

# R&S® UPP

## Audio Analyzer

### Specifications



**ROHDE & SCHWARZ**

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# Definitions

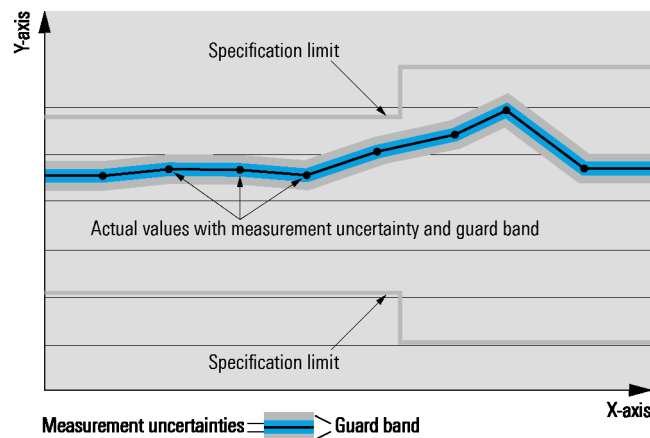
## General

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  $<$ ,  $\leq$ ,  $>$ ,  $\geq$ ,  $\pm$ , 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.

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

# Analog analyzer

## Input configurations

|                  |                |                       |
|------------------|----------------|-----------------------|
| <b>Analyzer</b>  |                |                       |
| Bandwidth 22 kHz | DC/AC coupling | DC/20 Hz to 21.76 kHz |
| Bandwidth 40 kHz | DC/AC coupling | DC/20 Hz to 40 kHz    |
| Bandwidth 80 kHz | DC/AC coupling | DC/20 Hz to 80 kHz    |

|                                          |                  |                              |
|------------------------------------------|------------------|------------------------------|
| <b>Level measurements (RMS)</b>          |                  |                              |
| Level error                              | at 1 kHz         | ±0.05 dB (±0.025 dB (meas.)) |
| Frequency response (referenced to 1 kHz) | 20 Hz to 20 kHz  | ±0.1 dB (±0.05 dB (meas.))   |
|                                          | 20 kHz to 80 kHz | ±0.2 dB                      |

|                                    |                                             |                                                                                                             |
|------------------------------------|---------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| <b>XLR connectors</b>              | pin 1 floating, 1 nF to ground <sup>1</sup> | 2/4/8 channels, balanced (unbalanced measurements possible with BNC adapter set), AC/DC coupling selectable |
| Voltage range                      | RMS, sine                                   | 1 µV to 50 V                                                                                                |
| Measurement ranges                 |                                             | 200 mV to 50 V, in steps of 12 dB                                                                           |
| Input impedance                    | each pin to ground                          | 100 kΩ ± 1 %    220 pF                                                                                      |
|                                    | between pins 2 and 3                        | 200 kΩ ± 1 % / 600 Ω ± 1 %                                                                                  |
| Crosstalk attenuation              | < 20 kHz                                    | > 100 dB                                                                                                    |
| Common-mode rejection, DC coupling | < 20 kHz for V <sub>in</sub> < 3 V          | > 50 dB                                                                                                     |

## Measurement functions

|                            |                             |                                        |
|----------------------------|-----------------------------|----------------------------------------|
| <b>RMS wideband</b>        |                             |                                        |
| Level error at 1 kHz, sine | measurement speed AUTO      | ±0.05 dB (±0.025 dB (meas.))           |
|                            | 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)      | A weighted                  | < 1.5 µV (1.0 µV (meas.))              |
|                            | CCIR unweighted             | < 2.0 µV (1.5 µV (meas.))              |
| Spectrum                   |                             | post FFT                               |

|                      |                                                                   |                                                                                                     |
|----------------------|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| <b>RMS selective</b> |                                                                   |                                                                                                     |
| Filter bandwidth     | analyzer bandwidth 22 kHz/40 kHz/80 kHz                           | 1 %, 3 %, 1/12 octave, 1/3 octave, fixed 20 Hz to 16 kHz/32 kHz/64 kHz, min. 20 Hz filter bandwidth |
| Selectivity          | 22 kHz bandwidth, bandpass, bandstop, elliptical filter 8th order | > 100 dB (nom.)                                                                                     |
| Frequency setting    |                                                                   | automatic to input signal, tracked to generator, fixed or sweep                                     |
| Level error          |                                                                   | +0.2 dB/–0.3 dB                                                                                     |

|                   |          |                                         |
|-------------------|----------|-----------------------------------------|
| <b>Peak</b>       |          |                                         |
| Measurement modes |          | peak max, peak min, peak-peak, peak abs |
| Level error       | at 1 kHz | ±0.1 dB                                 |
| Interval length   |          | 20 ms to 10 s                           |

|                   |  |                                                       |
|-------------------|--|-------------------------------------------------------|
| <b>DC voltage</b> |  |                                                       |
| Voltage range     |  | 0 V to ±50 V                                          |
| Level error       |  | ±(1 % of measured value + 0.1 % of measurement range) |

<sup>1</sup> Pin 1 grounded with serial numbers below 120100, 140100, 180100.

|                  |                    |                     |
|------------------|--------------------|---------------------|
| <b>S/N</b>       |                    |                     |
| Measurement mode | RMS wideband, peak | reading in dB units |
| Error limits     |                    | ±0.5 dB (nom.)      |

|                     |  |                          |
|---------------------|--|--------------------------|
| <b>FFT analysis</b> |  | see FFT analyzer section |
|---------------------|--|--------------------------|

|                                                                 |                                                                  |                                                                       |
|-----------------------------------------------------------------|------------------------------------------------------------------|-----------------------------------------------------------------------|
| <b>Total harmonic distortion (THD)</b>                          |                                                                  |                                                                       |
| Fundamental                                                     | bandwidth 22 kHz/40 kHz/80 kHz                                   | 10 Hz to 10.95 kHz/20 kHz/40 kHz                                      |
| Frequency tuning                                                |                                                                  | automatic to input or generator signal or fixed through entered value |
| Weighted harmonics                                              |                                                                  | any combination of d <sub>2</sub> to d <sub>9</sub>                   |
| Error limits                                                    | harmonics < 50 kHz                                               | ±0.5 dB                                                               |
|                                                                 | harmonics < 80 kHz                                               | ±0.7 dB                                                               |
| Inherent distortion <sup>2</sup><br>(analyzer bandwidth 22 kHz) | bandwidth 20 Hz to 22 kHz<br>at 1 kHz, 2.5 V, all d <sub>i</sub> | –110 dB (meas.)                                                       |
| Spectrum                                                        |                                                                  | bargraph showing signal and distortion,<br>post FFT                   |

|                                                                 |                                              |                                                                                 |
|-----------------------------------------------------------------|----------------------------------------------|---------------------------------------------------------------------------------|
| <b>THD+N and SINAD</b>                                          |                                              |                                                                                 |
| Fundamental                                                     | bandwidth 22 kHz/40 kHz/80 kHz               | 10 Hz to 21.75 kHz/40 kHz/80 kHz                                                |
| Frequency tuning                                                |                                              | automatic to input or generator signal or fixed through entered value           |
| Input voltage                                                   |                                              | > 100 µV with automatic tuning                                                  |
| Bandwidth                                                       |                                              | selectable upper and lower frequency limit,<br>one weighting filter in addition |
| Error limits                                                    | harmonics < 50 kHz                           | ±0.5 dB                                                                         |
|                                                                 | harmonics < 80 kHz                           | ±0.7 dB                                                                         |
| Inherent distortion <sup>2</sup><br>(analyzer bandwidth 22 kHz) | bandwidth 20 Hz to 22 kHz<br>at 1 kHz, 2.5 V | < –105 dB (meas.)                                                               |
| Inherent distortion <sup>2, 3</sup>                             | bandwidth 20 Hz to 22 kHz                    | < –100 dB + 2.5 µV                                                              |
|                                                                 | bandwidth 20 Hz to 80 kHz                    | < –94 dB + 3.5 µV                                                               |
| Spectrum                                                        |                                              | post FFT                                                                        |

