R&S®NRPxxP PULSE POWER SENSORS

Specifications

3 year warranty

Data Sheet
Version 01.00

ROHDE&SCHWARZ

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CONTENTS

Definitions

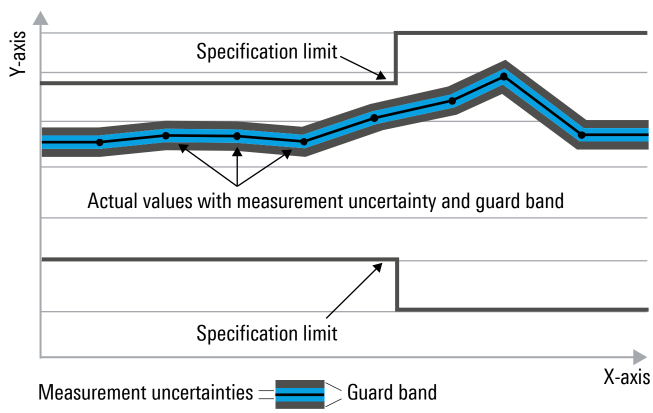
General

Product data applies under the following conditions:

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

Specifications with limits

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



Non-traceable specifications with limits (n. trc.)

Represent product performance that is specified and tested as described under “Specifications with limits” above. However, product performance in this case cannot be warranted due to the lack of measuring equipment traceable to national metrology standards. In this case, measurements are referenced to standards used in the Rohde & Schwarz laboratories.

Specifications without limits

Represent warranted product performance for the specified parameter. These specifications are not specially marked and represent values with no or negligible deviations from the given value (e.g. dimensions or resolution of a setting parameter). Compliance is ensured by design.

Typical data (typ.)

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

Nominal values (nom.)

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

Measured values (meas.)

Characterize expected product performance by means of measurement results gained from individual samples.

Uncertainties

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

Device settings and GUI parameters are designated with the format “parameter: value”.

Non-traceable specifications with limits, typical data as well as nominal and measured values are not warranted by Rohde & Schwarz.

In line with the 3GPP/3GPP2 standard, chip rates are specified in million chips per second (Mcps), whereas bit rates and symbol rates are specified in billion bit per second (Gbps), million bit per second (Mbps), thousand bit per second (kbps), million symbols per second (Msps) or thousand symbols per second (ksps), and sample rates are specified in million samples per second (Msample/s). Gbps, Mcps, Mbps, Msps, kbps, ksps and Msample/s are not SI units.

Overview

Sensor type	Frequency range	Power range, max. average power/peak envelope power	Connector type
R&S®NRP18P	50 MHz to 18 GHz	1 nW to 100 mW (–60 dBm to +20 dBm), max. 200 mW (AVG)/1 W (PK, 1 µs), max. 10 V DC	N (m)
R&S®NRP40P	50 MHz to 40 GHz	1 nW to 100 mW (–60 dBm to +20 dBm), max. 200 mW (AVG)/1 W (PK, 1 µs), max. 10 V DC	2.92 mm (m)
R&S®NRP50P	50 MHz to 50 GHz	1 nW to 100 mW (–60 dBm to +20 dBm), max. 200 mW (AVG)/1 W (PK, 1 µs), max. 10 V DC	2.40 mm (m)

Specifications

Specifications in brief

Sensor type	Impedance matching (SWR)		Rise time video bandwidth	Zero offset (typ.)	Noise (typ.)	Uncertainty for power measurements at +20 °C to +25 °C	
						absolute (in dB)	relative (in dB)
R&S®NRP18P	50 MHz to 2.4 GHz: > 2.4 GHz to 8.0 GHz: > 8.0 GHz to 18.0 GHz:	< 1.16 < 1.20 < 1.25	⩽ 13 ns ⩾ 30 MHz	220 pW	110 pW	0.130 to 0.148	0.039 to 0.148
R&S®NRP40P	50 MHz to 2.4 GHz: > 2.4 GHz to 8.0 GHz: > 8.0 GHz to 18.0 GHz: > 18.0 GHz to 26.5 GHz: > 26.5 GHz to 40.0 GHz:	< 1.16 < 1.20 < 1.25 < 1.30 < 1.35				0.130 to 0.170	0.039 to 0.165
R&S®NRP50P	50 MHz to 2.4 GHz: > 2.4 GHz to 8.0 GHz: > 8.0 GHz to 18.0 GHz: > 18.0 GHz to 26.5 GHz: > 26.5 GHz to 40.0 GHz: > 40.0 GHz to 50.0 GHz:	< 1.16 < 1.20 < 1.25 < 1.30 < 1.35 < 1.40				0.130 to 0.190	0.039 to 0.165

Characteristics

Frequency range	R&S®NRP18P	50 MHz to 18 GHz
	R&S®NRP40P	50 MHz to 40 GHz
	R&S®NRP50P	50 MHz to 50 GHz
Impedance matching (SWR) ( ): +15 °C to +35 °C	50 MHz to 2.4 GHz	< 1.16 (1.11)
	> 2.4 GHz to 8.0 GHz	< 1.20 (1.18)
	> 8.0 GHz to 18.0 GHz	< 1.25 (1.23)
	> 18.0 GHz to 26.5 GHz	< 1.30 (1.28)
	> 26.5 GHz to 40.0 GHz	< 1.35 (1.33)
	> 40.0 GHz to 50.0 GHz	< 1.40 (1.38)
Power measurement range	continuous average	1 nW to 100 mW (–60 dBm to +20 dBm)
	burst	
	full video bandwidth	20 µW to 100 mW (–17 dBm to +20 dBm)
	300 kHz	4 µW to 100 mW (–24 dBm to +20 dBm)
	trace, timeslot/gate	20 nW to 100 mW (–47 dBm to +20 dBm)
	statistics	4 µW [1] to 100 mW (–24 dBm to +20 dBm)
Maximum power	average power, max. 10 V DC	0.2 W (+23 dBm), continuous
	peak envelope power, max. 10 V DC	1.0 W (+30 dBm), for max. 1 µs
Dynamic response	video bandwidth	≥ 30 MHz [2]
	single-shot bandwidth	≥ 30 MHz [2]
	video bandwidth settings	full (≥ 30 MHz), 5 MHz, 1.5 MHz, 300 kHz
	rise time 10 %/90 %	
	full video bandwidth	
	f ≥ 500 MHz	≤ 13 ns [2]
	f < 500 MHz	< 40 ns [2]
	5 MHz	< 75 ns
	1.5 MHz	< 250 ns
	300 kHz	< 1.2 µs

