R&S®NRP POWER METER FAMILY

3 year warranty

Trust your power measurements

Product Brochure
Version 11.00

ROHDE&SCHWARZ
Make ideas real

AT A GLANCE

The most important features for accurate and uncomplicated power measurements are top measurement accuracy and speed as well as simple operation on a base unit or a laptop/PC. The R&S®NRP power meter family combines all these characteristics in the R&S®NRX base unit, R&S®NRPV virtual power meter PC software and a comprehensive portfolio of LAN and USB power sensors. The R&S®NRP family is ideal for use in production, R&D and calibration labs as well as for installation and maintenance tasks.

All R&S®NRP power sensors are independent measuring instruments. Using a USB adapter, they can be directly connected to a laptop/PC and operated via the R&S®NRPV software.

The compact, robust R&S®NRX base unit with color touch display supports up to four R&S®NRP power sensors and all sensor-dependent measurement functions. Measured values are displayed numerically or graphically, depending on the measurement function. The high resolution graphical user interface allows simple, intuitive operation; the base unit can be remotely controlled via Ethernet, GPIB or USB.

Key facts

- Cost-effective and compact: sensor operation on a laptop/PC via USB
- R&S®NRPxxSN/TN/AN LAN models: measurements over any distance via built-in web GUI and powered with PoE
- Comprehensive portfolio for power measurements from DC to 110 GHz, from –70 dBm to +45 dBm
- Up to 93 dB dynamic range with three-path diode power sensors
- Precise analysis of envelope power with wideband power sensors
- Top accuracy with thermal power sensors
- Up to four R&S®NRP power sensors can be simultaneously connected to the R&S®NRX base unit

BENEFITS AND KEY FEATURES

Functions and performance features
- Fully characterized power sensors
- Minimizes measurement uncertainty
- Intelligent averaging function minimizes measurement time
- Versatile measurement functions

Additional R&S®NRPxxS(N)/T(N)/TWG/A(N) features
- USBTMC for easy system integration
- Built-in trigger I/O port
- Sensor status at a glance with status LED
- Detachable cables for flexible operation
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Intelligent, LAN power measurements
- Almost every sensor available as LAN model
- Remote monitoring via LAN over any distance
- Power supply via Power over Ethernet (PoE)
- Built-in web GUI with full power measurement support
- page 9

R&S®NRX versatile, user-friendly base unit
- Straightforward numerical and graphical display of measured values, plus intuitive operation
- Hardware interfaces for remote control and triggering
- Expandable to up to four measurement channels
- Flexible sensor interfaces
- Power reflection measurements
- Code emulation of the R&S®NRP2
- Sensor check source
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R&S®NRPV: convenient power measurements via PC application
- Sophisticated PC application
- Multifunctional trace mode window
- Extremely flexible marker functions
- Intelligent licensing concept: dongle-free on multiple PCs
- page 24

Versatile use of the R&S®NRP power sensors

		Available measurement functions (modes)				
Sensor type	**Features**	**Continuous average**	**Trace**	**Timeslot/ time gate**	**Burst average**	**Statistics**
R&S®NRPxxS(N) three-path diode power sensors ► page 11	fast, accurate and packed with features to measure CW and modulated signals	•	•	•	•	–
R&S®NRP33SN-V TVAC-compliant three-path diode power sensor ► page 14	specially designed for use in thermal vacuum (TVAC) chambers	•	•	•	•	–
R&S®NRPxxT(N)/TWG thermal power sensors ► page 15	most accurate power measurements for reference applications and use in calibration labs	•	–	–	–	–
R&S®NRPxxA(N) EMC average power sensors ► page 18	accurate average power measurements for EMC applications	•	–	–	–	–
R&S®NRP-Z8x wideband power sensors ► page 19	time domain analysis and automatic pulse analysis for radar applications and universal use	•	•	•	•	•
R&S®NRP-Z211/-Z221 two-path diode power sensors ► page 21	cost-effective power measurement solution for production	•	•	•	•	–
R&S®NRP-Z27/-Z37 power sensor modules ► page 22	level calibration of signal sources in conjunction with the R&S®FSMR measurement receiver	•	–	–	–	–
R&S®NRP-Z28/-Z98 level control sensors ► page 23	highly accurate signal level generation in conjunction with a signal generator	•	• [1]	• [1]	• [1]	–

[1] R&S®NRP-Z28 only.

FUNCTIONS AND PERFORMANCE FEATURES

Fully characterized power sensors

The R&S®NRPxxS(N), R&S®NRPxxT(N), R&S®NRPxxTWG, R&S®NRPxxA(N) and R&S®NRP-Zxx power sensors are immediately ready for use. In contrast to conventional power sensors, no calibration is required prior to making measurements since the sensors are fully characterized over frequency, level and temperature and feature long-term stability. All calibration data is stored in the sensors, so they function as independent measuring instruments. Usually, no zeroing is required. Users can plug in a sensor and simply start measuring.

Minimizes measurement uncertainty

Even complex test setups are no challenge for the R&S®NRPxxS(N), R&S®NRPxxT(N), R&S®NRPxxTWG, R&S®NRPxxA(N) and R&S®NRP-Zxx power sensors. Unwanted effects such as cable losses and reflections can be compensated using offset, S-parameter and Γ correction. Offset correction is used to take into account frequency-independent attenuation. S-parameter correction is used to mathematically shift the reference plane to the device under test (DUT) by taking into account the S-parameters of any components connected upstream of the sensor. Γ correction compensates for the effects of impedance mismatch between the source and the power sensor.

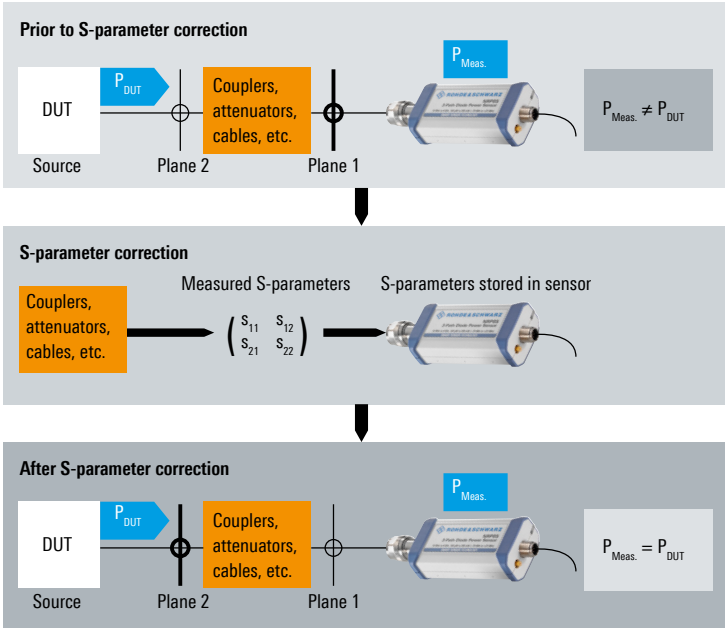
Intelligent averaging function minimizes measurement time

With fixed noise averaging (an enhanced auto averaging function), any measurement can be optimized with respect to measurement time and accuracy. The averaging filter is dynamically set to the optimum averaging value to achieve a user-defined maximum noise content. This helps minimize measurement time and maximize production throughput for a user-specified accuracy, and simplify programming of remotely controlled measurement sequences.