|                                  |                                     |                                                     |
|----------------------------------|-------------------------------------|-----------------------------------------------------|
| <b>MOD DIST</b>                  |                                     |                                                     |
| Measurement mode                 |                                     | in line with DIN IEC 60268-3                        |
| Frequency range                  | lower frequency (LF)                | 30 Hz to UF/8                                       |
|                                  | upper frequency (UF)                | 8 × LF to 80 kHz                                    |
| Error limits                     |                                     | ±0.5 dB                                             |
| Inherent distortion <sup>2</sup> | LF 60 Hz, UF 7 kHz, level ratio 4:1 | < –80 dB (< –90 dB (meas.))                         |
| Spectrum                         |                                     | bargraph showing signal and distortion,<br>post FFT |

|                                  |                                          |                                                     |
|----------------------------------|------------------------------------------|-----------------------------------------------------|
| <b>DFD</b>                       |                                          |                                                     |
| Measurement mode                 |                                          | in line with DIN IEC 60268-3 or 60118               |
| Frequency range                  | difference frequency (DF)                | 80 Hz to 2 kHz,<br>depending on mean frequency      |
|                                  | mean frequency (MF)                      | 200 Hz to 80 kHz                                    |
| Error limits                     | mean frequency < 20 kHz                  | ±0.5 dB                                             |
| Inherent distortion <sup>2</sup> | DFD d <sub>2</sub> , MF 7 kHz, DF 500 Hz | < –100 dB (< –110 dB (meas.))                       |
|                                  | DFD d <sub>3</sub> , MF 7 kHz, DF 500 Hz | < –90 dB (< –100 dB (meas.))                        |
| Spectrum                         |                                          | bargraph showing signal and distortion,<br>post FFT |

<sup>2</sup> Total inherent distortion of analyzer and generator.

<sup>3</sup> + 5 dB when input voltage > 3 V.

| <b>Time domain display (WAVEFORM)</b> |  |                                                     |
|---------------------------------------|--|-----------------------------------------------------|
| Trigger                               |  | rise/fall                                           |
| Trigger level                         |  | –50 V to +50 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 sample recorded (envelope) |
| Undersample mode                      |  | undersampling factor up to 1024                     |

| <b>Frequency</b> |  |                 |
|------------------|--|-----------------|
| Frequency range  |  | 20 Hz to 80 kHz |
| Frequency error  |  | ±10 ppm         |

| <b>Phase</b>    |                  |                 |
|-----------------|------------------|-----------------|
| Frequency range |                  | 20 Hz to 80 kHz |
| Phase error     | 20 Hz to 20 kHz  | ±0.5°           |
|                 | 20 kHz to 40 kHz | ±1.0°           |

| <b>Group delay</b> |  |                 |
|--------------------|--|-----------------|
| Frequency range    |  | 20 Hz to 80 kHz |

| <b>Polarity</b>  |  |                                     |
|------------------|--|-------------------------------------|
| Measurement mode |  | measurement of asymmetrical signals |
| Display          |  | +POL, –POL                          |

# Analog generator

## Outputs

XLR connectors, two channels, electronically floating, balanced/unbalanced selectable, short-circuit-proof; max. current < 120 mA with external feed.

|                       |                                                                          |                                        |
|-----------------------|--------------------------------------------------------------------------|----------------------------------------|
| <b>Balanced</b>       |                                                                          |                                        |
| Voltage               | balanced, RMS, sine, open circuit<br>unbalanced, RMS, sine, open circuit | 0.2 mV to 14 V<br>0.1 mV to 7 V        |
| Crosstalk attenuation | frequency < 20 kHz                                                       | > 115 dB (130 dB (meas.))              |
| Source impedance      | between pins 2 and 3<br>pin 1 not connected                              | 25 $\Omega$ /600 $\Omega$ <sup>4</sup> |
| Load impedance        |                                                                          | > 400 $\Omega$                         |

## Signals

|                                          |                                     |                                                                            |
|------------------------------------------|-------------------------------------|----------------------------------------------------------------------------|
| <b>Sine</b>                              |                                     |                                                                            |
| Frequency range                          | bandwidth 22 kHz/40 kHz/80 kHz      | 0.1 Hz to 21.75 kHz/40 kHz/80 kHz                                          |
| Frequency error                          |                                     | $\pm 10$ ppm                                                               |
| Level error                              | at 1 kHz                            | $\pm 0.05$ dB                                                              |
| Frequency response (referenced to 1 kHz) | 20 Hz to 20 kHz<br>20 kHz to 80 kHz | $\pm 0.1$ dB (< $\pm 0.05$ (meas.))<br>$\pm 0.2$ dB (< $\pm 0.10$ (meas.)) |
| Inherent distortion (THD+N) <sup>5</sup> | 20 Hz to 22 kHz                     | < -100 dB + 2.5 $\mu$ V                                                    |
| Sweep parameters                         |                                     | frequency, level                                                           |

|                    |                                 |                                                     |
|--------------------|---------------------------------|-----------------------------------------------------|
| <b>Stereo sine</b> |                                 |                                                     |
| Frequency range    | bandwidth 22 kHz/40 kHz/80 kHz  | 0.1 Hz to 21.75 kHz/40 kHz/80 kHz                   |
| Frequency          |                                 | adjustable for each channel                         |
| Phase              | same frequency in both channels | -360° to +360°                                      |
| Level              |                                 | adjustable for each channel or<br>channel ratio 2/1 |
| Sweep parameters   |                                 | frequency, level of channel 1, phase                |

|                                  |                                                                      |                                                           |
|----------------------------------|----------------------------------------------------------------------|-----------------------------------------------------------|
| <b>MOD DIST</b>                  |                                                                      |                                                           |
|                                  | for measuring the modulation distortion in line with DIN IEC 60268-3 |                                                           |
| Frequency range                  | lower frequency (LF)<br>upper frequency (UF)                         | 30 Hz to UF/8<br>8 $\times$ LF to 21.75 kHz/40 kHz/80 kHz |
| Level ratio (LF:UF)              |                                                                      | selectable from 10:1 to 1:1                               |
| Level error                      |                                                                      | $\pm 0.5$ dB                                              |
| Inherent distortion <sup>5</sup> | level ratio LF:UF = 4:1<br>at 7 kHz, 60 Hz                           | < -90 dB (-95 dB (meas.))<br>< -96 dB (-100 dB (meas.))   |
| Sweep parameters                 |                                                                      | upper frequency, level                                    |

|                                  |                                                                                         |                                                                                     |
|----------------------------------|-----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <b>DFD</b>                       |                                                                                         |                                                                                     |
|                                  | for measuring the difference frequency distortion in line with DIN IEC 60268-3 or 60118 |                                                                                     |
| Frequency range                  | difference frequency<br>mean frequency                                                  | 80 Hz to 2 kHz,<br>depending on mean frequency<br>200 Hz to 20.75 kHz/39 kHz/79 kHz |
| Level error                      |                                                                                         | $\pm 0.5$ dB                                                                        |
| Inherent distortion <sup>5</sup> | DFD d <sub>2</sub><br>DFD d <sub>3</sub>                                                | < -110 dB (-115 dB (meas.))<br>< -94 dB (-105 dB (meas.))                           |
| Sweep parameters                 |                                                                                         | mean frequency, level                                                               |

<sup>4</sup> 600  $\Omega$  available only with serial numbers above 120099, 140099, 180099.