	detectable burst width, f ≥ 500 MHz, full video bandwidth	≥ 50 ns [2]
	overshoot	≤ 5 %
Acquisition	sample rate (period)	
	full video bandwidth	80 Msample/s (12.5 ns)
	5 MHz	40 Msample/s (25.0 ns)
	1.5 MHz	10 Msample/s (100 ns)
	300 kHz	2.5 Msample/s (400 ns)
	capture length, depending on measurement function	50 ns to 1 s
	time base accuracy	±50 ppm
	time base jitter	< 1 ns
Triggering	internal	
	threshold level range	–30 dBm to +20 dBm (usable from –22 dBm with full video bandwidth)
	threshold level accuracy	identical to uncertainty for absolute power measurements
	threshold level hysteresis	0 dB to 10 dB
	dropout [3]	0 s to 10 s
	external	see R&S®NRX base unit or R&S®NRP-Z5 USB sensor hub
	slope (external, internal)	pos./neg.
	delay	–51.2 µs to +10 s
	hold-off	0 s to 10 s
	resolution (delay, hold-off, dropout)	sample period
	source	internal, external, immediate, bus, hold
Zero offset after external zeroing [4] ( ): typical at 1 GHz	continuous average	
	R&S®NRP18P	
	aperture time: 10 µs	< 400 pW (220 pW)
	other durations	< 10.0 nW (2.0 nW)
	R&S®NRP40P/NRP50P	
	aperture time: 10 µs	< 460 pW (235 pW)
	other durations	< 11.4 nW (2.2 nW)
	burst/timeslot/gate average, trace (pixel mean)	
	R&S®NRP18P	
	with averaging	< 10.0 nW (2.0 nW)
	without averaging	< 200 nW (100 nW)
	statistics	< 200 nW (100 nW)
	R&S®NRP40P/NRP50P	
	with averaging	< 11.4 nW (2.2 nW)
	without averaging	< 230 nW (110 nW)
	statistics	< 230 nW (110 nW)
Zero drift [4, 5]	continuous average	
	R&S®NRP18P	
	aperture time: 10 µs	< 200 pW
	other durations	< 500 pW
	R&S®NRP40P/NRP50P	
	aperture time: 10 µs	< 230 pW
	other durations	< 570 pW
	burst/timeslot/gate average, trace (pixel mean)	
	R&S®NRP18P	
	with averaging	< 2.0 nW
	without averaging	< 150 nW
	statistics	< 150 nW
	R&S®NRP40P/NRP50P	
	with averaging	< 2.3 nW
	without averaging	< 170 nW
	statistics	< 170 nW
Measurement noise [4, 6] ( ): typical at 1 GHz	continuous average [7]	
	R&S®NRP18P	
	aperture time: 10 µs	< 200 pW (110 pW)
	other durations	< 5.0 nW (1.0 nW)
	R&S®NRP40P/NRP50P	
	aperture time: 10 µs	< 230 pW (120 pW)
	other durations	< 5.7 nW (1.1 nW)

Measurement noise (continued)	trace/statistics (noise per sample)	
	R&S®NRP18P	
	full video bandwidth	< 3.0 µW (2.0 µW)
	5 MHz	< 1.5 µW (1.0 µW)
	1.5 MHz	< 0.9 µW (0.6 µW)
	300 kHz	< 0.6 µW (0.4 µW)
	R&S®NRP40P/NRP50P	
	full video bandwidth	< 3.5 µW (2.2 µW)
	5 MHz	< 1.7 µW (1.1 µW)
	1.5 MHz	< 1.0 µW (0.7 µW)
	300 kHz	< 0.7 µW (0.5 µW)
	burst/timeslot/gate average trace (pixel mean)	Multiply the noise-per-sample specification for full video bandwidth with noise reduction factors from tables B and C. For gate (pixel) lengths ≥ 2 µs, a noise value of 5 nW or better can be achieved with adequate averaging.
Uncertainty for absolute power measurements [8] 0 °C to +50 °C	R&S®NRP18P	
	50 MHz to < 100 MHz	0.15 dB (3.5 %)
	100 MHz to 8.0 GHz	0.13 dB (3.0 %)
	> 8.0 GHz to 18.0 GHz	0.15 dB (3.5 %)
	R&S®NRP40P/NRP50P	
	50 MHz to < 100 MHz	0.15 dB (3.5 %)
	100 MHz to 8.0 GHz	0.13 dB (3.0 %)
	> 8.0 GHz to 18.0 GHz	0.15 dB (3.5 %)
	> 18.0 GHz to 26.5 GHz	0.15 dB (3.5 %)
	> 26.5 GHz to 40.0 GHz	0.17 dB (4.0 %)
	> 40.0 GHz to 50.0 GHz	0.19 dB (4.5 %)

Uncertainty for relative power measurements [9] in dB

1 GHz to 18 GHz

Power level in dBm	–60 to –15	–15 to +10	+10 to +20	Temperature
+20 to +10	0.179	0.116	0.064	0 °C to +50 °C
	0.155	0.105	0.058	+15 °C to +35 °C
	0.148	0.102	0.056	+20 °C to +25 °C
+10 to –15	0.145	0.094	0.116	0 °C to +50 °C
	0.114	0.079	0.105	+15 °C to +35 °C
	0.105	0.075	0.102	+20 °C to +25 °C
–15 to –60	0.064	0.145	0.179	0 °C to +50 °C
	0.045	0.114	0.155	+15 °C to +35 °C
	0.039	0.105	0.148	+20 °C to +25 °C

50 MHz to < 1GHz
> 18 GHz to 50 GHz

Power level in dBm	–60 to –15	–15 to +10	+10 to +20	Temperature
+20 to +10	0.193	0.130	0.088	0 °C to +50 °C
	0.170	0.120	0.083	+15 °C to +35 °C
	0.165	0.117	0.083	+20 °C to +25 °C
+10 to –15	0.162	0.110	0.130	0 °C to +50 °C
	0.134	0.098	0.120	+15 °C to +35 °C
	0.126	0.095	0.117	+20 °C to +25 °C
–15 to –60	0.068	0.162	0.193	0 °C to +50 °C
	0.051	0.134	0.170	+15 °C to +35 °C
	0.046	0.126	0.165	+20 °C to +25 °C

Table A: Multipliers for zero offset, zero drift and noise specifications

Use these multipliers to calculate zero offset, zero drift and noise when operating the sensor at power levels above –20 dBm, at frequencies below 500 MHz, or at temperatures other than +23 °C.

( ): at frequencies < 500 MHz.

