digital 48/96 kHz
DC to 21.9/43.8 kHz
ANLG 22/110 kHz
DC to 21.9/110 kHz

Dynamic range
Digital >135 dB
ANLG 22 kHz 120 dB/105 dB
ANLG 110 kHz 115 dB/65 dB

Noise floor
Digital −160 dB
ANLG 22 kHz −140 dB/110 dB
ANLG 110 kHz −120 dB/90 dB

FFT size
256, 512, 1k, 2k, 4k, 8k points (16k with zoom factor 2)

Window functions
rectangular, Hann, Blackman-Harris, Rife-Vincent 1-3, Hamming, flat top, Kaiser (β = 1 to 20)

Resolution
from 0.05 Hz with zoom, from 5.86 Hz without zoom

Zoom
2 to 128 (2 to 16 with ANLG 110)

Averaging
1 to 256, exponential or normal

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

User-definable filters
8th order elliptical, type C (for highpass and lowpass filters also 4th order), passband ripple +0/−0.1 dB, stopband attenuation to 22.5 kHz, 20 dB to 120 dB selectable in steps of approx. 10 dB (highpass and lowpass filters: stopband attenuation 40 to 120 dB).

Highpass, lowpass filters
limit frequencies +0/−0.1 dB selectable, stopband indicated

Bandpass, bandstop filters
passband +0/−0.1 dB selectable, stopband indicated

Notch filter
center frequency and width +0/−0.1 dB selectable, stopband indicated

Third octave and octave filters
center frequency selectable, bandwidth +0/−0.1 dB indicated

File-defined filters
any 8th order filter cascaded from 4 biquads, defined in the z plane by poles/zeros 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 140 dB for analyzer 22 kHz, or 120 dB for analyzer 110 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 analog analyzers with measurement functions:
— rms, wideband
— rms, selective
— quasi-peak
— FFT analysis

Frequency range
10 Hz to 22.5 kHz center frequency (f_c)

Frequency tuning
— automatic to input signal
— coupled to generator
— fixed through entered value

Stopband (typ.)
>30 dB, +0/−0.1 dB

Passband (typ.)
−3 dB at 0.77 x f_c, 1.3 x f_c

Typ. −0/−1 dB outside 0.5 x f_c; 2 x f_c

Sweep

Generator sweep
Parameters
frequency, level, with bursts also interval and duration, one- or two-dimensional

Sweep
linear, logarithmic, tabular, single, continuous, manual

Stepping
— automatic after end of measurement
— time delay (fixed or loaded table)

Analyzer sweep
Parameters
frequency or level of input signal
single, continuous

Trigger
— delayed (0 to 10 s) after input level or input frequency variation, settling function selectable
— time-controlled

Setting
for level, frequency, phase, distortion measurements, settling function: exponential, flat or averaging

Sweep speed
Two-channel rms measurement 20 Hz to 20 kHz, 30-point generator sweep logarithmic (frequency measurement switched off, Low Dist off)

with GEN TRACK
AUTO FAST 0.5 s
AUTO 2.5 s

Filter

For all analog and digital analyzers. Up to 3 filters can be combined as required. All filters are digital filters with a coefficient accuracy of 32 bit floating point (exception: analog notch filter).

Typical noise floor of FFT analysis at analog inputs

Audio Analyzer R&S UPL

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Display of results

Units
Level (analog) V, dBu, dBV, W, dBm, difference (Δ) and deviation (Δ%) and ratio (without dimension, %, dB) to reference value
Level (digital) FS, %FS, dBFS, LSBs deviation (Δ%) or ratio (dB) 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/fref, 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).
Current value of a channel or generator signal: permits direct measurement of gain, linearity, channel difference, crosstalk. In sweep mode, traces (other trace or loaded from file) can be used as a reference too.

Graphical display of results
Monitor (not R&S UPL) 8.4” LCD, colour
Display modes
- display of any sweep trace
- display of trace groups
- bar graph display with min./max. values
- spectrum, also as waterfall display
- list of results
- bar charts for THD and intermodulation measurements
Display functions
- autoscale
- X-axis zoom
- full-screen and part-screen mode
- 2 vertical, 1 horizontal cursor line
- search function for max. values
- marker for harmonics (spectrum)
- user-labelling for graphs
- change of unit and scale also possible for loaded traces
Test reports
Functions
- screen copy to printer, plotter or file (PCX, HPGL, Postscript)
- lists of results
- sweep lists
- tolerance curves
- list of out-of-tolerance values
- equalizer traces

Audio monitor (option R&S UPL-B5)
Headphone connector 6.3 mm jack
Output voltage (Uo) max. 8 V
Output current (Io) max. 50 mA
Source impedance 10 Ω, short-circuit-proof
Recommended headphone impedance 600 Ω