<sup>5</sup> Total inherent distortion of analyzer and generator.

|                   |                                |                                                       |
|-------------------|--------------------------------|-------------------------------------------------------|
| <b>Sine burst</b> |                                |                                                       |
| Burst time        |                                | 1 sample up to 60 s, 1 sample resolution              |
| Interval          |                                | single burst                                          |
| Low level         |                                | 0 to burst level, absolute or relative to burst level |
| Frequency         | bandwidth 22 kHz/40 kHz/80 kHz | 0.1 Hz to 21.75 kHz/40 kHz/80 kHz                     |
| Sweep parameters  |                                | burst frequency, level                                |

|                           |                                |                       |
|---------------------------|--------------------------------|-----------------------|
| <b>Arbitrary waveform</b> |                                |                       |
| Memory depth              |                                | max. 256 ksample      |
| Clock rate                | bandwidth 22 kHz/40 kHz/80 kHz | 48 kHz/96 kHz/192 kHz |
| File format               |                                | *.arb                 |

|                       |                                |                                |
|-----------------------|--------------------------------|--------------------------------|
| <b>Play WAV files</b> |                                |                                |
| File length           |                                | max. 16 Msample                |
| Clock rate            | bandwidth 22 kHz/40 kHz/80 kHz | 44.1 kHz/48 kHz/96 kHz/192 kHz |
| File format           |                                | *.wav                          |

|                             |                                |                                                              |
|-----------------------------|--------------------------------|--------------------------------------------------------------|
| <b>Polarity test signal</b> |                                |                                                              |
|                             |                                | asymmetrical two-tone signal<br>(fundamental + 2nd harmonic) |
| Fundamental frequency       | bandwidth 22 kHz/40 kHz/80 kHz | 0.1 Hz to 8 kHz/16 kHz/32 kHz                                |

|                   |            |                   |
|-------------------|------------|-------------------|
| <b>DC voltage</b> |            |                   |
| Level range       | balanced   | 0 V to $\pm 10$ V |
|                   | unbalanced | 0 V to $\pm 5$ V  |
| Level error       |            | $\pm 2$ %         |
| Sweep parameters  |            | level             |

|                  |            |                                     |
|------------------|------------|-------------------------------------|
| <b>DC offset</b> |            |                                     |
| Level range      | balanced   | 0 V to $\pm 10$ V                   |
|                  | unbalanced | 0 V to $\pm 5$ V                    |
| Level error      |            | $\pm 2$ %                           |
| Residual offset  |            | $\pm 1$ % of RMS value of AC signal |

# Digital audio analyzer (R&S®UPP-B2 option)

## Digital audio inputs

|                         |          |                                                                 |
|-------------------------|----------|-----------------------------------------------------------------|
| <b>Balanced input</b>   |          | 9-pin D-Sub connector (male), transformer coupling              |
| Impedance               |          | 110 $\Omega$                                                    |
| Level                   | $V_{pp}$ | 200 mV to 12 V                                                  |
| <b>Unbalanced input</b> |          | BNC, grounded                                                   |
| Impedance               |          | 75 $\Omega$                                                     |
| Level                   | $V_{pp}$ | 100 mV to 5 V                                                   |
| <b>Optical input</b>    |          | TOSLINK                                                         |
| <b>Channels</b>         |          | 1, 2 or both                                                    |
| <b>Audio bits</b>       |          | 8 to 24                                                         |
| <b>Clock rate</b>       |          | 30 kHz to 200 kHz                                               |
| <b>Format</b>           |          | professional and consumer format in line with AES3 or IEC 60958 |

## I<sup>2</sup>S input

|                        |                                        |                                  |
|------------------------|----------------------------------------|----------------------------------|
| <b>Input</b>           |                                        | 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 k $\Omega$                    |
|                        | level –5 V to –0.5 V and +5 V to +10 V | 100 $\Omega$                     |
| <b>Channels</b>        |                                        | 1, 2 or both multiplexed         |
| <b>Word length</b>     |                                        | 16 bit/24 bit/32 bit per channel |
| <b>Audio bits</b>      |                                        | 8 to 32                          |
| <b>Word clock rate</b> |                                        | 6.75 kHz to 200 kHz              |

## Measurement functions

All measurements at 24 bit, full scale.

|                       |           |                                    |
|-----------------------|-----------|------------------------------------|
| <b>RMS wideband</b>   |           |                                    |
| Measurement bandwidth |           | up to 50 % of sampling rate        |
| Level error           | AUTO FAST | $\pm 0.1$ dB                       |
|                       | AUTO      | $\pm 0.01$ dB                      |
|                       | GEN TRACK | $\pm 0.001$ dB                     |
| Integration time      | GEN TRACK | min. 100 sample, at least 1 cycle  |
|                       | AUTO FAST | min. 200 sample, at least 1 cycle  |
|                       | AUTO      | min. 4000 sample, at least 1 cycle |
|                       | VALUE     | 0.1 ms to 100 s                    |
| Spectrum              |           | post FFT                           |

|                      |                                                 |                                                                         |
|----------------------|-------------------------------------------------|-------------------------------------------------------------------------|
| <b>RMS selective</b> |                                                 |                                                                         |
| Bandwidth            | > 20 Hz                                         | 1 %, 3 %, 1/12 octave, 1/3 octave, fixed 20 Hz to 80 % of sampling rate |
| Selectivity          | bandpass, bandstop, elliptical filter 8th order | > 100 dB                                                                |
| Frequency setting    |                                                 | automatic to input signal, tracked to generator, fixed or sweep         |
| Level error          |                                                 | +0.2 dB/–0.3 dB                                                         |

|                   |          |                                         |
|-------------------|----------|-----------------------------------------|
| <b>Peak</b>       |          |                                         |
| Measurement modes |          | peak max, peak min, peak-peak, peak abs |
| Level error       | at 1 kHz | $\pm 0.05$ dB                           |
| Interval length   |          | 20 ms to 10 s                           |

|                   |  |                 |
|-------------------|--|-----------------|
| <b>DC voltage</b> |  |                 |
| Measurement range |  | 0 to $\pm 1$ FS |
| Level error       |  | $\pm 1$ %       |

|                  |                    |                     |
|------------------|--------------------|---------------------|
| <b>S/N</b>       |                    |                     |
| Measurement mode | RMS wideband, peak | reading in dB units |
| Error limits     |                    | ±0.2 dB (nom.)      |

|                     |  |                          |
|---------------------|--|--------------------------|
| <b>FFT analysis</b> |  | see FFT analyzer section |
|---------------------|--|--------------------------|

|                                        |  |                                                                       |
|----------------------------------------|--|-----------------------------------------------------------------------|
| <b>Total harmonic distortion (THD)</b> |  |                                                                       |
| Fundamental                            |  | 10 Hz to 47.9 % of sampling rate                                      |
| Frequency tuning                       |  | automatic to input or generator signal or fixed through entered value |
| Weighted harmonics                     |  | any combination of $d_2$ to $d_9$                                     |
| Error limits                           |  | ±0.3 dB                                                               |
| Inherent distortion <sup>6</sup>       |  | < -155 dB                                                             |
| Spectrum                               |  | bargraph showing signal and distortion, post FFT                      |

|                                  |                              |                                                                              |
|----------------------------------|------------------------------|------------------------------------------------------------------------------|
| <b>THD+N and SINAD</b>           |                              |                                                                              |
| 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                        |                              | selectable upper and lower frequency limit, one weighting filter in addition |
| Error limits                     |                              | ±0.3 dB                                                                      |
| Inherent distortion <sup>6</sup> | bandwidth 20 Hz to 21.90 kHz | < -142 dB                                                                    |
| Spectrum                         |                              | post FFT                                                                     |