<table>
<tr><th>Temperature \ Power</th><th>≤ –20 dBm</th><th>–10 dBm</th><th>–5 dBm</th><th>0 dBm</th><th>5 dBm</th><th>10 dBm</th><th>15 dBm</th><th>20 dBm</th></tr>
<tr><td>0 °C</td><td>0.8 (0.9)</td><td>0.9 (1.0)</td><td>1.4 (1.5)</td><td>3.2 (3.5)</td><td>7.5 (8.5)</td><td rowspan="5">17 (18)</td><td rowspan="5">35 (37)</td><td rowspan="5">65 (70)</td></tr>
<tr><td>+15 °C</td><td>0.9 (1.0)</td><td>1.1 (1.2)</td><td>1.6 (1.8)</td><td>3.4 (3.6)</td><td>7.5 (8.5)</td></tr>
<tr><td>+23 °C</td><td>1.0 (1.2)</td><td>1.3 (1.5)</td><td>1.8 (2.0)</td><td>3.5 (3.8)</td><td>7.6 (8.7)</td></tr>
<tr><td>+35 °C</td><td>1.4 (1.7)</td><td>1.7 (2.1)</td><td>2.3 (2.6)</td><td>3.9 (4.3)</td><td>7.8 (9.0)</td></tr>
<tr><td>+50 °C</td><td>2.5 (3.0)</td><td>2.7 (3.3)</td><td>3.3 (4.0)</td><td>5.2 (5.4)</td><td>8.7 (9.5)</td></tr>
</table>

Table B: Noise reduction factors for gating and smoothing

The noise reduction factors in this table describe how measurement noise is reduced if the mean value of adjacent samples is taken over a time interval. The time interval can be the length of a gate, timeslot or pixel in trace mode. Without averaging or for single events, use the leftmost column. If averaging is activated, use the columns for the individual repetition rates and additionally apply multipliers from table C. The repetition rate is identical to the frequency of the measurement being carried out, i.e. the inverse of the trigger period.

<table>
<tr><th>Gate (pixel) length \ Repetition rate</th><th>0</th><th>$10\ s^{-1}$</th><th>$100\ s^{-1}$</th><th>$10^3\ s^{-1}$</th><th>$10^4\ s^{-1}$</th><th>$5 \times 10^4\ s^{-1}$</th><th>$10^5\ s^{-1}$</th></tr>
<tr><td>25 ns</td><td colspan="7">0.7</td></tr>
<tr><td>50 ns</td><td colspan="7">0.5</td></tr>
<tr><td>100 ns</td><td colspan="7">0.4</td></tr>
<tr><td>200 ns</td><td colspan="7">0.3</td></tr>
<tr><td>500 ns</td><td colspan="7">0.2</td></tr>
<tr><td>1 µs</td><td>0.16</td><td colspan="2">0.15</td><td colspan="4">0.14</td></tr>
<tr><td>2 µs</td><td>0.14</td><td>0.13</td><td>0.12</td><td>0.11</td><td></td><td>0.10</td><td></td></tr>
<tr><td>10 µs</td><td>0.11</td><td>0.1</td><td>0.09</td><td>0.08</td><td>0.07</td><td>0.06</td><td></td></tr>
<tr><td>100 µs</td><td>0.10</td><td>0.09</td><td>0.07</td><td>0.06</td><td>0.04</td><td></td><td></td></tr>
<tr><td>1 ms</td><td>0.10</td><td>0.07</td><td>0.06</td><td>0.035</td><td></td><td></td><td></td></tr>
<tr><td>10 ms</td><td>0.10</td><td>0.06</td><td>0.035</td><td></td><td></td><td></td><td></td></tr>
</table>

Table C: Noise reduction factors for averaging

Averaging number	2	4	8	16	32	64	128	256	512	1k	2k	4k	8k
Reduction factor	0.7	0.5	0.35	0.25	0.18	0.13	0.09	0.063	0.044	0.031	0.022	0.016	0.011

Example: A power measurement on a radar pulse is carried out by means of the timeslot/gate function. The gate length is set to 1 µs, and the averaging number to 32. The pulse repetition rate is 100 Hz, and the measurement is performed at +15 °C ambient temperature. The pulse power is about –10 dBm.

From the specifications, a 2σ noise-per-sample value of 2 µW (typ.) can be derived for reference conditions. Applying a multiplier of 1.1 from table A for +15 °C ambient temperature and –10 dBm pulse power results in 2.2 µW sampling noise under measurement conditions. Gating reduces noise by a factor of 0.15 (table B), and averaging further reduces noise by a factor of 0.18 (table C). The residual 2σ noise of mean power within the gate can then be calculated as follows: 2.2 µW × 0.15 × 0.18 = 59 nW (0.06 % of measured value).

Additional characteristics

Sensor type		pulse power sensor
Measurand		power of incident wave
		power of source (DUT) into 50 Ω [10]
RF connector	R&S®NRP18P	N (m)
	R&S®NRP40P	2.92 mm (m)
	R&S®NRP50P	2.40 mm (m)
Measurement functions	stationary and recurring waveforms	continuous average
		burst
		timeslot/gate
		trace, statistics
	single events	trace, statistics
Continuous average function	measurand	mean power over recurring acquisition interval
	aperture	1 µs to 1 s (10 µs default)
	window function	uniform or von Hann [11]
	duty cycle correction [12]	0.001 % to 99.999 %
	capacity of measurement buffer [13]	1 to 8192 results
Burst average function	measurand	mean power over burst portion of recurring signal (trigger settings required)
	detectable burst width	50 ns to 0.1 s
	minimum gap between bursts	40 ns
	dropout period [14] for burst end detection	0 s to 0.1 s
	exclusion periods [15]	
	start	0 to burst width
	end	0 s to 51.2 µs
	resolution (dropout and exclusion periods)	sample period
Timeslot/gate function	measurand	mean, maximum and minimum power over individual timeslots/gates of recurring signal
	number of timeslots/gates	1 to 16 (consecutive)
	nominal length	50 ns to 0.1 s
	start of first timeslot/gate	at delayed trigger event
	exclusion periods [15]	
	start	0 to nominal length
	fence	0 s to 0.1 s (anywhere within timeslot)
	end	0 s to 51.2 µs
	resolution (nominal length and exclusion periods)	12.5 ns
Trace function	measurand	mean, random, maximum and minimum power over pixel length
	acquisition	
	length (Δ)	50 ns to 1 s
	start (referenced to delayed trigger)	–4096 × Δ/M to +10 s
	result	
	pixels (M)	3 to 8192
	resolution (Δ/M)	
	normal	≥ sample period
	equivalent time	≥ 100 ps
	automatic pulse measurements	pulse width, pulse period, pulse off time, pulse duty cycle, pulse rise time, pulse fall time, pulse start time, pulse stop time, pulse top power, pulse base power, pulse peak power, pulse average power, positive overshoot, negative overshoot pulse droop