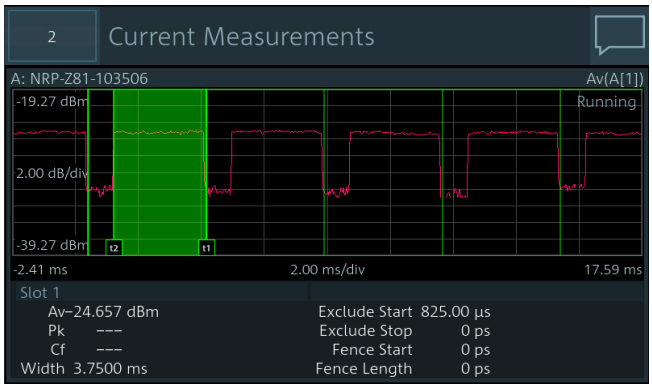
Versatile measurement functions

- Continuous average mode: reliable average power measurements on CW and modulated signals
- Burst average mode: burst average power measurements; sensors automatically detect start and end of a burst
- Trace mode: display of envelope power versus time
- Timeslot mode: timeslot average power measurements on TDMA signals (e.g. GSM/EDGE)
- Time gate mode: average power measurements in up to four independent time gates with user-defined position and length

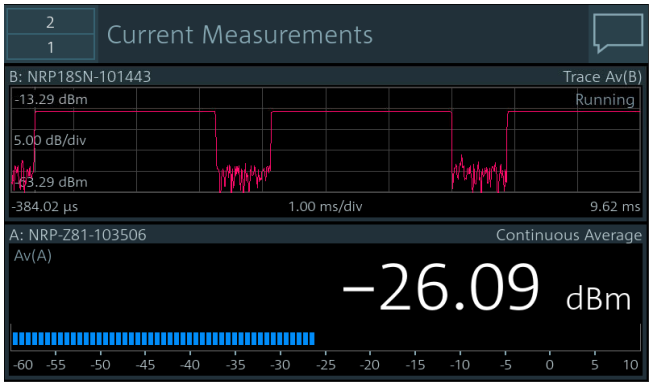
Shifting the measurement plane from 1 to 2 by using S-parameter correction; the influence of upstream components is compensated



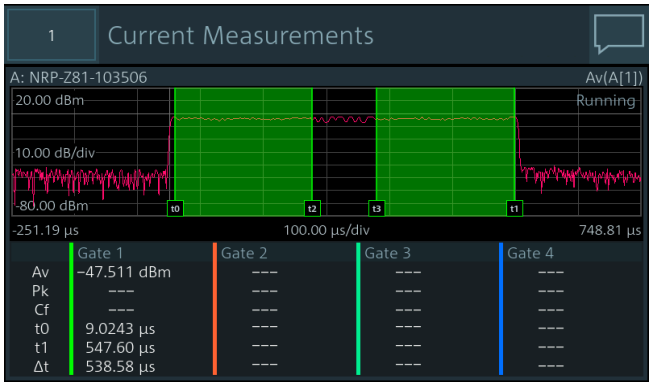
ADDITIONAL R&S®NRPXXS(N)/T(N)/ TWG/A(N) FEATURES



Timeslot measurement of a Bluetooth® signal with exclude start time



Mixed display of trace and continuous average measurement



Determination of power of an EDGE burst using an R&S®NRPxxS(N) three-path diode power sensor and the gate function; exclusion of training sequence in the center of the signal

USBTMC for easy system integration

The R&S®NRPxxS(N), R&S®NRPxxT(N), R&S®NRPxxTWG and R&S®NRPxxA(N) power sensors are USBTMC devices that can easily be integrated into automated test setups without having to install additional drivers.

R&S®NRPxxS(N), R&S®NRPxxT(N), R&S®NRPxxTWG and R&S®NRPxxA(N) power sensors can replace R&S®NRP legacy power sensors with 100 % code compatibility for remote operation.

Built-in trigger I/O port

The R&S®NRPxxS(N), R&S®NRPxxT(N), R&S®NRPxxTWG and R&S®NRPxxA(N) power sensors have integrated trigger capability. To measure power levels below the minimum trigger threshold, an external trigger signal is required. Such signals can be conveniently supplied via the built-in trigger port, which can also be used as a trigger output. In the trigger master mode, a trigger signal is derived from the measured signal inside the power sensor and output via the trigger port. This feature can be used to determine the input and output power levels of a power amplifier when the level at the amplifier input is too low for an internally triggered measurement, yet the level at the amplifier output is sufficiently high. In this case, the R&S®NRPxxS(N), R&S®NRPxxT(N), R&S®NRPxxTWG and R&S®NRPxxA(N) used for measuring the output level acts as the trigger master to trigger the input level measurement.

Sensor status at a glance with status LED

A status LED on the sensors allows the sensor status to be viewed from different angles. This is especially advantageous in the case of production racks with many sensors. The LED lights green to indicate error-free measurements. System-related errors, e.g. the absence of a trigger signal, are also indicated by dedicated colors. This allows users to immediately see the operating status of all sensors and quickly respond to problems.

By assigning the same color (RGB value) to a measured trace and the LED of the associated sensor, users can more easily attribute a trace to a specific sensor. This is beneficial when using multiple sensors at the same time.

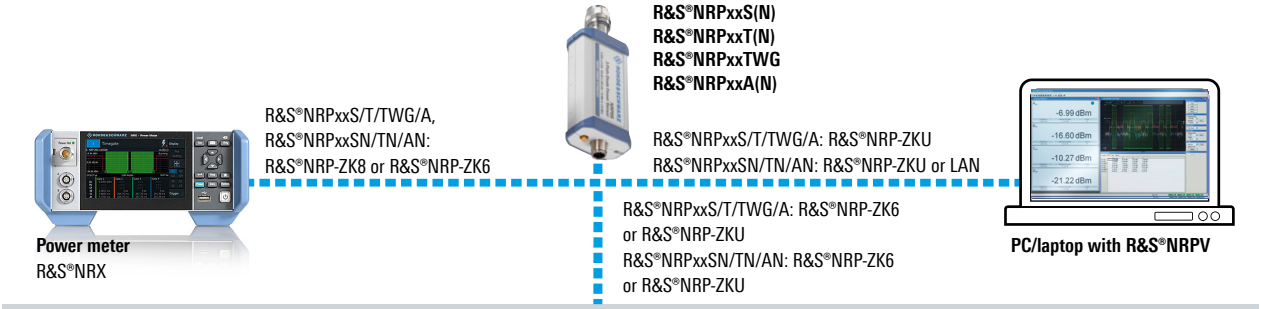
Detachable cables for flexible operation

The power sensors come with various, detachable cables for connection to diverse display units. A screw connection is provided on the sensor end to prevent accidental loosening of the cable.

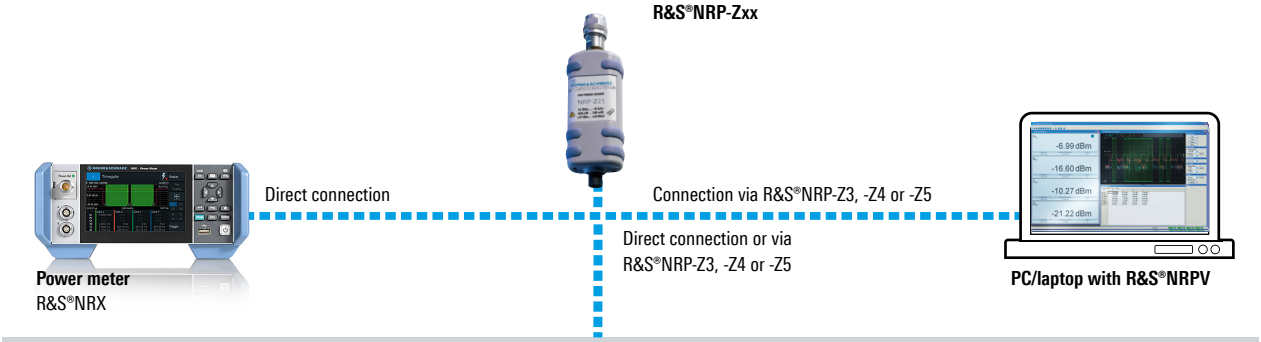
The R&S®NRP-ZKU USB interface cable can be used to connect a power sensor to a laptop/PC via the USB interface. This is an extremely space-saving and also cost-efficient solution that does not require a base unit. Two software tools – R&S®Power Viewer Plus and R&S®NRPV virtual power meter – are available to simplify sensor operation from a laptop/PC. These tools support all measurement functions implemented in the sensors.

The R&S®NRP-ZK6 interface cable is intended for operating a power sensor on the R&S®NRX base unit. It can also be used to connect the power sensor to diverse Rohde&Schwarz signal generators and signal and spectrum analyzers to enhance these instruments with a high-performance power meter.