|                                  |                         |                                                  |
|----------------------------------|-------------------------|--------------------------------------------------|
| <b>MOD DIST</b>                  |                         |                                                  |
| Measurement mode                 |                         | in line with DIN IEC 60268-3                     |
| Frequency range                  | lower frequency (LF)    | 30 Hz to UF/8                                    |
|                                  | upper frequency (UF)    | 8 × LF to 49.9 % of sampling rate                |
| Error limits                     |                         | ±0.2 dB                                          |
| Inherent distortion <sup>6</sup> | level ratio LF:UF = 4:1 | < -142 dB                                        |
| Spectrum                         |                         | bargraph showing signal and distortion, post FFT |

|                                  |                         |                                                  |
|----------------------------------|-------------------------|--------------------------------------------------|
| <b>DFD</b>                       |                         |                                                  |
| Measurement mode                 |                         | in line with DIN IEC 60268-3 or 60118            |
| Frequency range                  | difference frequency    | 80 Hz to 2 kHz, depending on mean frequency      |
|                                  | mean frequency          | 200 Hz to 49.9 % of sampling rate – 1 kHz        |
| Error limits                     | mean frequency < 20 kHz | ±0.2 dB                                          |
| Inherent distortion <sup>6</sup> | DFD $d_2$               | < -155 dB                                        |
|                                  | DFD $d_3$               | < -155 dB                                        |
| Spectrum                         |                         | bargraph showing signal and distortion, post FFT |

|                                       |  |                                                     |
|---------------------------------------|--|-----------------------------------------------------|
| <b>Time domain display (WAVEFORM)</b> |  |                                                     |
| Trigger                               |  | rise/fall                                           |
| 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 sample recorded (envelope) |
| Undersample mode                      |  | undersampling factor up to 1024                     |

<sup>6</sup> Total inherent distortion of analyzer and generator.

|                  |  |                                  |
|------------------|--|----------------------------------|
| <b>Frequency</b> |  |                                  |
| Frequency range  |  | 20 Hz to 41.7 % of sampling rate |
| Frequency error  |  | ±10 ppm                          |

|                 |  |                                  |
|-----------------|--|----------------------------------|
| <b>Phase</b>    |  |                                  |
| Frequency range |  | 20 Hz to 41.7 % of sampling rate |
| Phase error     |  | ±0.4°                            |

|                    |  |                                  |
|--------------------|--|----------------------------------|
| <b>Group delay</b> |  |                                  |
| Frequency range    |  | 20 Hz to 41.7 % of sampling rate |

|                  |  |                                     |
|------------------|--|-------------------------------------|
| <b>Polarity</b>  |  |                                     |
| Measurement mode |  | measurement of asymmetrical signals |
| Display          |  | +POL, -POL                          |

# Digital audio generator (R&S®UPP-B2 option)

## Digital audio outputs

|                             |                            |                                                                 |
|-----------------------------|----------------------------|-----------------------------------------------------------------|
| <b>Balanced output</b>      |                            | 9-pin D-Sub connector (male), transformer coupling              |
| Impedance                   |                            | 110 $\Omega$ , short-circuit-proof                              |
| Level                       | $V_{pp}$ into 110 $\Omega$ | 0 V to 8 V, in 240 steps                                        |
| Error limits                |                            | $\pm 1$ dB                                                      |
| <b>Unbalanced output</b>    |                            | BNC, grounded                                                   |
| Impedance                   |                            | 75 $\Omega$ , short-circuit-proof                               |
| Level                       | $V_{pp}$ into 75 $\Omega$  | 0 V to 2 V, in 240 steps                                        |
| Error limits                |                            | $\pm 1$ dB                                                      |
| <b>Optical output</b>       |                            | TOSLINK                                                         |
| <b>Channels</b>             |                            | 1, 2 or both                                                    |
| <b>Audio bits</b>           |                            | 8 to 24                                                         |
| <b>Clock rate</b>           |                            | 30 kHz to 200 kHz                                               |
| <b>Format</b>               |                            | professional and consumer format in line with AES3 or IEC 60958 |
| <b>Synchronization</b>      |                            | internal clock<br>external word clock or DARS                   |
| <b>Sync input (SYNC IN)</b> |                            | BNC, grounded                                                   |
| Level                       | low                        | < 0.8 V                                                         |
|                             | high                       | > 2 V                                                           |
| Impedance                   |                            | 75 $\Omega$                                                     |

## I<sup>2</sup>S output

|                             |      |                                                       |
|-----------------------------|------|-------------------------------------------------------|
| <b>Output</b>               |      | 25-pin D-Sub connector (male)                         |
| Impedance                   |      | 50 $\Omega$ , short-circuit-proof                     |
| Level                       |      | 3.3 V                                                 |
| <b>Channels</b>             |      | 1, 2 or both multiplexed                              |
| <b>Word length</b>          |      | 16 bit/24 bit/32 bit per channel                      |
| <b>Audio bits</b>           |      | 8 to 32                                               |
| <b>Clock rate</b>           |      | 6.75 kHz to 200 kHz                                   |
| <b>Synchronization</b>      |      | internal clock<br>external word clock or master clock |
| Master clock rate           |      | 432 kHz to 25.6 MHz                                   |
| <b>Sync input (SYNC IN)</b> |      | BNC, grounded                                         |
| Level                       | low  | < 0.8 V                                               |
|                             | high | > 2 V                                                 |
| Impedance                   |      | > 5 k $\Omega$                                        |

## Signals

All signals 24 bit, full scale.

|                                |                                         |                             |
|--------------------------------|-----------------------------------------|-----------------------------|
| <b>General characteristics</b> |                                         |                             |
| Dither                         | for sine, stereo sine, DFD and MOD DIST |                             |
|                                | distribution                            | rectangular                 |
|                                | level                                   | 0.5 LSB to 1 FS             |
| Frequency error                | internal clock                          | $\pm 10$ ppm                |
|                                | relative to clock rate                  | $\pm 1$ ppm                 |
| DC offset                      |                                         | 0 to $\pm 1$ FS, adjustable |

|                                        |  |                                   |
|----------------------------------------|--|-----------------------------------|
| <b>Sine</b>                            |  |                                   |
| Frequency range                        |  | 0.1 Hz to 49.9 % of sampling rate |
| Inherent distortion (THD) <sup>7</sup> |  | < -155 dB                         |
| Sweep parameters                       |  | frequency, level                  |

<sup>7</sup> Total inherent distortion of analyzer and generator.

|                    |                                 |                                                     |
|--------------------|---------------------------------|-----------------------------------------------------|
| <b>Stereo sine</b> |                                 |                                                     |
| Frequency range    |                                 | 0.1 Hz to 49.9 % of sampling rate                   |
| Frequency          |                                 | adjustable for each channel                         |
| Phase              | same frequency in both channels | –360° to +360°                                      |
| Level              |                                 | adjustable for each channel<br>or channel ratio 2/1 |
| Sweep parameters   |                                 | frequency, level of channel 1, phase                |

|                                  |                                                                      |                                   |
|----------------------------------|----------------------------------------------------------------------|-----------------------------------|
| <b>MOD DIST</b>                  |                                                                      |                                   |
|                                  | for measuring the modulation distortion in line with DIN IEC 60268-3 |                                   |
| Frequency range                  | lower frequency (LF)                                                 | 30 Hz to UF/8                     |
|                                  | upper frequency (UF)                                                 | 8 × LF to 49.9 % of sampling rate |
| Level ratio (LF:UF)              |                                                                      | selectable from 10:1 to 1:1       |
| Inherent distortion <sup>8</sup> | level ratio LF:UF = 4:1                                              | < –142 dB                         |
| Sweep parameters                 |                                                                      | upper frequency, level            |