Statistics functions	measurand	CCDF or PDF over accumulated records
	acquisition	
	mode	recurring or triggered
	length (aperture)	10 µs to 53 s
	start (referenced to delayed trigger)	0 s to +10 s
	exclusion period (fence)	0 s to 53 s (anywhere within aperture)
	number of accumulated records	2^N, N = 0 to 16 (set by averaging number)
	result	
	number of histogram classes (C)	3 to 8192
	power span (S)	0.01 dB to 100 dB
	minimum class width (S/C)	0.006 dB
	peak value acquisition	per aperture interval, overall
Averaging filter	modes	• auto off (fixed averaging number) • auto on (continuously auto-adapted) • auto once (automatically fixed once)
	auto off	
	supported measurement functions	all
	averaging number	2^N, N = 0 to 20 (16 for trace/statistics)
	auto on/once	
	supported measurement functions	continuous average, burst average, timeslot/gate average
	normal operating mode	averaging number adapted to resolution setting and power to be measured
	fixed noise operating mode	averaging number adapted to specified noise content
	result output	
	moving mode	continuous, independent of averaging number
	rate	can be limited to 0.1 s^{-1}
	repeat mode	only final result
Attenuation correction	function	corrects the measurement result by means of a fixed factor (dB offset)
	range	–200 000 dB to +200 000 dB
Embedding	function	incorporates a two-port device at the sensor input so that the measurement plane is shifted to the input of this device
	parameters	S_{11}, S_{21}, S_{12} and S_{22} of device
	number of devices	0 to 999
	frequencies (sum of all devices)	≤ 80000
Gamma correction	function	removes the influence of impedance mismatch from the measurement result so that the power of the source (DUT) into 50 Ω can be read
	parameters	magnitude and phase of reflection coefficient of source (DUT)
Frequency response correction	function	takes the frequency response of the power sensor into account
	parameter	center frequency of test signal
	residual uncertainty	see specification of calibration uncertainty and uncertainty for absolute power measurements
Measurement time [16] 2^N: averaging number T: number of timeslots w: nominal length of timeslot	continuous average mode	
	single-triggered	2 × (aperture + 6.0 µs) × 2^N + t_z
	buffered [13], without averaging	2 × (aperture + 66 µs) × buffer size + t_z t_z: < 1 ms
	timeslot/gate average	
	signal period – T × w > 6 µs	≤ signal period × (2^N + 1) + t_t
	all other cases	≤ 2 × signal period × (2^N + ½) + t_t t_t: 1 ms (typ.)
Measurement speed without averaging aperture time: 1 µs	continuous average mode	
	single-triggered	1000 s^{-1} (typ.)
	buffered [13]	10000 s^{-1} (typ.)

Zeroing (duration)	including all functions, entire frequency range	8 s
	restricted to < 500 MHz, all functions	4 s
	restricted to ≥ 500 MHz, all functions	4 s
	restricted to trace and statistics function, entire frequency range	1 s
Measurement error due to harmonics [17]	third harmonic	
	–60 dBc	
	f ≤ 4 GHz	< 0.004 dB
	4 GHz < f ≤ 12.4 GHz	< 0.003 dB
	f > 12.4 GHz	< 0.003 dB
	–40 dBc	
	f ≤ 4 GHz	< 0.035 dB
	4 GHz < f ≤ 12.4 GHz	< 0.030 dB
	f > 12.4 GHz	< 0.025 dB
	–20 dBc	
	f ≤ 4 GHz	< 0.350 dB
	4 GHz < f ≤ 12.4 GHz	< 0.300 dB
	f > 12.4 GHz	< 0.250 dB
	second harmonic	
	–60 dBc	
	f ≤ 4 GHz	< 0.001 dB
	4 GHz < f ≤ 8 GHz	< 0.002 dB
	f > 8 GHz	< 0.003 dB
	–40 dBc	
	f ≤ 4 GHz	< 0.010 dB
	4 GHz < f ≤ 8 GHz	< 0.017 dB
	f > 8 GHz	< 0.025 dB
	–20 dBc	
	f ≤ 4 GHz	< 0.100 dB
	4 GHz < f ≤ 8 GHz	< 0.170 dB
	f > 8 GHz	< 0.250 dB
Change of input reflection coefficient with respect to power [18]	–20 dBm to –9 dBm	
	f ≤ 18 GHz	< 0.020
	18 GHz < f ≤ 40 GHz	< 0.035
	40 GHz < f ≤ 50 GHz	< 0.040
	–9 dBm to 0 dBm	
	f ≤ 18 GHz	< 0.035
	18 GHz < f ≤ 40 GHz	< 0.040
	40 GHz < f ≤ 50 GHz	< 0.060
	0 dBm to +11 dBm	
	f ≤ 18 GHz	< 0.065
	18 GHz < f ≤ 40 GHz	< 0.075
	40 GHz < f ≤ 50 GHz	< 0.085
	+11 dBm to +20 dBm	
	f ≤ 18 GHz	< 0.075
	40 GHz < f ≤ 50 GHz	< 0.090
	40 GHz < f ≤ 50 GHz	< 0.100
Interface to host	mechanical	8-pin (m) M12 connector (A-coded)
	power supply	+5 V/0.5 A (USB high-power device), ≤ 3 mA in suspend mode
	speed	supports full-speed mode according to the specification
	remote	supports USB test and measurement device class (USBTMC) and legacy mode for compatibility with R&S®NRP-Zxx power sensors
	trigger input EXTernal1	differential (0 V/+3.3 V)
	permissible total cable length	≤ 5 m

Trigger-I/O EXTernal2	mechanical	SMB built-in jack
	impedance	
	input	10 kΩ (nom.) or 50 Ω (nom.) selectable
	output	50 Ω (nom.)
	signal level	
	input	compatible with 3 V or 5 V logic, max. –1 V to +6 V
	output	≥ 2 V into 50 Ω load, max. 5.3 V
Dimensions	W × H × L	48 mm × 30 mm × 138 mm (1.89 in × 1.18 in × 5.43 in)
Weight		< 0.20 kg (0.44 lb)

Accessories

Accessories are not approved for the usage in thermal vacuum chambers.

R&S®NRP-ZKU interface cables

The R&S®NRP-ZKU interface cables are used to connect Rohde & Schwarz power sensors described in this data sheet to any standard-conforming USB downstream port (USB-A receptacle), e.g. on a PC, USB hub or an Rohde & Schwarz instrument.

Connectors	sensor side	8-pin (f) M12 connector (A-coded)
	host side	USB-A plug
Length	model .02	0.75 m
	model .03	1.50 m
	model .04	3.00 m
	model .05	5.00 m

The R&S®NRP-ZKU interface cables must not be combined with passive USB extension cables as well as commercially available M12 extension cables. Using such extension cables can affect the reliability of the high-speed data transfer.

R&S®NRP-ZKC interface cables

The R&S®NRP-ZKC interface cables are used to connect Rohde & Schwarz power sensors described in this data sheet to any standard-conforming USB downstream port (USB-C receptacle), e.g. on a PC or mobile device.

Connectors	sensor side	8-pin (f) M12 connector (A-coded)
	host side	USB-C plug
Length	model .02	0.75 m
	model .03	1.50 m
	model .04	3.00 m

The R&S®NRP-ZKC interface cables must not be combined with passive USB extension cables as well as commercially available M12 extension cables. Using such extension cables can affect the reliability of the high-speed data transfer.