Extended analysis functions (option R&S UPL-B6)
Coherence and transfer functions can be displayed simultaneously
Frequency range DC to 21.9 kHz
Frequency resolution from 5.86 Hz
FFT length 2 to 2048
256, 512, 1, 2, 4, 8k points
Rub & buzz measurement simultaneous measurement of frequency response, rub & buzz and polarity
Frequency range 10 Hz to 110 kHz
Tracking highpass filter 2 to 20 times fundamental
Measurement time (200 Hz to 20 kHz, 200 points log.) 2 s

Multi-sine generator function
Mode 1 extended functions
- crest factor or phase of each component selectable
Mode 2 crest factor selectable

Third octave analysis
for analyzer ANLG 22 kHz and digital 48 kHz
Number of third octaves 32
Frequency range
22 Hz to 22 kHz
Level accuracy
±0.2 dB
±1.0 dB (IEC 1260, class 0)
Stereo sine
in digital generator only
Frequency range 2 Hz to 21.9 kHz
Frequency adjustable for each channel
0 to 360° (same frequency in both channels)
Level adjustable for each channel or channel ratio 2:1
Sweep parameters
frequency and level of channel 1

Other functions
under development

Hearing aids test accessories (option R&S UPL-B7)
Consisting of acoustic test chamber, acoustic 2 cm³ coupler, various battery adapters, connecting cables, software for measurements to IEC60118 and ANSI S3.22.
Additionally required options R&S UPL-B5 and R&S UPL-B10

1) With R&S UPL-B10 only in base rate mode.
2) Fixed frequency independent of clock rate.
LAN Interface for R&S UPL06/66 (option R&S UPL-B11)

Connector (rear panel) RJ45
Supported standards 10Base-T (IEEE standard 10 Mbit/s 802.3)
100Base-Tx (IEEE standard 100 Mbit/s 802.3u)
LAN client Novell Netware
Supported protocols IPX, TCP/IP

Modification R&S UPL-U3

Change of source impedance of analog generator to 150 Ω
(instead of 200 Ω set as standard) at the factory

General data

Operating temperature range 0 °C to +45 °C
Storage temperature range –20 °C to +60 °C
Humidity max. 85% for max. 60 days, below 65% on average/year, no condensation
EMI EN 50081-1
EMS EN 50082-1
Safety standards DIN EN 61010-1, IEC 1010-1, UL 3111-1, CAN/CSA C 22.2 No. 1010-1
Conformity marks VDE- GS, UL, cUL
Power supply 100/120/220/230 V ±10%, 50 Hz to 60 Hz, 100 VA
Dimensions (W x H x D) 435 mm x 192 mm x 475 mm
Weight 12.6 kg

Ordering information

Order designation
Audio Analyzer R&S UPL 1078.2088.06
Audio Analyzer R&S UPL16 1078.2088.16
Audio Analyzer (for conformance tests on GSM mobile phones) R&S UPL66 1078.2088.66

Accessories supplied

power cable, operating manual, backup system disks with MS-DOS operating system, backup program disk with operating and measurement software

Options

Low Distortion Generator R&S UPL-B1 1078.4400.02
Digital Audio I/O 48 kHz R&S UPL-B2 1078.4000.02
Digital Audio I/O 96 kHz R&S UPL-B29 1078.5107.02
Digital Audio Protocol R&S UPL-B21 1078.3856.02
Jitter and Interface Test R&S UPL-B22 1078.3956.02
Coded Audio Signal Generation R&S UPL-B23 1078.5188.02
Remote Control R&S UPL-B4 1078.3804.02
Audio Monitor R&S UPL-B5 1078.4600.03
Extended Analysis Functions R&S UPL-B6 1078.4500.02
Hearing Aids Test Accessories R&S UPL-B7 1078.2704.02
Mobile Phone Test Set R&S UPL-B8 1117.3505.02
3G Mobile Phone Tests R&S UPL-B9 1154.7500.02
Universal Sequence Controller R&S UPL-B10 1078.3904.02
LAN Interface for R&S UPL06/66 R&S UPL-B11 1154.7600.02
Line Measurement to ITU-T O.33 R&S UPL-B33 1078.4852.02
XLR/BNC Adapter Set R&S UPL-Z1 1078.3704.02
Line Measurement to ITU-T O.33 R&S UPL-B33 1078.4852.02

Recommended extras

19" Rack Adapter R&S ZZ-A4 0396.4905.00
Service manual 1078.2089.24
Audio Switcher (Input, female) R&S UP2 1120.8004.02
Audio Switcher (Output, male) R&S UP2 1120.8004.03