|                                  |                                                                                         |                                                |
|----------------------------------|-----------------------------------------------------------------------------------------|------------------------------------------------|
| <b>DFD</b>                       |                                                                                         |                                                |
|                                  | for measuring the difference frequency distortion in line with DIN IEC 60268-3 or 60118 |                                                |
| Frequency range                  | difference frequency                                                                    | 80 Hz to 2 kHz,<br>depending on mean frequency |
|                                  | mean frequency                                                                          | 200 Hz to 49.9 % of sampling rate – 1 kHz      |
| Inherent distortion <sup>8</sup> | DFD d <sub>2</sub>                                                                      | < –155 dB                                      |
|                                  | DFD d <sub>3</sub>                                                                      | < –155 dB                                      |
| Sweep parameters                 |                                                                                         | mean frequency, level                          |

|                   |  |                                                         |
|-------------------|--|---------------------------------------------------------|
| <b>Sine burst</b> |  |                                                         |
| Burst time        |  | 1 sample up to 60 s, 1 sample resolution                |
| Interval          |  | single burst                                            |
| Low level         |  | 0 to burst level, absolute or referenced to burst level |
| Sweep parameters  |  | burst frequency, level                                  |

|                           |  |                            |
|---------------------------|--|----------------------------|
| <b>Arbitrary waveform</b> |  |                            |
| Memory depth              |  | max. 256 ksample           |
| Clock rate                |  | sampling rate of generator |
| File format               |  | *.arb                      |

|                       |  |                            |
|-----------------------|--|----------------------------|
| <b>Play WAV files</b> |  |                            |
| File length           |  | max. 16 Msample            |
| Clock rate            |  | sampling rate of generator |
| File format           |  | *.wav                      |

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

|                   |  |            |
|-------------------|--|------------|
| <b>DC voltage</b> |  |            |
| Level range       |  | 0 to ±1 FS |
| Sweep parameters  |  | level      |

<sup>8</sup> Total inherent distortion of analyzer and generator.

# HDMI/digital audio analyzer (R&S® UPP-B4 option)

## Digital audio inputs

|                         |          |                                                                 |
|-------------------------|----------|-----------------------------------------------------------------|
| <b>Unbalanced input</b> |          | BNC, grounded                                                   |
| Impedance               |          | 75 $\Omega$                                                     |
| Level                   | $V_{pp}$ | 100 mV to 5 V                                                   |
| <b>Optical input</b>    |          | TOSLINK                                                         |
| <b>Channels</b>         |          | 1, 2 or both                                                    |
| <b>Audio bits</b>       |          | 8 to 24                                                         |
| <b>Clock rate</b>       |          | 30 kHz to 200 kHz                                               |
| <b>Format</b>           |          | professional and consumer format in line with AES3 or IEC 60958 |

## I<sup>2</sup>S input

|                        |                                        |                                    |
|------------------------|----------------------------------------|------------------------------------|
| <b>Input</b>           | max. 4 data lines                      | 26-pin D-Sub HD connector (female) |
| Level                  | low                                    | < 0.8 V (min. -5 V)                |
|                        | high                                   | > 2 V (max. 10 V)                  |
| Impedance              | level -0.5 V to +5.5 V                 | 10 k $\Omega$                      |
|                        | level -5 V to -0.5 V and +5 V to +10 V | 100 $\Omega$                       |
| <b>Channels</b>        |                                        | 1 to 8                             |
| <b>Word length</b>     |                                        | 16 bit/24 bit/32 bit per channel   |
| <b>Audio bits</b>      |                                        | 8 to 32                            |
| <b>Word clock rate</b> |                                        | 6.75 kHz to 200 kHz                |

## HDMI input

|                        |                          |                             |
|------------------------|--------------------------|-----------------------------|
| <b>Input</b>           |                          | HDMI type A                 |
| <b>Input format</b>    |                          | PCM                         |
|                        | with R&S® UPP-K41 option | Dolby coded signals         |
| <b>Channels</b>        |                          | 1 to 8                      |
| <b>Word length</b>     |                          | 16 bit/20 bit/24 bit        |
| <b>Audio bits</b>      |                          | 16 to 24                    |
| <b>Word clock rate</b> | standard clock rates     | 32 kHz to 192 kHz $\pm$ 4 % |

## Measurement functions

All measurements at 24 bit (digital audio), full scale.

|                       |           |                                    |
|-----------------------|-----------|------------------------------------|
| <b>RMS wideband</b>   |           |                                    |
| Measurement bandwidth |           | up to 50 % of sampling rate        |
| Level error           | AUTO FAST | $\pm 0.1$ dB                       |
|                       | AUTO      | $\pm 0.01$ dB                      |
|                       | GEN TRACK | $\pm 0.001$ dB                     |
| Integration time      | GEN TRACK | min. 100 sample, at least 1 cycle  |
|                       | AUTO FAST | min. 200 sample, at least 1 cycle  |
|                       | AUTO      | min. 4000 sample, at least 1 cycle |
|                       | VALUE     | 0.1 ms to 100 s                    |
| Spectrum              |           | post FFT                           |

|                      |                                                 |                                                                         |
|----------------------|-------------------------------------------------|-------------------------------------------------------------------------|
| <b>RMS selective</b> |                                                 |                                                                         |
| Bandwidth            | > 20 Hz                                         | 1 %, 3 %, 1/12 octave, 1/3 octave, fixed 20 Hz to 80 % of sampling rate |
| Selectivity          | bandpass, bandstop, elliptical filter 8th order | > 100 dB                                                                |
| Frequency setting    |                                                 | automatic to input signal, tracked to generator, fixed or sweep         |
| Level error          |                                                 | +0.2 dB/-0.3 dB                                                         |

|                   |          |                                         |
|-------------------|----------|-----------------------------------------|
| <b>Peak</b>       |          |                                         |
| Measurement modes |          | peak max, peak min, peak-peak, peak abs |
| Level error       | at 1 kHz | $\pm 0.05$ dB                           |
| Interval length   |          | 20 ms to 10 s                           |

|                   |  |                 |
|-------------------|--|-----------------|
| <b>DC voltage</b> |  |                 |
| Measurement range |  | 0 to $\pm 1$ FS |
| Level error       |  | $\pm 1$ %       |

|                  |                    |                     |
|------------------|--------------------|---------------------|
| <b>S/N</b>       |                    |                     |
| Measurement mode | RMS wideband, peak | reading in dB units |
| Error limits     |                    | $\pm 0.2$ dB (nom.) |

|                     |  |                          |
|---------------------|--|--------------------------|
| <b>FFT analysis</b> |  | see FFT analyzer section |
|---------------------|--|--------------------------|

|                                        |  |                                                                       |
|----------------------------------------|--|-----------------------------------------------------------------------|
| <b>Total harmonic distortion (THD)</b> |  |                                                                       |
| Fundamental                            |  | 10 Hz to 47.9 % of sampling rate                                      |
| Frequency tuning                       |  | automatic to input or generator signal or fixed through entered value |
| Weighted harmonics                     |  | any combination of $d_2$ to $d_9$                                     |
| Error limits                           |  | $\pm 0.3$ dB                                                          |
| Inherent distortion <sup>9</sup>       |  | $< -155$ dB                                                           |
| Spectrum                               |  | bargraph showing signal and distortion, post FFT                      |

|                                  |                              |                                                                              |
|----------------------------------|------------------------------|------------------------------------------------------------------------------|
| <b>THD+N and SINAD</b>           |                              |                                                                              |
| Fundamental                      |                              | 10 Hz to 45.6 % of sampling rate                                             |
| Frequency tuning                 |                              | automatic to input or generator signal or fixed through entered value        |
| Stop band range                  |                              | fundamental $\pm 28$ Hz, max. up to 2nd harmonic                             |
| Bandwidth                        |                              | selectable upper and lower frequency limit, one weighting filter in addition |
| Error limits                     |                              | $\pm 0.3$ dB                                                                 |
| Inherent distortion <sup>9</sup> | bandwidth 20 Hz to 21.90 kHz | $< -142$ dB                                                                  |
| Spectrum                         |                              | post FFT                                                                     |