R&S®NRP-ZK6 interface cables

The R&S®NRP-ZK6 interface cables are used to connect Rohde & Schwarz power sensors described in this data sheet to an R&S®NRX power meter, R&S®NRP2 power meter, R&S®NRP-Z5 sensor hub or an Rohde & Schwarz instrument providing a 6-pole circular receptacle for R&S®NRP power sensors.

Connectors	sensor side	8-pin (f) M12 connector (A-coded)
	host side	6-pole circular plug with push-pull locking
Length	model .02	1.50 m
	model .03	3.00 m
	model .04	5.00 m

The R&S®NRP-ZK6 interface cables must not be combined with the R&S®NRP-Z2/-Z4 cables as well as commercially available M12 extension cables. Using such extension or adapter cables can affect the reliability of the high-speed data transfer.

R&S®NRP-ZK8 interface cables

The R&S®NRP-ZK8 interface cables are used to connect Rohde & Schwarz power sensors described in this data sheet to an R&S®NRX power meter. Compared to R&S®NRP-ZK6, they contain an additional signal pair for routing the common time base clock provided by the R&S®NRX to sensors A, B, C and D.

Connectors	sensor side	8-pin (f) M12 connector (A-coded)
	host side	8-pole circular plug with push-pull locking
Length	model .02	1.50 m
	model .03	3.00 m
	model .04	5.00 m

The R&S®NRP-ZK8 interface cables must not be combined with commercially available M12 extension cables. Using such extension cables can affect the reliability of the high-speed data transfer.

General data for power sensors and accessories

Temperature [19]		in line with IEC 60068
	operating temperature range	0 °C to +50 °C
	permissible temperature range	–10 °C to +55 °C
	storage temperature range	–40 °C to +70 °C
Cimatic resistance	damp heat	in line with EN 60068
	noncondensing	+25 °C/+55 °C cyclic at 95 % relative humidity, in line with EN 60068-2-30
Mechanical resistance	vibration	
	sinusoidal	5 Hz to 55 Hz, 0.15 mm amplitude, 1.8 g at 55 Hz; 55 Hz to 150 Hz, 0.5 g constant, in line with EN 60068-2-6
	random	8 Hz to 650 Hz, 1.9 g (RMS), in line with EN 60068-2-64
	shock	45 Hz to 2 kHz, max. 40 g shock spectrum, in line with MIL-STD-810E, method 516.4, procedure I
Altitude	operating	max. 2000 m
	transport	max. 15 000 m
Electromagnetic compatibility		applied harmonized standards: • EN 61326-1 • EN 61326-2-1 • EN 55011 (class B)
Safety		in line with: • EN 61010-1 • IEC 61010-1 • CAN/CSA-C22.2 No. 61010-1-04 • UL STD. No. 61010-1
Calibration interval	recommended	1 year

R&S®NRX base unit

Application		universal power meter
Sensors		R&S®NRPxxS(N), R&S®NRPxxA(N), R&S®NRPxxT(N), R&S®NRPxxTWG(N), R&S®NRP-Zxx and R&S®NRQ6
Sensor connectors	standard	two sensor connectors (A and B) on front panel
	with R&S®NRX-B4 option	two additional sensor connectors (C and D) on rear panel
	connector	8-pole receptacle; mates with R&S®NRP-ZK8, R&S®NRP-ZK6 and 6-pole push-pull plug of R&S®NRP-Zxx series sensors
Measurement channels	standard	one measurement channel
	with R&S®NRX-K2 option	two measurement channels
	with R&S®NRX-K2 and R&S®NRX-K4 options	four measurement channels
Frequency range		DC to 110 GHz (sensor-dependent)
Power measurement range		0.1 fW to 30 W (average) (sensor-dependent)
Measurement functions		
Single channel		see sensor specifications, plus: relative measurement referenced to result or user-selectable reference value, storage of minima and maxima (max., min., max. – min.), limit monitoring
	display	
	absolute	in W, dBm and dBµV
	relative	in dB, as change in percent (Δ %) or as quotient
Multichannel		simultaneous measurement in up to 4 channels; individual results, ratios, relative ratios [20], or difference of results of 2 channels can be displayed
	display	
	ratio	in dB, as change in percent (Δ %), as quotient or as one of the following impedance matching parameters: SWR, return loss, reflection coefficient
	relative ratio [20]	in dB, as change in percent (Δ %) or as quotient
Measurement uncertainty		see sensor specifications
Accuracy of common time base clock for sensors A, B, C and D		±5 ppm (R&S®NRP-ZK8 required)
Display		
Physical characteristics	type	127 mm (5") TFT color display
	resolution	800 × 480 pixel (WVGA)
Result representation	numeric measurements	up to four results can simultaneously be displayed in separate windows using selectable layouts: • full-size • 2 × half-size • half-size + 2 × 1/4-size • half-size + 3 × 1/6-size
	format	digital, digital + bargraph
	resolution	
	numeric values	selectable in four steps: • 1 dB (1.0 %) • 0.1 dB (1.0 %) • 0.01 dB (0.1 %) • 0.001 dB (0.01 %)
	bargraph	depending on user-definable scale end values

Result representation (continued)	auxiliary values (optional in full- or half-size windows)	
	extremes	maximum, minimum, maximum – minimum
	statistical parameters	mean, standard deviation, measurement count
	measurement of power versus time	one or two traces can be displayed in one window: • absolute power • ratio of two channels • sum of two channels • difference of two channels
	additional information	• marker measurements • gate and timeslot measurements
	power envelope statistics	versus absolute power in dBm or versus relative power referenced to the average power level: • CCDF • CDF • PDF
	additional information	marker measurements
Manual operation		via capacitive touch panel and/or keypad
Remote control		
Systems		IEC 60625.1 (IEEE-488.1), IEC 60625.2 (IEEE-488.2)
Command set		SCPI-1999.0
IEC/IEEE bus (R&S®NRX-B8 option)	interface functions	SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT1, C0
	connector	24-pin Amphenol (f)
USB		USB 2.0 high-speed
	connector	USB type B receptacle
	supported protocols	USBTMC via VISA
Ethernet		10/100/1000BASE-T
	connector	RJ-45 modular socket
	supported protocols	VXI-11, HiSLIP, SCPI-RAW
Measurement times	single continuous average measurements, with `SYSTem:SPEed FAST`	add 2 ms (meas.) to sensor specifications
Analog outputs and trigger I/O		
Out 1/Trig Out	Out 1 (analog output 1)	recorder output; user-definable linear relation to measurement result
	output voltage range	0 V to 2.5 V (no load)
	output resistance	600 Ω (nom.)
	accuracy of no-load output voltage	±(0.4 % of output voltage + 4 mV)
	resolution	16 bit
	update rate	same as result rate of sensor
	Trig Out (trigger output)	signaling output; user-definable logic levels for the PASS and FAIL states in the case of limit monitoring
	high-level output voltage	(5.1 ± 0.2) V (≥ 10 kΩ load), 2.6 V (nom.) (50 Ω load)
	low-level output voltage	0 V to 0.4 V (meas.) (5 mA sink current)
	output impedance	50 Ω (nom.)
	connector	BNC (f)
Trig In/Out 2	Trig In (trigger input)	input for trigger signals to sensors (routed internally to ports sensor A–D; translated to *TRG command for sensors operated on standard USB ports and via network)
	input impedance	10 kΩ (nom.) or 50 Ω (nom.) selectable
	absolute minimum voltage	−3 V
	absolute maximum voltage	6 V (with 10 kΩ input impedance), 4 V (with 50 Ω input impedance)
	low-to-high input threshold	(1.8 ± 0.3) V
	high-to-low input threshold	(1.15 ± 0.25) V