Multiple ways to operate the R&S®NRP power sensors



Supported Rohde&Schwarz instruments

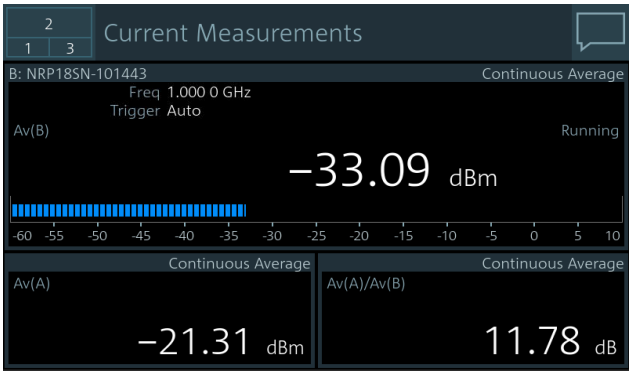


Supported Rohde&Schwarz instruments

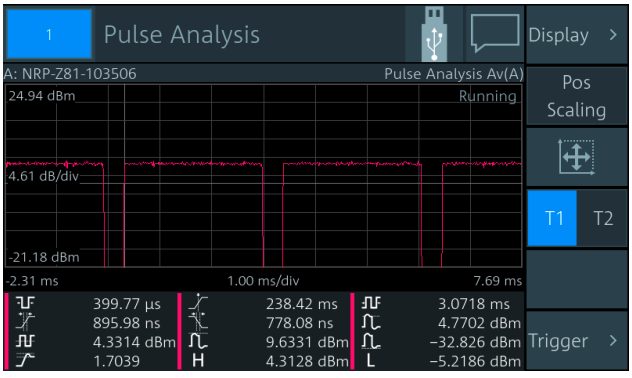
R&S®NRX VERSATILE, USER-FRIENDLY BASE UNIT

Straightforward numerical and graphical display of measured values, plus intuitive operation

The R&S®NRX simultaneously supports up to four power sensors of the R&S®NRP and R&S®NRQ family. Function keys on the front panel provide quick access to the most important functions. Users can open the frequency setting menu or zero the connected sensors at the push of a button.



R&S®NRX displays up to four measurements simultaneously



Automatic pulse analysis with the R&S®NRX and R&S®NRP-Z81

R&S®NRX power meter with connected R&S®NRP-Z81 wideband power sensor

User-programmable save/recall memory locations allow fast access to personal settings. Presets for all major mobile radio standards, such as 3GPP LTE, 3GPP WCDMA, GSM/EDGE, WLAN and Bluetooth®, ensure correct measurement with a minimum of keystrokes.

The 5" TFT color display supports the intuitive, window based operating concept. Key parameters and functions are color-coded and can be seen at a glance.

Results are presented in numerical and graphical display windows that can be easily configured.

In the continuous average, burst average, timeslot and time gate average measurement modes, up to four numerical results can be displayed in parallel. The ratio, SWR, return loss and reflection coefficient can be calculated from two measurement channels using predefined computation functions and displayed in addition to the absolute and relative power level.

Trace measurements and statistical measurements are presented in graphical windows. The trace mode allows simultaneous display of two traces in one measurement window. Level differences and time offset can be seen at a glance and accurately measured using horizontal and vertical markers. It is also possible to display the ratio of two traces.

Timeslots and time gates as well as the associated measurement values (average, peak or crest factor) can be graphically displayed in the trace window.

All R&S®NRP-Z8x wideband power sensors allow automatic pulse analysis. Up to 12 of 18 user-selected pulse parameters can be displayed in addition to the measurement trace.

The statistical amplitude distribution of the envelope power is shown as CCDF, CDF or PDF in a statistics window.

Hardware interfaces for remote control and triggering

The R&S®NRX provides three different remote interfaces for integration in automated test setups: Ethernet, USB and optionally GPIB (R&S®NRX-B8).

A trigger input on the rear panel permits external triggering for synchronized power measurements. Using an R&S®NRP-Z81, for example, a trigger signal can be derived from the measurement signal and output at the trigger output (trigger master mode). A level-proportional voltage or a digital signal for limit monitoring can be output via BNC connectors.

Expandable to up to four measurement channels

The R&S®NRX standard configuration includes one measurement channel. The base unit can be optionally expanded to two (R&S®NRX-K2, software option) or four (R&S®NRX-K2 and R&S®NRX-K4, software options) measurement channels.

Flexible sensor interfaces

The R&S®NRX provides two sensor connectors on the front and optionally two additional sensor connectors on the rear (R&S®NRX-B4, hardware option). A USB 2.0 interface on the front and the rear provides further connectivity (USB power sensors, memory key, mouse or keyboard).

Power reflection measurements

The R&S®NRX optionally provides the R&S®NRX-B9 interface for the R&S®NRT2 directional power sensors.

Code emulation of the R&S®NRP2

The R&S®NRX can interpret the command set of its predecessor, the R&S®NRP2.

Sensor check source

An optional high-precision 50 MHz/1 GHz reference source module (R&S®NRX-B1 sensor check source) can be used in CW mode to check the function of all R&S®NRP power sensors. In pulse mode, the test generator can be used to check the pulse measurement performance of the R&S®NRP-Z8x wideband power sensors or the R&S®NRQ frequency selective power sensor.

The modular concept allows users to choose between the R&S®NRX-B9 or the R&S®NRX-B1 option.

R&S®NRX rear view

INTELLIGENT, LAN POWER MEASUREMENTS

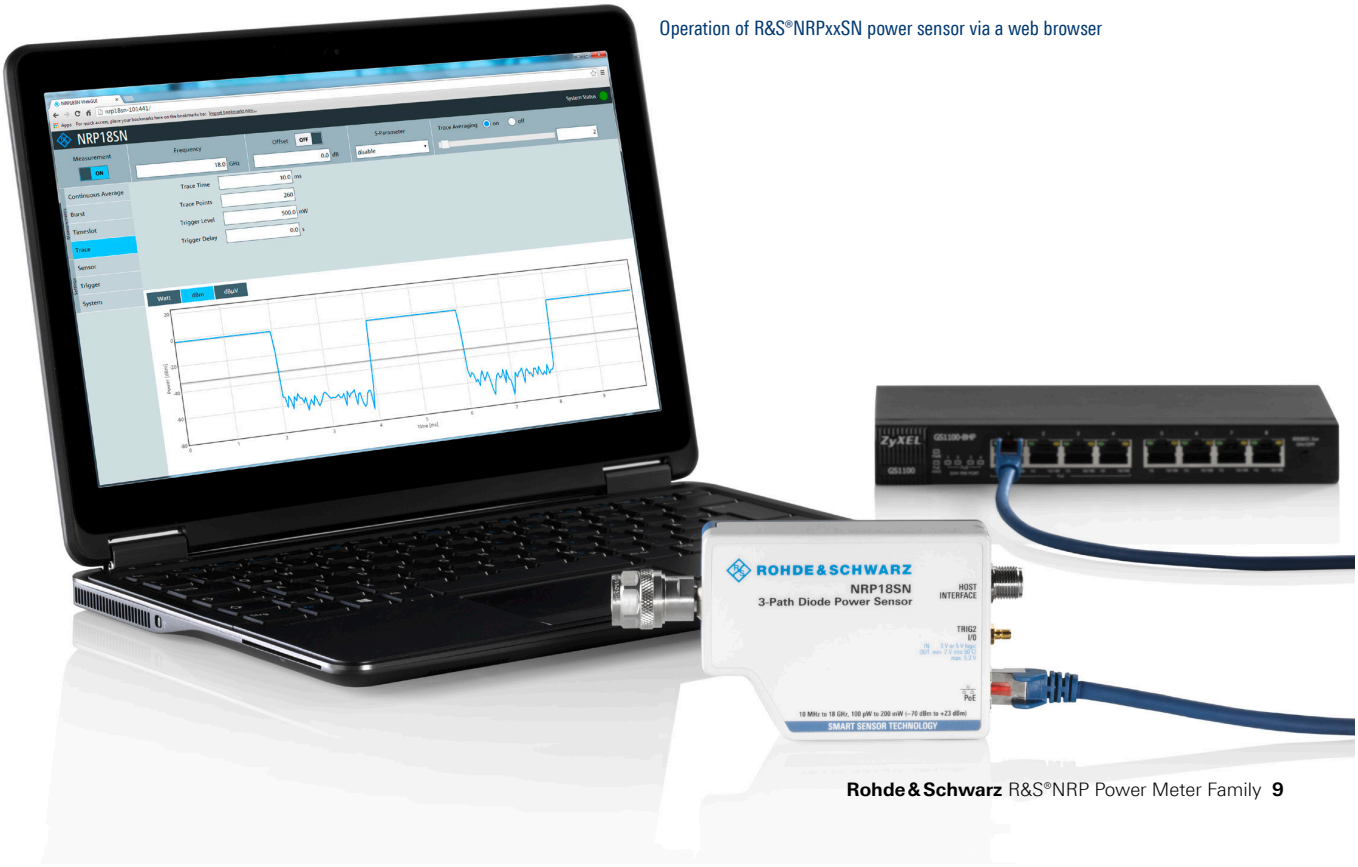
Almost every sensor available as LAN model