|                                  |                         |                                                  |
|----------------------------------|-------------------------|--------------------------------------------------|
| <b>MOD DIST</b>                  |                         |                                                  |
| Measurement mode                 |                         | in line with DIN IEC 60268-3                     |
| Frequency range                  | lower frequency (LF)    | 30 Hz to 2700 Hz                                 |
|                                  | upper frequency (UF)    | $8 \times \text{LF}$ to 45.6 % of sampling rate  |
| Error limits                     |                         | $\pm 0.2$ dB                                     |
| Inherent distortion <sup>9</sup> | level ratio LF:UF = 4:1 | $< -142$ dB                                      |
| Spectrum                         |                         | bargraph showing signal and distortion, post FFT |

|                                  |                           |                                                  |
|----------------------------------|---------------------------|--------------------------------------------------|
| <b>DFD</b>                       |                           |                                                  |
| Measurement mode                 |                           | in line with DIN IEC 60268-3 or 60118            |
| Frequency range                  | difference frequency      | 80 Hz to 2 kHz                                   |
|                                  | mean frequency            | 200 Hz to 43.5 % of sampling rate                |
| Error limits                     | mean frequency $< 20$ kHz | $\pm 0.2$ dB                                     |
| Inherent distortion <sup>9</sup> | DFD $d_2$                 | $< -155$ dB                                      |
|                                  | DFD $d_3$                 | $< -155$ dB                                      |
| Spectrum                         |                           | bargraph showing signal and distortion, post FFT |

<sup>9</sup> Total inherent distortion of analyzer and generator.

| <b>Time domain display (WAVEFORM)</b> |  |                                                     |
|---------------------------------------|--|-----------------------------------------------------|
| Trigger                               |  | rise/fall                                           |
| 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 sample recorded (envelope) |
| Undersample mode                      |  | undersampling factor up to 1024                     |

| <b>Frequency</b> |  |                                  |
|------------------|--|----------------------------------|
| Frequency range  |  | 20 Hz to 41.7 % of sampling rate |
| Frequency error  |  | ±10 ppm                          |

| <b>Phase</b>    |  |                                  |
|-----------------|--|----------------------------------|
| Frequency range |  | 20 Hz to 41.7 % of sampling rate |
| Phase error     |  | ±0.4°                            |

| <b>Group delay</b> |  |                                  |
|--------------------|--|----------------------------------|
| Frequency range    |  | 20 Hz to 41.7 % of sampling rate |

| <b>Polarity</b>  |  |                                     |
|------------------|--|-------------------------------------|
| Measurement mode |  | measurement of asymmetrical signals |
| Display          |  | +POL, –POL                          |

| <b>Lip sync</b>  |                         |                      |
|------------------|-------------------------|----------------------|
|                  | with R&S®UPP-K45 option |                      |
| Measurement mode |                         | audio to video delay |
| Error limits     |                         | ±1/sampling rate     |

| <b>BERT</b>      |                         |                                                                       |
|------------------|-------------------------|-----------------------------------------------------------------------|
|                  | with R&S®UPP-K45 option |                                                                       |
| Measurement mode |                         | deterministic patterns                                                |
| Error limits     |                         | $\pm 100 \times (1/(\text{HSYNC freq.} \times \text{meas. time})) \%$ |

# HDMI/digital audio generator (R&S®UPP-B4 option)

## Digital audio outputs

|                             |                           |                                                                 |
|-----------------------------|---------------------------|-----------------------------------------------------------------|
| <b>Unbalanced output</b>    |                           | BNC, grounded                                                   |
| Impedance                   |                           | 75 $\Omega$ , short-circuit-proof                               |
| Level                       | $V_{pp}$ into 75 $\Omega$ | 0 V to 2 V, in 240 steps                                        |
| Error limits                |                           | $\pm 1$ dB                                                      |
| <b>Optical output</b>       |                           | TOSLINK                                                         |
| <b>Channels</b>             |                           | 1, 2 or both                                                    |
| <b>Audio bits</b>           |                           | 8 to 24                                                         |
| <b>Clock rate</b>           |                           | 30 kHz to 200 kHz                                               |
| <b>Format</b>               |                           | professional and consumer format in line with AES3 or IEC 60958 |
| <b>Synchronization</b>      |                           | internal clock<br>external word clock or DARS                   |
| <b>Sync input (SYNC IN)</b> |                           | BNC, grounded                                                   |
| Level                       | low                       | < 0.8 V                                                         |
|                             | high                      | > 2 V                                                           |
| Impedance                   |                           | 75 $\Omega$                                                     |

## I<sup>2</sup>S output

|                             |                   |                                                       |
|-----------------------------|-------------------|-------------------------------------------------------|
| <b>Output</b>               | max. 4 data lines | 26-pin D-Sub HD connector (female)                    |
| Impedance                   |                   | 50 $\Omega$ , short-circuit-proof                     |
| Level                       |                   | 3.3 V                                                 |
| <b>Channels</b>             |                   | 1 to 8                                                |
| <b>Word length</b>          |                   | 16 bit/24 bit/32 bit per channel                      |
| <b>Audio bits</b>           |                   | 8 to 32                                               |
| <b>Clock rate</b>           |                   | 6.75 kHz to 200 kHz                                   |
| <b>Synchronization</b>      |                   | internal clock<br>external word clock or master clock |
| Master clock rate           |                   | 432 kHz to 25.6 MHz                                   |
| <b>Sync input (SYNC IN)</b> |                   | BNC, grounded                                         |
| Level                       | low               | < 0.8 V                                               |
|                             | high              | > 2 V                                                 |
| Impedance                   |                   | > 5 k $\Omega$                                        |

## HDMI output

|                        |                                        |                             |
|------------------------|----------------------------------------|-----------------------------|
| <b>Output</b>          |                                        | HDMI type A                 |
| <b>Output format</b>   |                                        | PCM                         |
|                        | with R&S®UPP-K41 option, function play | Dolby coded signals         |
| <b>Channels</b>        |                                        | 1 to 8                      |
| <b>Word length</b>     |                                        | 16 bit/20 bit/24 bit        |
| <b>Audio bits</b>      |                                        | 16 to 24                    |
| <b>Word clock rate</b> | standard clock rates                   | 32 kHz to 192 kHz $\pm 4$ % |

## Signals

All signals with 24 bit (digital audio), full scale.

|                                |                                         |                             |
|--------------------------------|-----------------------------------------|-----------------------------|
| <b>General characteristics</b> |                                         |                             |
| Dither                         | for sine, stereo sine, DFD and MOD DIST |                             |
|                                | distribution                            | rectangular                 |
|                                | level                                   | 0.5 LSB to 1 FS             |
| Frequency error                | internal clock                          | $\pm 10$ ppm                |
|                                | relative to clock rate                  | $\pm 1$ ppm                 |
| DC offset                      |                                         | 0 to $\pm 1$ FS, adjustable |

|                                         |  |                                   |
|-----------------------------------------|--|-----------------------------------|
| <b>Sine</b>                             |  |                                   |
| Frequency range                         |  | 0.1 Hz to 45.6 % of sampling rate |
| Inherent distortion (THD) <sup>10</sup> |  | < -155 dB                         |
| Sweep parameters                        |  | frequency, level                  |

|                    |                                 |                                                     |
|--------------------|---------------------------------|-----------------------------------------------------|
| <b>Stereo sine</b> |                                 |                                                     |
| Frequency range    |                                 | 0.1 Hz to 45.6 % of sampling rate                   |
| Frequency          |                                 | adjustable for each channel                         |
| Phase              | same frequency in both channels | -360° to +360°                                      |
| Level              |                                 | adjustable for each channel<br>or channel ratio 2/1 |
| Sweep parameters   |                                 | frequency, level of channel 1, phase                |