Trig In/Out 2 (continued)	Out 2 (analog output 2)	recorder output; user-definable linear relation to measurement result
	electrical characteristics	see Out 1
	connector	BNC (f)
USB host ports		two USB 2.0 high-speed host ports (one on front panel, one on rear panel)
	connector	USB type A receptacle
Firmware update		• from a USB flash memory stick (copy .rsu file to root directory and connect to either USB host port of R&S®NRX) • from the R&S®NRP toolkit via Ethernet or USBTMC using a Windows program; VISA installation is required
Environmental conditions		
Temperature	operating temperature range	0 °C to +50 °C
	permissible temperature range	–10 °C to +55 °C
	storage temperature range	–40 °C to +70 °C
Damp heat	noncondensing	+25 °C/+55 °C, 95 % rel. humidity, cyclic, in line with EN 60068-2-30
Altitude	operating or nonoperating	max. 4600 m
Mechanical resistance		
Vibration	sinusoidal	5 Hz to 55 Hz, 0.15 mm amplitude const., 55 Hz to 150 Hz, acceleration 0.5 g const., in line with EN 60068-2-6
	random	10 Hz to 500 Hz, acceleration 1.9 g (RMS), in line with EN 60068-2-64
Shock		40 g shock spectrum, in line with MIL-STD-810E, method 516.4, procedure I
Power rating		
Rated voltage	nominal voltage	100 V to 240 V
	voltage range	90 V to 264 V
Rated frequency	nominal frequency	50 Hz to 60 Hz or 400 Hz
	frequency range	47 Hz to 63 Hz or 380 Hz to 420 Hz
Rated current (including options, connected sensors and connected USB devices)	at 100 V AC	max. 1.7 A
	at 240 V AC	max. 0.8 A
Product conformity		
Electromagnetic compatibility	EU: in line with EMC Directive 2014/30/EU	applied harmonized standards: • EN 61326-1 (industrial environment) • EN 55011 (class B)
Electrical safety	EU: in line with Low Voltage Directive 2014/35/EU	applied harmonized standard: EN 61010-1
	USA	UL 61010-1
	Canada	CAN/CSA-C22.2 No. 61010-1
RoHS	EU: in line with Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment	applied harmonized standard: EN IEC 63000
Dimensions	W × H × D	234 mm × 106 mm × 272 mm (9.21 in × 4.17 in × 10.71 in)
Weight	without any options installed	2.35 kg (5.18 lb)
	with R&S®NRX-B1, R&S®NRX-B4 and R&S®NRX-B8 options installed	2.58 kg (5.69 lb)

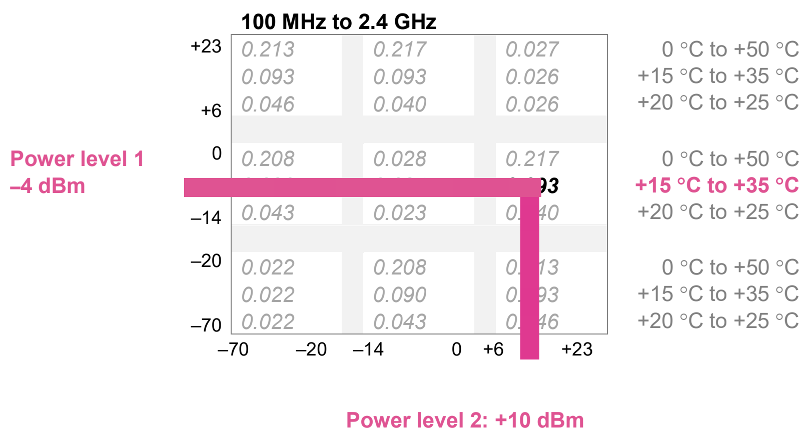
Options for the R&S®NRX base unit

R&S®NRX-B1 sensor check source	application	as a power reference for testing sensors
	mutually exclusive with	R&S®NRX-B9
	frequency	50 MHz (nom.) or 1 GHz (nom.) selectable
	power	
	CW and pulses	−20 dBm (10 µW), −10 dBm (100 µW), 0 dBm (1 mW), +10 dBm (10 mW)
	CW only	+20 dBm (100 mW)
	uncertainty	
	+20 °C to +25 °C	0.85 % at 50 MHz, 1.00 % at 1 GHz
	+15 °C to +35 °C	1.00 % at 50 MHz, 1.20 % at 1 GHz
	0 °C to +50 °C	
	power level setting: 0 dBm	1.00 % at 50 MHz
	power level settings: −20 dBm, −10 dBm, +10 dBm, +20 dBm	1.30 % at 50 MHz
	all power level settings	1.50 % at 1 GHz
	pulse repetition frequency	10 kHz ± 5 ppm [21]
	duty cycle	(50 ± 0.02) %
	on/off ratio	60 dB (typ.)
	rise/fall time	5 ns (typ.) at 1 GHz, 20 ns (typ.) at 50 MHz
	SWR	< 1.05 (typ.)
	RF connector	N (f) on front panel
	source impedance	50 Ω (nom.)
	weight	0.155 kg
	recommended calibration interval	2 years
R&S®NRX-B4 third (C) and fourth (D) sensor connector	application	provides two additional sensor connectors on rear panel
	weight	0.025 kg
R&S®NRX-B8 GPIB/IEEE-488 interface	application	provides a GPIB/IEEE-488 interface
	weight	0.055 kg
R&S®NRX-B9 interface for R&S®NRT-Z sensors	application	provides an additional connector for R&S®NRT-Z14, R&S®NRT-Z43 or R&S®NRT-Z44 directional power sensors
	mutually exclusive with	R&S®NRX-B1
	connector	LEMO S series, ERA model, size 2, 6-pole receptacle on front panel (1: RXD+, 2: RXD−, 3: V_{SUPPLY}, 4: GND, 5: TXD−, 6: TXD+)
	weight	0.135 kg (0.30 lb)
R&S®NRX-K2 second measurement channel	application	allows using up to two sensors simultaneously
R&S®NRX-K4 third and fourth measurement channel	application	allows using up to four sensors simultaneously (R&S®NRX-K2 required)

Appendix

Reading the uncertainty of diode power sensors for relative power measurements

The example shows a level step of approx. 14 dB (–4 dBm → +10 dBm) at 1.9 GHz and an ambient temperature of +28 °C for an R&S®NRP8S power sensor. The expanded uncertainty for relative power measurements in this example is 0.093 dB.