Almost every R&S®NRPxxS three-path diode, R&S®NRPxxA average and R&S®NRPxxT thermal sensor from the R&S®NRP product range is available as a LAN model (R&S®NRPxxSN, R&S®NRPxxAN, R&S®NRPxxTN). LAN models are equipped with an additional LAN interface without compromising sensor features and performance.

Remote monitoring via LAN over any distance

The R&S®NRPxxSN, R&S®NRPxxTN and R&S®NRPxxAN LAN power sensors are ideal for remote monitoring applications, e.g. for satellite systems or particle accelerators, where sensors need to be placed at different points in the system. The LAN interface makes it easy to overcome large distances between the various test points and the control center.

LAN interface, trigger I/O port and detachable cable for the R&S®NRPxxSN sensors



Operation of R&S®NRPxxSN power sensor via a web browser

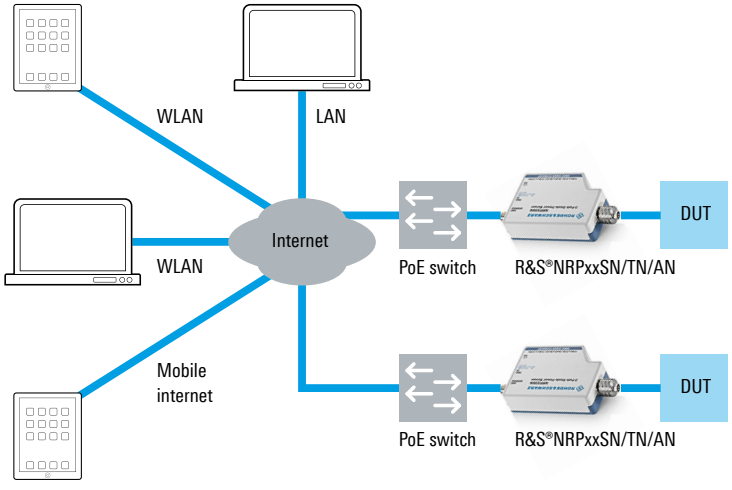
Power supply via Power over Ethernet (PoE)

In LAN operation, the sensors are powered via a PoE-capable LAN interface on the power sensor. If the LAN used does not support the PoE standard, then the sensors are connected to the LAN via a PoE+ compliant switch.

Built-in web GUI with full power measurement support

The R&S®NRPxxSN, R&S®NRPxxTN and R&S®NRPxxAN can be operated via a web interface. Using a PC connected to the internet, the power sensors can be conveniently controlled via a web browser – no additional software needs to be installed.

Simultaneous, location-independent remote monitoring of multiple R&S®NRPxxSN/TN/AN power sensors using a web browser



THREE-PATH DIODE POWER SENSORS

Ideal for universal applications

Three-path diode power sensors are suitable for numerous applications since they support continuous average, burst average, timeslot average, gate average and trace measurements. Featuring outstanding performance and unprecedented measurement speed and accuracy, the sensors can be used to perform precise average power measurements on wireless signals ranging from GSM and LTE up to 5G NR. For detailed analysis, the sensors offer additional measurement functions such as timeslot mode and trace mode with a video bandwidth of 100 kHz.

Offering a frequency range of up to 33 GHz, the R&S®NRP33S(N) is ideal for use in the automotive sector, for example in the development and production of long-range and short-range anti-collision radars (24 GHz). It is also a perfect choice for installation, maintenance and remote monitoring of ground stations for satellite systems (up to 33 GHz).

The R&S®NRP40S(N) and R&S®NRP50S(N) are ideal for measurements on microwave link systems operating at frequencies up to 50 GHz. The user benefits from short measurement times and the sensors' wide dynamic range.

The R&S®NRP67S(N) supports frequencies up to 67 GHz including IEEE 802.11ad and IEEE 802.11ay.

93 dB dynamic range thanks to improved three-path concept

The R&S®NRPxxS(N) power sensors use three separate diode paths, each operated in the optimum detector range. As a result, the average power can be determined with high accuracy irrespective of the modulation type. Measurement results are hardly affected by interfering signals or harmonics. The R&S®NRPxxS(N) power sensors therefore behave similar to thermal power sensors but offer significantly higher speed. They provide up to 93 dB dynamic range with an excellent lower measurement limit of –70 dBm.

Sensor type	Frequency range	Level range	Connector type
R&S®NRP8S(N)	10 MHz to 8 GHz	–70 dBm to +23 dBm	N (m)
R&S®NRP18S(N)	10 MHz to 18 GHz	–70 dBm to +23 dBm	N (m)
R&S®NRP33S(N)	10 MHz to 33 GHz	–70 dBm to +23 dBm	3.5 mm (m)
R&S®NRP40S(N)	50 MHz to 40 GHz	–70 dBm to +20 dBm	2.92 mm (m)
R&S®NRP50S(N)	50 MHz to 50 GHz	–70 dBm to +20 dBm	2.4 mm (m)
R&S®NRP67S(N)	50 MHz to 67 GHz	–70 dBm to +20 dBm	1.85 mm (m)
R&S®NRP18S-10	10 MHz to 18 GHz	–60 dBm to +33 dBm	N (m)
R&S®NRP18S-20	10 MHz to 18 GHz	–50 dBm to +42 dBm	N (m)
R&S®NRP18S-25	10 MHz to 18 GHz	–45 dBm to +45 dBm	N (m)

R&S®NRP50S and R&S®NRP50SN
three-path diode power sensors

Unlike conventional multipath technology, adjacent diode paths in the R&S®NRPxxS(N) power sensors overlap by 6 dB. All paths are continuously and simultaneously measured. The final measurement result is achieved by appropriately weighting the measurement results of all paths. This innovative approach ensures a smooth transition between measurement paths. Problems due to hard switching between the measurement paths, such as hysteresis effects, additional measurement delays and differential nonlinearity, are eliminated. The patented sensor architecture also improves the signal-to-noise ratio and increases measurement speed in the transition region.

Unprecedented measurement speed and accuracy even at low levels

The measurement speed is not only a function of the sampling rate. It depends to a substantial degree on the level to be measured and the desired measurement accuracy. To increase measurement accuracy, especially at low levels, it is necessary to average multiple measured values. While averaging reduces the noise component and thus increases measurement accuracy, it also slows down the measurement. The R&S®NRPxxS(N) power sensors have therefore been designed with an extremely low measurement noise in mind.