|                                   |                                                                      |                                   |
|-----------------------------------|----------------------------------------------------------------------|-----------------------------------|
| <b>MOD DIST</b>                   |                                                                      |                                   |
|                                   | for measuring the modulation distortion in line with DIN IEC 60268-3 |                                   |
| Frequency range                   | lower frequency (LF)                                                 | 30 Hz to UF/8                     |
|                                   | upper frequency (UF)                                                 | 8 × LF to 45.6 % of sampling rate |
| Level ratio (LF:UF)               |                                                                      | selectable from 10:1 to 1:1       |
| Inherent distortion <sup>10</sup> | level ratio LF:UF = 4:1                                              | < -142 dB                         |
| Sweep parameters                  |                                                                      | upper frequency, level            |

|                                   |                                                                                         |                                   |
|-----------------------------------|-----------------------------------------------------------------------------------------|-----------------------------------|
| <b>DFD</b>                        |                                                                                         |                                   |
|                                   | for measuring the difference frequency distortion in line with DIN IEC 60268-3 or 60118 |                                   |
| Frequency range                   | difference frequency                                                                    | 80 Hz to 2 kHz                    |
|                                   | mean frequency                                                                          | 200 Hz to 43.5 % of sampling rate |
| Inherent distortion <sup>10</sup> | DFD d <sub>2</sub>                                                                      | < -155 dB                         |
|                                   | DFD d <sub>3</sub>                                                                      | < -155 dB                         |
| Sweep parameters                  |                                                                                         | mean frequency, level             |

|                   |  |                                                         |
|-------------------|--|---------------------------------------------------------|
| <b>Sine burst</b> |  |                                                         |
| Burst time        |  | 1 sample up to 60 s, 1 sample resolution                |
| Interval          |  | single burst                                            |
| Low level         |  | 0 to burst level, absolute or referenced to burst level |
| Sweep parameters  |  | burst frequency, level                                  |

|                           |  |                            |
|---------------------------|--|----------------------------|
| <b>Arbitrary waveform</b> |  |                            |
| Memory depth              |  | max. 256 ksample           |
| Clock rate                |  | sampling rate of generator |
| File format               |  | *.arb                      |

|                       |                         |                            |
|-----------------------|-------------------------|----------------------------|
| <b>Play WAV files</b> |                         |                            |
| File length           |                         | max. 16 Msample            |
| Clock rate            |                         | sampling rate of generator |
| File format           |                         | *.wav                      |
|                       | with R&S®UPP-K41 option | *.ac3, *.ec3               |

|                             |  |                                                              |
|-----------------------------|--|--------------------------------------------------------------|
| <b>Polarity test signal</b> |  |                                                              |
|                             |  | asymmetrical two-tone signal<br>(fundamental + 2nd harmonic) |
| Fundamental frequency       |  | 0.1 Hz to 8 kHz                                              |

|                   |  |            |
|-------------------|--|------------|
| <b>DC voltage</b> |  |            |
| Level range       |  | 0 to ±1 FS |
| Sweep parameters  |  | level      |

<sup>10</sup> Total inherent distortion of analyzer and generator.

|                                       |                        |                                                                                        |
|---------------------------------------|------------------------|----------------------------------------------------------------------------------------|
| <b>Universal multichannel signals</b> |                        | individually per channel: addition of one or more of the following signals             |
| All channels dither                   | distribution           | rectangular                                                                            |
|                                       | level                  | 0 FS to 1 FS                                                                           |
| All channels sine                     | frequency range        | 100 mHz to 45.6 % of sampling rate                                                     |
|                                       | level                  | 0 FS to 1 FS                                                                           |
|                                       | sweep parameters       | frequency, voltage                                                                     |
| Per channel sine                      | frequency range        | 100 mHz to 45.6 % of sampling rate                                                     |
|                                       | level                  | 0 FS to 1 FS                                                                           |
| Per channel DC offset                 |                        | -1 FS to 1 FS                                                                          |
| Per channel arbitrary waveform        | memory depth           | max. 256 ksample                                                                       |
|                                       | clock rate             | sampling rate of generator                                                             |
|                                       | file format            | *.arb                                                                                  |
| Frequency error                       | internal clock         | ±10 ppm                                                                                |
|                                       | relative to clock rate | ±1 ppm                                                                                 |
| DC offset                             |                        | 0 FS to ±1 FS, adjustable                                                              |
| Limiter function                      | selectable             | limits the peak value of the sum signal to 1 FS with respect to the given level ratios |

## FFT analyzer

|                  |                                       |                                                                            |
|------------------|---------------------------------------|----------------------------------------------------------------------------|
| Frequency range  | digital                               | DC to 50 % of sampling rate                                                |
|                  | analog bandwidth 22 kHz/40 kHz/80 kHz | DC to 22.5 kHz/43.5 kHz/87 kHz                                             |
| FFT size         |                                       | 512, 1k, 2k, 4k, 8k, 16k, 32k, 64k, 128k, 256k points                      |
| Window functions |                                       | rectangular, Hann, Blackman-Harris, Rife-Vincent 1 to 3, Hamming, flat top |

## Filter

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

|                  |                 |                                             |
|------------------|-----------------|---------------------------------------------|
| <b>Analyzer</b>  | prefilter       | 1 weighting or user-definable filter        |
|                  | function filter | up to 2 weighting or user-definable filters |
| <b>Generator</b> |                 | 1 weighting or user-definable filter        |

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

|                                     |  |                                                                                                           |
|-------------------------------------|--|-----------------------------------------------------------------------------------------------------------|
| <b>Highpass and lowpass filters</b> |  | highpass 22 Hz<br>highpass 400 Hz<br>lowpass 22 kHz<br>lowpass 30 kHz<br>lowpass 80 kHz<br>AES 17 lowpass |
|-------------------------------------|--|-----------------------------------------------------------------------------------------------------------|

| <b>User-definable filters</b>   |  |                                                                                                                                                                                                                                                                        |
|---------------------------------|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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       |  | selectable passband (−0.1 dB), stopband indicated                                                                                                                                                                                                                      |
| Bandpass, bandstop filters      |  | selectable passband (−0.1 dB), stopband indicated                                                                                                                                                                                                                      |
| Notch                           |  | selectable center frequency and width (−0.1 dB), stopband indicated                                                                                                                                                                                                    |
| Third octave and octave filters |  | selectable center frequency, bandwidth (−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                                                                                                                                                                    |

## Sweep

| <b>Generator sweep</b> |                                      |                                           |
|------------------------|--------------------------------------|-------------------------------------------|
| Parameters             | sine, stereo sine, DC, MOD DIST, DFD | frequency, level, one- or two-dimensional |
| Sweep                  |                                      | linear, logarithmic, single, continuous   |
| Stepping               |                                      | time steps or synchronized to analyzer    |

| <b>Sweep speed</b>                                                                                                                        |           |                       |
|-------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------------------|
| RMS measurement 20 Hz to 20 kHz, logarithmic 30-point generator sweep (frequency measurement switched OFF, 80 kHz bandwidth, DC coupling) |           | 2 channels/8 channels |
|                                                                                                                                           | GEN TRACK | 0.3 s/0.4 s           |
|                                                                                                                                           | AUTO FAST | 0.4 s/0.5 s           |
|                                                                                                                                           | AUTO      | 0.8 s/0.9 s           |

## Display of results (using external monitor)

| <b>Units</b>    |  |                                                                                                                                                                                                     |
|-----------------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Level (analog)  |  | V, dBu, dBV, W, dBm, difference ( $\Delta$ ), deviation ( $\Delta\%$ ) and ratio (without dimension, %, dBr) to reference value (entered or stored, current generator level)                        |
| Level (digital) |  | FS, %FS, dBFS, LSBs, deviation ( $\Delta\%$ ) or ratio (dBr) to reference value (entered or stored, current generator level)                                                                        |
| 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 ( $\Delta$ ), deviation ( $\Delta\%$ ) and ratio (as quotient $f/f_{\text{ref}}$ , 1/3 octave, octave or decade) to reference value (entered or stored, current generator frequency) |
| Phase           |  | °, rad, difference ( $\Delta$ ) to reference value (entered or stored)                                                                                                                              |