Ordering information

Designation	Type	Order No.
Pulse power sensors		
1 nW to 100 mW, 50 MHz to 18 GHz	R&S®NRP18P	1444.1190.02
1 nW to 100 mW, 50 MHz to 40 GHz (2.92 mm)	R&S®NRP40P	1444.1290.02
1 nW to 100 mW, 50 MHz to 50 GHz (2.40 mm)	R&S®NRP50P	1444.1390.02
Base unit		
Power meter	R&S®NRX	1424.7005.02
Options for the R&S®NRX base unit		
Second measurement channel	R&S®NRX-K2	1424.9208.02
Third and fourth measurement channel	R&S®NRX-K4	1424.9308.02
Sensor check source	R&S®NRX-B1	1424.7805.02
Third (C) and fourth (D) sensor connector, for R&S®NRP	R&S®NRX-B4	1424.8901.02
GPIB/IEEE-488 interface	R&S®NRX-B8	1424.8301.02
Sensor interface, for R&S®NRT	R&S®NRX-B9	1424.8601.02
Recommended extras for R&S®NRX		
19" rack adapter, for one R&S®NRX power meter and one empty casing	R&S®ZZA-KNA22	1177.8184.00
19" rack adapter, for two R&S®NRX power meters	R&S®ZZA-KNA24	1177.8149.00
Recommended extras for R&S®NRPxxP A minimum of one interface cable is required for power sensor operation.		
USB-A interface cable, length: 0.75 m	R&S®NRP-ZKU	1419.0658.02
USB-A interface cable, length: 1.50 m	R&S®NRP-ZKU	1419.0658.03
USB-A interface cable, length: 3.00 m	R&S®NRP-ZKU	1419.0658.04
USB-A interface cable, length: 5.00 m	R&S®NRP-ZKU	1419.0658.05
USB-C interface cable, length: 0.75 m	R&S®NRP-ZKC	1425.2442.02
USB-C interface cable, length: 1.50 m	R&S®NRP-ZKC	1425.2442.03
USB-C interface cable, length: 3.00 m	R&S®NRP-ZKC	1425.2442.04
6-pole interface cable, length: 1.50 m	R&S®NRP-ZK6	1419.0664.02
6-pole interface cable, length: 3.00 m	R&S®NRP-ZK6	1419.0664.03
6-pole interface cable, length: 5.00 m	R&S®NRP-ZK6	1419.0664.04
8-pole interface cable, length: 1.50 m	R&S®NRP-ZK8	1424.9408.02
8-pole interface cable, length: 3.00 m	R&S®NRP-ZK8	1424.9408.03
8-pole interface cable, length: 5.00 m	R&S®NRP-ZK8	1424.9408.04
Sensor hub	R&S®NRP-Z5	1146.7740.02
Documentation		
Documentation of calibration values	R&S®DCV-1	0240.2187.06
Printout of DCV (in combination with DCV only)	R&S®DCV-ZP	1173.6506.02
Accredited calibration for R&S®NRP18P	R&S®ACANRP18P	3599.1050.03
Accredited calibration for R&S®NRP40P	R&S®ACANRP40P	3599.1066.03
Accredited calibration for R&S®NRP50P	R&S®ACANRP50P	3599.1072.03

Warranty		
R&S®NRX base unit and power sensors		3 years
All other items		1 year
Service options		
Extended warranty, one year	R&S®WE1	Please contact your local Rohde & Schwarz sales office.
Extended warranty, two years	R&S®WE2	
Extended warranty with calibration coverage, one year	R&S®CW1	
Extended warranty with calibration coverage, two years	R&S®CW2	
Extended warranty with accredited calibration coverage, one year	R&S®AW1	
Extended warranty with accredited calibration coverage, two years	R&S®AW2	

Extended warranty with a term of one and two years (WE1 and WE2)
Repairs carried out during the contract term are free of charge [22]. Necessary calibration and adjustments carried out during repairs are also covered.

Extended warranty with calibration coverage (CW1 and CW2)
Enhance your extended warranty by adding calibration coverage at a package price. This package ensures that your Rohde & Schwarz product is regularly calibrated, inspected and maintained during the term of the contract. It includes all repairs [22] and calibration at the recommended intervals as well as any calibration carried out during repairs or option upgrades.

Extended warranty with accredited calibration (AW1 and AW2)
Enhance your extended warranty by adding accredited calibration coverage at a package price. This package ensures that your Rohde & Schwarz product is regularly calibrated under accreditation, inspected and maintained during the term of the contract. It includes all repairs [22] and accredited calibration at the recommended intervals as well as any accredited calibration carried out during repairs or option upgrades.

For product brochure, see PD 5213.5539.12 and www.rohde-schwarz.com

Endnotes

1 With full video bandwidth. Reduce the specified minimum levels according to the reduction of sampling noise at lower bandwidths.

2 Specifications are valid from +15 °C to +50 °C ambient temperature. Below +15 °C, video bandwidth and single-shot bandwidth continuously decrease down to 20 MHz (typical) at 0 °C. Accordingly, the sensor rise time increases up to 50 ns for signals below 500 MHz and up to 20 ns for higher frequencies (typical at 0 °C).

3 Time span prior to triggering, where the trigger signal must be entirely below the threshold level in the case of a positive slope and vice versa in the case of a negative slope.

4 Specifications are valid at +23 °C ambient temperature for power levels ≤ –20 dBm and frequencies ≥ 500 MHz. For measurements at other temperatures levels and/or frequencies, use the multipliers from table A.

5 Within one hour after zeroing, permissible temperature change ±1 C, following a two-hour warm-up of the power sensor.

6 Measured over a one-minute interval, at constant temperature, two standard deviations.

7 512k averages taken with the aperture time set to default (10 µs). The measurement noise with other averaging numbers can be calculated by applying the multipliers indicated below:

Averaging number	512k	128k	32k	8k	2k	512	128	32	8
Integration time	10.49 s	2.62 s	655.36 ms	163.84 ms	40.96 ms	10.24 ms	2.56 ms	0.64 ms	0.16 ms
Noise multiplier	**1**	**2**	**4**	**8**	**16**	**32**	**64**	**128**	**256**

Using a von Hann window function further increases noise by a factor of 1.22. Integration time is defined as the total time used for signal acquisition, i.e. the product of twice the aperture time and the averaging number.