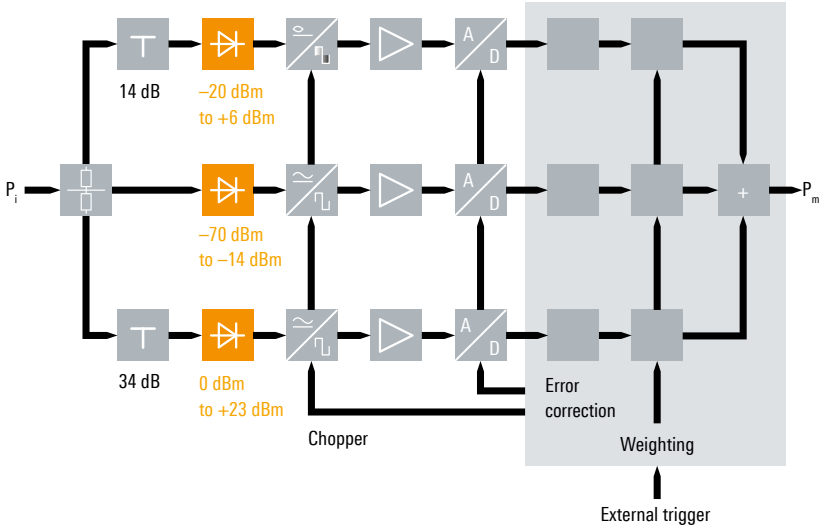
As a basic rule, it can be said that a 50 % reduction in the measurement noise will reduce the measurement time by a factor of four while maintaining the same accuracy.

With a typical measurement noise of 20 pW, the R&S®NRPxxS(N) power sensors can perform measurements down to a lower limit of –70 dBm with the highest speed and accuracy currently available on the market.

More than 50 000 readings/s

With more than 50 000 readings/s in fast continuous average mode, the R&S®NRPxxS(N) power sensors are currently the fastest sensors on the market. In buffered mode, they can transmit up to 8192 measured values per block with a minimum aperture of 10 µs. This corresponds to a continuous acquisition time of 81.92 ms. Any sporadic interference will be reliably detected.

Innovative three-path concept



10 000 triggered measurements/s

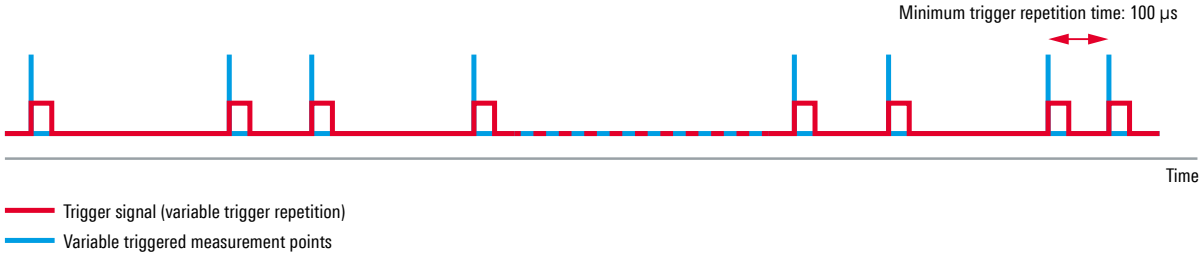
In fast continuous average mode, the R&S®NRPxxS(N) power sensors can perform up to 10 000 triggered measurements/s with a minimum trigger repetition time of 100 µs without losing any measurement. This measurement speed is achieved by using the buffered mode. In buffered mode, all measured data is collected inside the sensor and transmitted in one block to the sensor's host. By exploiting the maximum buffer size, the R&S®NRPxxS(N) sensors are able to collect measured data for up to 8192 triggered measurements within 0.81 s.

Sensors for high-power applications

The R&S®NRP18S-10, R&S®NRP18S-20 and R&S®NRP18S-25 high-power three-path diode power sensors consist of an R&S®NRP18S and a 10/20/25 dB upstream attenuator. They are able to perform power measurements up to 2 W, 15 W and 30 W.

When used with the attenuator, mismatch errors between the sensor and attenuator are automatically corrected. The S-parameters for the attenuator are determined and stored in the sensor during production. They are then automatically taken into account when performing measurements.

Triggered measurements



R&S®NRP18S-10, R&S®NRP18S-20 and R&S®NRP18S-25 high-power three-path diode power sensors for high-power applications up to 30 W

TVAC-COMPLIANT THREE-PATH DIODE POWER SENSOR

Specially designed for use in thermal vacuum (TVAC) chambers

In the satellite sector, components, subsystems and entire satellites must be qualified in a thermal vacuum (TVAC) before they can be used in space. This increasingly requires highly accurate, reliable power measurements directly on the DUT, i.e. in a TVAC chamber. Power sensors must therefore not only function in a high vacuum but also be able to withstand certain temperature fluctuations.

The R&S®NRPxxSN-V and R&S®NRP67SN-V TVAC-compliant power sensors are specially designed for these requirements. All components are baked in a vacuum chamber during the production process, so outgassing is reduced to a minimum. Venting holes in the housing ensure pressure equalization between the inside of the sensor and the environment.

The R&S®NRPxxSN-V and R&S®NRP67SN-V TVAC-compliant power sensors cover the satellite communications frequency range up to 67 GHz and allow fast, highly accurate power measurements over a dynamic range of up to 93 dB, independent of signal bandwidth and modulation type. Thanks to their LAN capability, the power sensors can be easily controlled and monitored from outside the chamber.

A set of dedicated, TVAC compliant cables is available as well. These cables are made of vacuum friendly material. Additionally, they are baked and come in vacuumized packaging. These measures ensure optimal performance in TVAC environments and prevent any gassing or contamination.

Sensor type	Frequency range	Level range	Connector type
R&S®NRP33SN-V	10 MHz to 33 GHz	–70 dBm to +23 dBm	3.5 mm (m)
R&S®NRP67SN-V	50 MHz to 67 GHz	–70 dBm to +20 dBm	1.85 mm (m)

R&S®NRP67SN-V
TVAC-compliant
power sensor

THERMAL POWER SENSORS

Outstanding performance for reference applications

Thermal power sensors are especially used for complex measurement tasks where highest accuracy counts. They tolerate any type of modulation. To improve measurement accuracy, the hardware of the R&S®NRPxxT(N)/TWG thermal power sensors is designed to reduce measurement noise to a minimum and to make the sensor immune to thermal environmental effects. To achieve stable measurement results, the temperature in the thermal test cell must correspond to the applied power. When the power is increased, the sophisticated measurement cell of the R&S®NRPxxT(N)/TWG thermal power sensors quickly attains a stable temperature. When the power level is decreased, the excess heat is dissipated extremely quickly. Consequently, thermal power sensors from Rohde&Schwarz are able to measure three times faster than comparable solutions on the market with triggered measurements and > 500 measurements/s in buffered mode – with top accuracy.

The R&S®NRPxxT(N) thermal power sensors feature an unparalleled linearity of 0.007 dB (0.16%) up to 67 GHz and 0.010 dB (0.23%) between 67 GHz and 110 GHz. The R&S®NRPxxTWG thermal power sensors feature a linearity of 0.010 dB (0.23%) between 50 GHz and 110 GHz – the ideal choice for performing relative measurements.

These sensor characteristics are particularly beneficial in reference applications and calibration labs.

Excellent impedance matching

To a large extent, measurement uncertainty results from multiple reflections at the source and power sensor caused by mismatch. To minimize these reflections, all thermal power sensors in the R&S®NRP family are excellently matched up to high frequencies, reducing measurement uncertainty.

Sensor type	Frequency range	Level range	Connector type
R&S®NRP18T(N)	DC to 18 GHz	–35 dBm to +20 dBm	N (m)
R&S®NRP33T(N)	DC to 33 GHz	–35 dBm to +20 dBm	3.5 mm (m)
R&S®NRP40T(N)	DC to 40 GHz	–35 dBm to +20 dBm	2.92 mm (m)
R&S®NRP50T(N)	DC to 50 GHz	–35 dBm to +20 dBm	2.4 mm (m)
R&S®NRP67T(N)	DC to 67 GHz	–35 dBm to +20 dBm	1.85 mm (m)
R&S®NRP90T(N)	DC to 90 GHz	–35 dBm to +20 dBm	1.35 mm (m)
R&S®NRP110T	DC to 110 GHz	–35 dBm to +20 dBm	1 mm (m)
R&S®NRP75TWG	50 GHz to 75 GHz	–35 dBm to +20 dBm	WR15
R&S®NRP90TWG	60 GHz to 90 GHz	–35 dBm to +20 dBm	WR12
R&S®NRP110TWG	75 GHz to 110 GHz	–35 dBm to +20 dBm	WR10

R&S®NRP67T and R&S®NRP67TN thermal power sensor

R&S®NRPxxTWG with waveguide interface

New, high-frequency technologies such as satellite communications, research and military radar targeting and tracking, and some non-military applications such as automotive radar create a challenging situation for the required test setup.