**Graphical display of results, external DVI-D monitor with resolution up to 1280 × 1024 pixel (75 Hz)**

|                    |  |                                                                                            |
|--------------------|--|--------------------------------------------------------------------------------------------|
| 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                                                                         |
|                    |  | two cursor lines, vertical or horizontal                                                   |
|                    |  | 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 printer, clipboard or file (BMP, variable size/colors/line type) |
| Printer types      |  | all Windows XP supported printers                                               |
| Printer interfaces |  | USB, LAN                                                                        |

## Remote control

|            |  |                                                                             |
|------------|--|-----------------------------------------------------------------------------|
| Interfaces |  | IEC 625-2 (IEEE 488), LAN or USB device; commands largely in line with SCPI |
| Protocols  |  | IEEE 488, VXI-11, NI-Visa                                                   |

## Audio monitor

|                          |       |                                                                                                                                                                                                  |
|--------------------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Unbalanced output</b> |       | 2 × BNC grounded, switchable to <ul style="list-style-type: none"> <li>input signal, unfiltered (any channel)</li> <li>input signal, filtered (any channel)</li> <li>DC <sup>11</sup></li> </ul> |
| Output voltage           | $V_p$ | max. 5.0 V <sup>12</sup>                                                                                                                                                                         |
| Source impedance         |       | < 2.5 $\Omega$ , short-circuit-proof <sup>12</sup>                                                                                                                                               |
| Output current           | $I_p$ | max. 50 mA                                                                                                                                                                                       |

<sup>11</sup> DC only available with serial numbers above 120099, 140099, 180099.

<sup>12</sup> Impedance 600  $\Omega$ , max. 4.5 V with serial numbers below 120100, 140100, 180100.

## General data

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

| Mechanical resistance |            |                                                                                                       |
|-----------------------|------------|-------------------------------------------------------------------------------------------------------|
| Vibration             | sinusoidal | in line with EN 60068-2-6<br>5 Hz to 55 Hz, 0.15 mm amplitude const.<br>55 Hz to 150 Hz, 0.5 g const. |
|                       | random     | in line with EN 60068-2-64<br>10 Hz to 300 Hz, acceleration 1.2 g RMS                                 |
| Shock                 |            | in line with MIL-STD-810E, method 516.4, procedure I, 40 g shock spectrum                             |

| Power rating    |  |                   |
|-----------------|--|-------------------|
| Rated voltage   |  | 100 V to 240 V AC |
| Rated frequency |  | 50 Hz to 60 Hz    |
| Rated power     |  | 80 VA             |

| Product conformity             |                                                                              |                                                                                                                                                          |
|--------------------------------|------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Electromagnetic compatibility  | complies with<br>EU – EMC Directive 2004/108/EC                              | applied harmonized standards:<br>EN 61326-1 (industrial environment)<br>EN 61326-2-1<br>EN 55011 (class B) <sup>13</sup><br>EN 61000-3-2<br>EN 61000-3-3 |
| Electrical safety              | complies with<br>Low Voltage Directive 2006/95/EC                            | applied harmonized standard:<br>EN 61010-1                                                                                                               |
|                                | USA                                                                          | UL 61010-1                                                                                                                                               |
|                                | Canada                                                                       | CAN/CSA-C22.2 No. 61010-1                                                                                                                                |
| International safety approvals | VDE – Association for Electrical,<br>Electronic and Information Technologies | GS certificate no. 40028654                                                                                                                              |
|                                | CSA – Canadian Standard Association                                          | CSA <sub>US</sub> certificate no. 2229570                                                                                                                |

|            |                |                                                             |
|------------|----------------|-------------------------------------------------------------|
| Dimensions | W × H × D      | 465 mm × 106 mm × 495 mm<br>(18.31 in × 4.17 in × 19.49 in) |
| Weight     | fully equipped | 6.7 kg (14.77 lb)                                           |

<sup>13</sup> With installed R&S®UPP-B4 option, the instrument complies with EN 55011 class A.

## Ordering information

| Designation                                                          | Type         | Order No.    |
|----------------------------------------------------------------------|--------------|--------------|
| <b>Base unit</b>                                                     |              |              |
| Audio Analyzer, two channels                                         | R&S®UPP200   | 1411.1003.02 |
| Audio Analyzer, four channels                                        | R&S®UPP400   | 1411.1003.04 |
| Audio Analyzer, eight channels                                       | R&S®UPP800   | 1411.1003.08 |
| <b>Accessories supplied</b>                                          |              |              |
| Power cable, quick start guide, CD with operating and service manual |              |              |
| <b>Hardware options</b>                                              |              |              |
| Digital Audio Interfaces                                             | R&S®UPP-B2   | 1411.2300.02 |
| HDMI and Digital Audio Interfaces                                    | R&S®UPP-B4   | 1411.2500.02 |
| <b>Software options</b>                                              |              |              |
| Cascading Software for R&S®UPP800                                    | R&S®UPP-K800 | 1411.0759.02 |
| 1/n Octave Analysis                                                  | R&S®UPP-K601 | 1411.0765.02 |
| Digital Audio Protocol for R&S®UPP-B2                                | R&S®UPP-K21  | 1411.0807.02 |
| Dolby Data Stream Decoding for R&S®UPP-B4                            | R&S®UPP-K41  | 1411.0813.02 |
| Extended Audio/Video Measurements for R&S®UPP-B4                     | R&S®UPP-K45  | 1411.0859.02 |

## System components

| Designation                         | Type        | Order No.    |
|-------------------------------------|-------------|--------------|
| XLR/BNC Adapter Set Male            | R&S®UP-Z1M  | 1411.3358.02 |
| XLR/BNC Adapter Set Male/Female     | R&S®UP-Z1MF | 1411.3306.02 |
| AES/EBU Cable for R&S®UPP-B2        | R&S®UP-Z2   | 1411.3406.02 |
| I²S Cable for R&S®UPP-B2/UPV-B41    | R&S®UP-Z3   | 1411.3458.02 |
| 8-Channel I²S Cable for R&S®UPP-B4  | R&S®UP-Z4   | 1411.3258.02 |
| 19" Rack Adapter                    | R&S®ZZA-211 | 1096.3260.00 |
| Operating and service manual        |             | 1411.1055.32 |
| Audio Switcher (input, USB device)  | R&S®UPZ     | 1120.8004.12 |
| Audio Switcher (output, USB device) | R&S®UPZ     | 1120.8004.13 |

|                                                        |            |                                                         |
|--------------------------------------------------------|------------|---------------------------------------------------------|
| <b>Service options</b>                                 |            |                                                         |
| Two-Year Calibration Service                           | R&S®CO2UPP | Please contact your local Rohde & Schwarz sales office. |
| Three-Year Calibration Service                         | R&S®CO3UPP |                                                         |
| Five-Year Calibration Service                          | R&S®CO5UPP |                                                         |
| One-Year Repair Service following the warranty period  | R&S®RO2UPP |                                                         |
| Two-Year Repair Service following the warranty period  | R&S®RO3UPP |                                                         |
| Four-Year Repair Service following the warranty period | R&S®RO5UPP |                                                         |

For product brochure, see PD 5214.3846.12 and [www.rohde-schwarz.com](http://www.rohde-schwarz.com)

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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.

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- Continuous improvement in environmental sustainability
- ISO 14001-certified environmental management system

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PD 5214.3846.22 | Version 03.00 | October 2011 | R&S®UPP  
Subject to change  
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5214384622