The measurement noise is always minimal for the default aperture time. Increasing the aperture time above this value is only useful for suppressing modulation-induced fluctuations of the measurement result, e.g. by matching the aperture time to the modulation period.

8 Expanded uncertainty (k = 2) for absolute power measurements on CW signals. Specifications include calibration uncertainty, linearity, influence of sensor-induced harmonics reflected on the DUT, and temperature effect. Zero offset, zero drift and measurement noise must additionally be taken into account when measuring low powers. As a rule of thumb, the contribution of zero offset and zero drift can be neglected for power levels above –35 dBm if external zeroing has been applied. The contribution of measurement noise can be neglected below 0.02 dB.

Example: The power to be measured is 40 nW (–44 dBm) at 12 GHz in the continuous average mode; ambient temperature +35 °C; averaging number set to 32k with an aperture time of 10 µs (1 s integration time).

The typical absolute uncertainty due to zero offset is 220 pW at +23 °C. From table A, a multiplier of 1.4 can be taken to read a typical zero offset of 308 pW at +35 °C. The corresponding relative measurement uncertainty can be calculated as follows:

$$10\ \lg\frac{40\ \text{nW} + 308\ \text{pW}}{40\ \text{nW}}\ \text{dB} = 0.033\ \text{dB}$$

Using the noise multiplier (4) from endnote 7 and the multiplier (1.4) from table A, the absolute noise contribution is typically 110 pW × 4 × 1.4 = 616 pW, which corresponds to a relative measurement uncertainty of

$$10\ \lg\frac{40\ \text{nW} + 616\ \text{pW}}{40\ \text{nW}}\ \text{dB} = 0.066\ \text{dB}$$

Combined with the value of 0.18 dB specified for the uncertainty of absolute power measurements at 12 GHz, the total expanded uncertainty is

$$\sqrt{0.18^2 + 0.033^2 + 0.066^2}\ \text{dB} = 0.195\ \text{dB}$$

The contribution of zero drift has been neglected in this case. It must be treated like zero offset if it is relevant for total uncertainty.

9 Expanded uncertainty (k = 2) for relative power measurements on CW signals of the same frequency, carried out using a matched source. For reading the measurement uncertainty, see the Appendix. For small power ratios up to 5 dB, expanded uncertainty will typically not exceed 0.06 dB at +23 °C (0.08 dB from 0 °C to +50 °C).

Specifications include linearity of the sensor, influence of sensor-induced harmonics that may be re-reflected at the source (DUT), and temperature effect. Zero offset, zero drift and measurement noise must additionally be taken into account when measuring low powers. As a rule of thumb, the contribution of zero offset and zero drift can be neglected for power levels above –35 dBm if external zeroing has been applied. The contribution of measurement noise can be neglected below a two-sigma value of 0.02 dB. A source (DUT) SWR of 3 has been assumed for signal frequency harmonics emanating from the sensor.

Example: The uncertainty of a power step from 1 mW (0 dBm) to 1 µW (–30 dBm) at 31 GHz is to be determined with an R&S®NRP40P. The ambient temperature is +21 ºC and the averaging number is set to 128 for both measurements. Measurements are carried out in the continuous average mode with a default aperture time of 10 µs.

For the calculation of total uncertainty, the relative contribution of zero offset and zero drift can be neglected in this case since both power levels are higher than –30 dBm. Noise must be taken into account for measurements at 1 µW. Using the noise multiplier (64) from endnote 7 and the multiplier (1.0) from table A, the absolute noise contribution is typically 110 pW × 64 × 1.0 = 7 nW, which corresponds to a relative measurement uncertainty of

$$10\ \lg\frac{1\ \mu\text{W} + 0.007\ \text{nW}}{1\ \mu\text{W}}\ \text{dB} = 0.030\ \text{dB}$$

Combined with the uncertainty of 0.126 dB for relative power measurements with a matched source (see table "Uncertainty for relative power measurements" on page 6), total expanded uncertainty is

$$\sqrt{0.03^2 + 0.126^2}\ \text{dB} = 0.130\ \text{dB}$$

Mismatch of the source (DUT) at the signal frequency can further impair linearity due to a change of the input reflection coefficient of the power sensor as a function of applied power (for specifications of reflection coefficient changes, see page 10). Limits of the induced linearity error can be approximated by

$$\pm 8.7\ \text{dB} \times r_{DUT} \times \Delta r_{SEN}$$

where r_{DUT} denotes the magnitude of the reflection coefficient of the source (DUT) and Δr_{SEN} denotes the change of the input reflection coefficient of the power sensor.

10 Gamma correction activated.

11 Preferably used with determined modulation when the aperture time cannot be matched to the modulation period. Compared to a uniform window, measurement noise is about 22 % higher.

12 For measuring the power of periodic bursts based on an average power measurement.

13 To increase measurement speed, the power sensor can be operated in buffered mode. In this mode, measurement results are stored in a buffer of user-definable size and then output as a block of data when the buffer is full. To enhance measurement speed even further, the sensor can be set to record the entire series of measurements when triggered by a single event. In this case, the power sensor automatically starts a new measurement as soon as it has completed the previous one.

14 This parameter enables power measurements on modulated bursts. The parameter must be longer in duration than modulation-induced power drops within the burst.

15 To exclude unwanted portions of the signal from the measurement result.

16 Valid for repeat mode, extending from the beginning to the end of all transfers via the USB interface of the power sensor. Measurement times under remote control of the R&S®NRX base unit via IEC/IEEE bus are approximately 2.5 ms longer, extending from the start of the measurement up to when the measurement result has been supplied to the output buffer of the R&S®NRX.

17 Magnitude of measurement error referenced to an ideal thermal power sensor that measures the sum power of carrier and harmonics. The specified error for second harmonic can be lowered by a factor of $\sqrt{10}$ and for third harmonic by a factor of 10 per 10 dB distortion level below –10 dBm. Example: At 12 GHz carrier frequency and –30 dBm power level of the carrier, the influence of the second harmonic, suppressed by 20 dBc, will cause an error of max. 0.25 dB / ($\sqrt{10} \times \sqrt{10}$) = 0.025 dB. Standard uncertainties can be assumed to be half the values.

18 Magnitude of the change vector in the complex plane.

19 The operating temperature range defines the span of ambient temperature in which the instrument complies with specifications. In the permissible temperature range, the instrument is still functioning but compliance with specifications is not warranted.

20 Quotient of a measured and a stored power ratio, e.g. for measuring gain compression of amplifiers.

21 Guaranteed by design and the specifications of the internal oscillator.

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

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- ► Local and personalized
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- ► Uncompromising quality
- ► Long-term dependability

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