The R&S®NRPxxTWG thermal power sensors provide a convenient and accurate solution with integrated waveguide interfaces.

Waveguide adapters and a waveguide bracket are available for the R&S®NRP110T sensor.

R&S®NRP110T thermal power sensor with waveguide adapter and bracket

R&S®NRP75TWG/90TWG/110TWG thermal power sensors

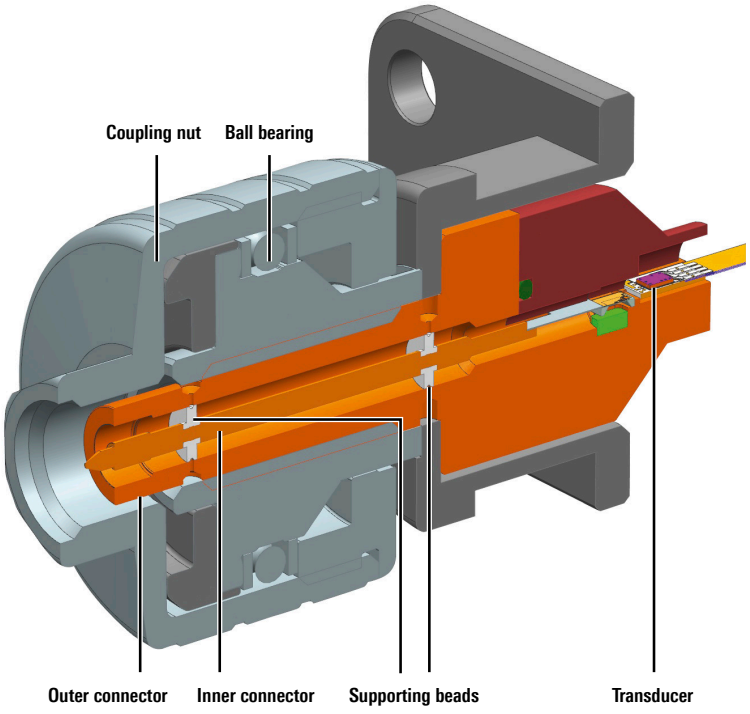
Sophisticated coaxial connector concept

Thanks to the innovative connector design, the sensors can be easily screw-connected to the signal source to be measured. A ball bearing in the coupling nut ensures that only the coupling nut has to be turned to tighten the sensor. The sensor body stays fixed in the required position. Contrary to conventional connecting screws, the outer conductors of the sensor and DUT are not turned relative to each other and so their mating surfaces do not rub together. This reduces wear and enhances reproducibility of measurements. The connector concept contributes to high measurement accuracy.

Internal calibration test

Rohde&Schwarz has implemented a special verification function in the R&S®NRPxxT(N)/TWG sensors. This function covers all essential components of the signal path. Using a test routine, the sensor's response to a highly stable applied DC power is measured and compared to the value stored during the previous calibration. The result provides information about the functionality and accuracy of the power sensor.

Interior view of the connector



EMC AVERAGE POWER SENSORS

Specially designed for EMC applications

In EMC applications, usually only the average power is of interest. This is where the R&S®NRPxxA(N) average power sensors are the perfect fit. They cover measurement ranges that are used in telecommunications as well as the important lower frequency bands down to 8 kHz. Users benefit from the excellent properties of the three-path diode power sensors, including a dynamic range of up to 93 dB, very low influence of the modulation on the measurement and outstanding impedance matching.

Sensor type	Frequency range	Level range	Connector type
R&S®NRP6A(N)	8 kHz to 6 GHz	–70 dBm to +23 dBm	N (m)
R&S®NRP18A(N)	8 kHz to 18 GHz	–70 dBm to +23 dBm	N (m)

R&S®NRP18A and R&S®NRP18AN
EMC average power sensor

WIDEBAND POWER SENSORS

Ideal for radar applications

The R&S®NRP-Z8x wideband power sensors are ideal for radar applications. In development or during installation and maintenance, pulse characteristics as well as output power have to be measured. Similar measurements are required in the production of radar systems and radar components. Thanks to a maximum video bandwidth of 30 MHz and a rise/fall time < 13 ns, the sensors can measure pulses with a pulse width as small as 50 ns.

Up to 44 GHz

The R&S®NRP-Z8x wideband power sensors are ideal for power measurements on microwave link modules. Especially the R&S®NRP-Z86 model .44 (upper frequency limit of 44 GHz) can be used for the development, production, installation and maintenance of the latest generation of microwave link modules. The user benefits from the sensor's high measurement speed and large dynamic range.

Outstanding dynamic range and accuracy

The dynamic range of the R&S®NRP-Z8x wideband power sensors yields a lower limit of –47 dBm for envelope power measurements and –60 dBm for average power measurements. This sensitivity is unique and so far unprecedented on the market. Users benefit from enhanced reproducibility and high measurement speed.

These sensors are therefore ideal for analyzing envelope power as well as for measuring average power.

High resolution mode

Some applications require the display of strongly magnified signal sections such as the rising edge of a pulse. To improve the graphical display in the trace mode, which has a resolution of 12.5 ns, a high density of samples is required. Equivalent time sampling with repetitive signals can achieve a time resolution of up to 100 ps.

Highest measurement speed

The R&S®NRP-Z8x wideband power sensors are the world's fastest sensors. In buffered mode, a specified measurement speed of > 9000 measurements/s can be achieved.

Sensor type	Frequency range	Measurement range	Connector type
R&S®NRP-Z81	50 MHz to 18 GHz	–60 dBm to +20 dBm	N
R&S®NRP-Z85	50 MHz to 40 GHz	–60 dBm to +20 dBm	2.92 mm
R&S®NRP-Z86, model .40	50 MHz to 40 GHz	–60 dBm to +20 dBm	2.4 mm
R&S®NRP-Z86, model .44	50 MHz to 44 GHz	–60 dBm to +20 dBm	2.4 mm

R&S®NRP-Z81/-Z85/-Z86 wideband power sensors

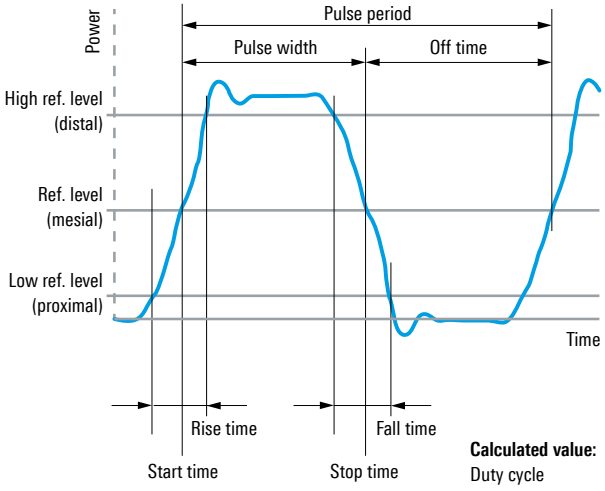
Automatic pulse analysis

Automatic pulse analysis supports users in measuring important pulse parameters. It eliminates the need for complex measurements using markers; changes in the pulse shape are immediately taken into account in the measurement results.

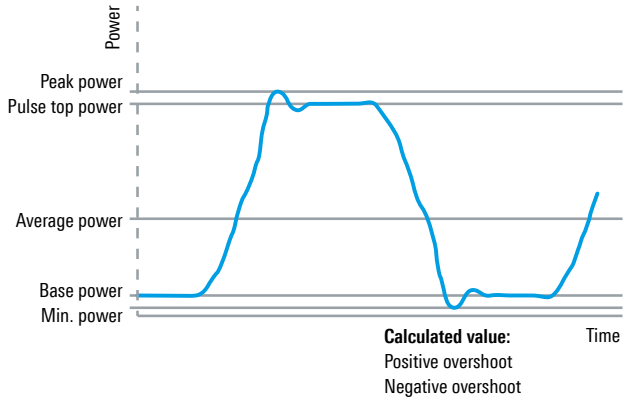
The following parameters are determined by automatic pulse analysis:

- Time parameters: rise/fall time, start/stop time, pulse width, duty cycle, pulse period, pulse off time
- Level parameters: pulse top, pulse base, peak, average, minimum, overshoot (positive and negative)

Time parameters



Level parameters



Statistical analysis

The R&S®NRP-Z8x wideband power sensors permit statistical analysis of the amplitude distribution of noise-like signals to determine key parameters such as peak envelope power, average power and peak-to-average power ratio. The measurement data supports the design of components for modern OFDM or CDMA based wireless systems such as EUTRA/LTE and 3GPP FDD. Using one million samples, the R&S®NRP-Z8x wideband power sensors can measure the CCDF, CDF or PDF in less than 25 ms at full video bandwidth.

It is also possible to perform statistical analysis on an individually configured time gate so that only specific signal sections are observed.

Trigger master mode (with base unit or R&S®NRP-Z5)

Combined with the R&S®NRX base unit or the R&S®NRP-Z5 sensor hub, an R&S®NRP-Z8x wideband power sensor can be used as a trigger source. In the trigger master mode, a trigger signal is derived from the measured signal inside the power sensor and forwarded to the base unit or sensor hub for further use. All other connected sensors can be externally triggered using this trigger signal. An additional external trigger source is not required. This feature can be used to determine the input and output level of power amplifiers when the level at the input is too low for an internally triggered measurement, yet the level at the output is sufficient. In this case, an R&S®NRP-Z8x used for measuring the output signal acts as the trigger master to trigger the input signal measurement.

TWO-PATH DIODE POWER SENSORS

Cost-effective solution for production applications

The R&S®NRP-Z211/-Z221 two-path diode power sensors combine all key characteristics relevant for their use in production. These USB sensors are cost-effective, fast and precise. The sensors support the same measurement functions as the R&S®NRPxxS three-path diode power sensors and offer the best price/performance ratio in their class.

Mid-class sensor with tried and tested technology

The two-path diode power sensors use the tried and tested Rohde&Schwarz multipath technology. With two overlapping diode paths measured in parallel and a wide dynamic range of 80 dB, the power sensors feature high measurement accuracy and speed.

Sensor type	Frequency range	Measurement range	Connector type
R&S®NRP-Z211	10 MHz to 8 GHz	–60 dBm to +20 dBm	N
R&S®NRP-Z221	10 MHz to 18 GHz	–60 dBm to +20 dBm	N

R&S®NRP-Z211/-Z221 two-path diode power sensors

POWER SENSOR MODULES

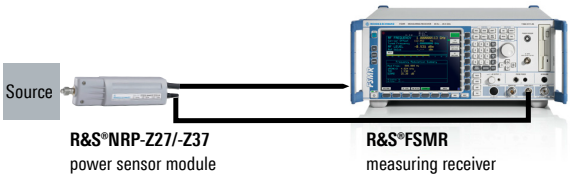
Solution for accurate level calibration

The R&S®NRP-Z27/-Z37 power sensor modules turn the R&S®FSMR measuring receivers into precision power meters with a wide dynamic range from –115 dBm to +30 dBm.

The R&S®NRP-Z27/-Z37 power sensor modules were developed especially for level calibration using the R&S®FSMR measuring receiver. These sensors act as highly accurate references for determining the absolute power level. Together with the excellent linearity of the R&S®FSMR, this enables precise power calibration over the entire level range of the measuring receiver. Using an integrated power splitter, the power is fed to the integrated R&S®NRP-Z27/-Z37 thermal power sensor module and simultaneously to the measuring receiver via a phase-stable cable.

Like all other power sensors in the R&S®NRP family, the power sensor modules are fully self-contained power meters that are remotely controlled from the R&S®FSMR, R&S®NRX or any Windows PC via USB.

R&S®FSMR measuring receiver with R&S®NRP-Z27/-Z37 power sensor module



R&S®FSMR measuring receiver with R&S®NRP-Z27 power sensor module

Sensor type	Frequency range	Measurement range	Connector type
R&S®NRP-Z27	DC to 18 GHz	–24 dBm to +26 dBm	N
R&S®NRP-Z37	DC to 26.5 GHz	–24 dBm to +26 dBm	3.5 mm

R&S®NRP-Z27/-Z37 power sensor modules

LEVEL CONTROL SENSORS

Feeding accurate power level to a device under test (DUT)

The R&S®NRP-Z28/-Z98 level control sensors were developed especially to feed power to the DUT and monitor the power at the same time. The sensor's integrated power splitter splits the signal into two equal power parts. One part is measured by the integrated power sensor and displayed on a Rohde&Schwarz signal generator, on the R&S®NRX base unit or on a laptop/PC. The other part, which is identical to the measured part, is output at the sensor's RF output and can be directly fed to the DUT. The sensor is a permanent part of the test setup. To perform a power measurement, it is not necessary to disconnect the DUT from the RF source. Uncertainties caused by a mismatched load or the cable loss between the signal generator and the DUT are prevented by using the R&S®NRP-Z28/-Z98 level control sensors together with the automatic level correction feature of Rohde&Schwarz signal generators. Distances of up to 1.2 m are bridged by an integrated low-loss microwave cable.

Sensor type	Frequency range	Measurement range	Connector type
R&S®NRP-Z28	10 MHz to 18 GHz	–67 dBm to +20 dBm	N
R&S®NRP-Z98	9 kHz to 6 GHz	–67 dBm to +20 dBm	N

R&S®NRP-Z28/-Z98 level control sensors

R&S®NRPV: CONVENIENT POWER MEASUREMENTS VIA PC APPLICATION

Sophisticated PC application

In combination with the R&S®NRPV virtual power meter software, the USB capability of the R&S®NRP power sensors can be ideally utilized. The software covers all sensor functions and supports up to four sensors connected to a laptop/PC via the R&S®NRP-Z3/-Z4 USB adapter cables or the R&S®NRP-Z5 sensor hub. The sensors are automatically detected when plugged in and added to all open measurement windows (hot plugging).

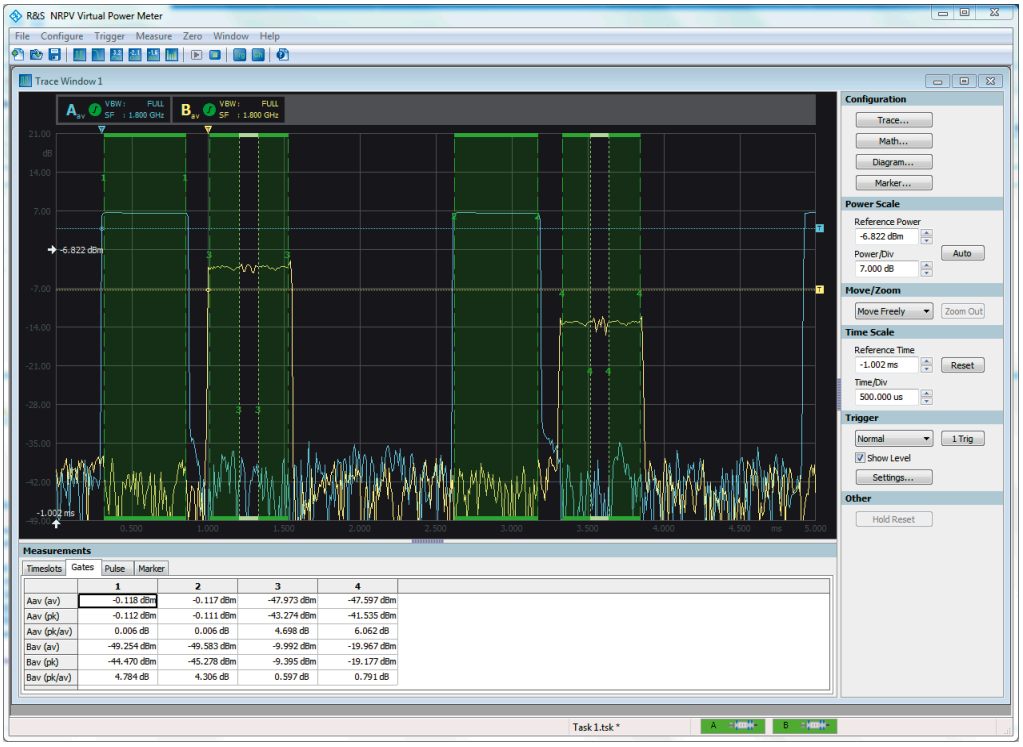
This cost-effective measurement solution supports all available measurement modes. Mathematical calculations during measurements to determine the SWR, difference or ratio are possible in the continuous average, gated average and burst average numerical modes and in the graphical trace mode.

Multifunctional trace mode window

The trace mode is supported by all three-path diode power sensors, two-path diode power sensors and wideband power sensors. Up to four trace measurements and four mathematical traces can be simultaneously displayed in one window.

Timeslot/time gate

Timeslot and time gate measurements are performed directly in the trace window. The R&S®NRPV virtual power meter software supports up to 16 timeslots and four independent time gates. They can be transparently displayed in the trace window. Timeslot and gate length as well as their starting position are adjusted using the mouse; measured values are displayed as a table in the measurement window.



Gated measurement of two GSM/EDGE traces with the R&S®NRP-Z81

Automatic pulse analysis

The R&S®NRP-Z8x wideband power sensors can quickly and automatically analyze pulsed signals in trace mode to continuously determine the most important time and power parameters.

Extremely flexible marker functions

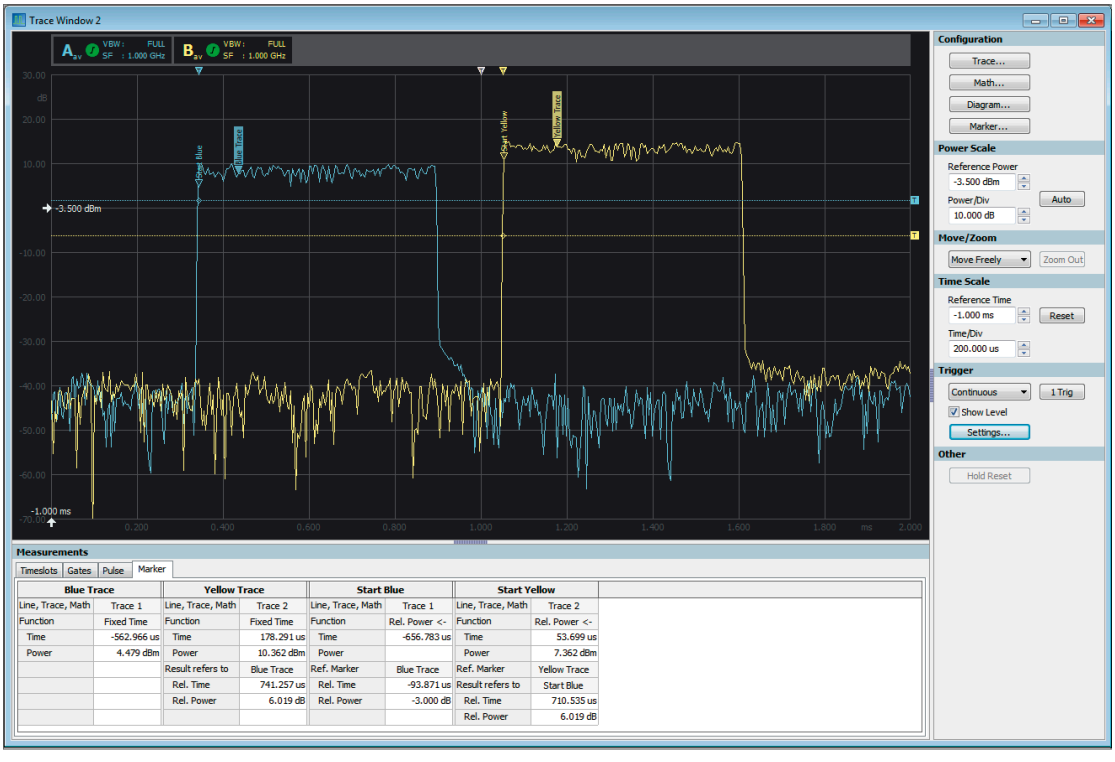
The marker function in the trace mode supports an unlimited number of markers that can be linked together as required. In addition to single markers (to measure the level at a fixed time) and double markers (to determine the level difference after a fixed time period), other functions such as automatic peak search are available.

Each marker can be used as a reference marker and functions as a reference point to determine time and level differences. Linked markers can be combined and extended as required. Since each marker is associated with a trace, markers from different traces can also be linked. The spacing between two pulses in different traces can be accurately and continuously measured, even if the pulse spacing changes.

Complex marker settings can be stored and retrieved at any time.

Intelligent licensing concept: dongle-free on multiple PCs

The R&S®NRPV virtual power meter software can be installed on an unlimited number of laptops/PCs. All R&S®NRPxxS(N)/T(N)/A(N) sensors come from the factory enabled for use with the R&S®NRPV software. Each R&S®NRP-Zxx sensor has to be activated individually using the sensor-specific R&S®NRPZ-K1 keycode option. Once activated, the sensor can be operated on any laptop/PC. This licensing concept eliminates the need for USB dongles and does not tie a license to a specific laptop/PC.



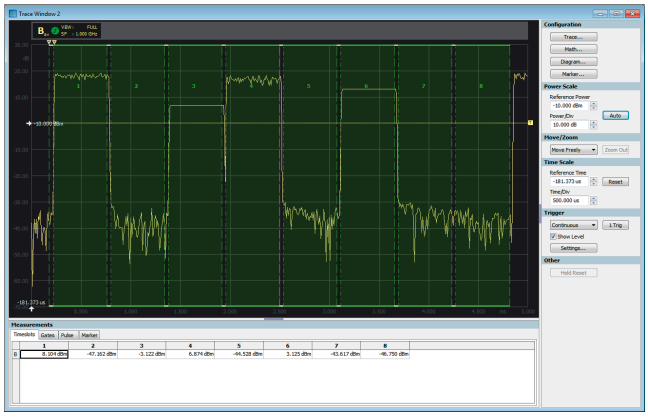
Pulse delay measurement on different traces

APPLICATIONS

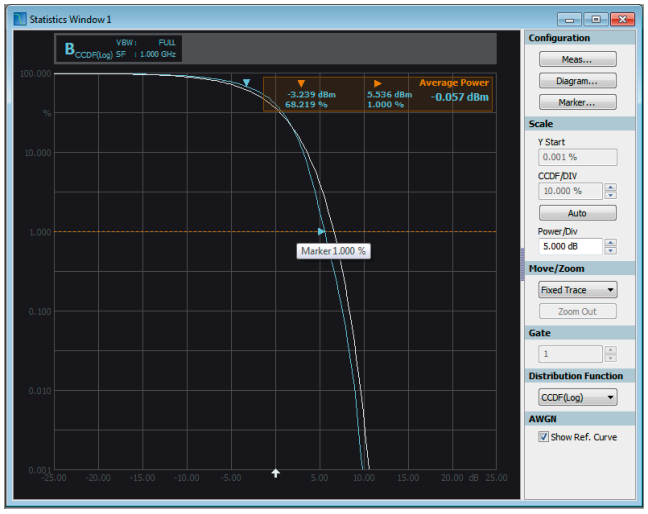
Accurate measurement of TDMA based signals

The analysis of TDMA based signals encountered in GSM/EDGE and DECT is a common application for power measurements. The R&S®NRPxxS/-Z2xx/-Z8x sensors are very powerful tools for such work. The trace mode makes graphical analysis of any signal very straightforward. The ability to easily modify the time axis and the auto scaling function provide useful support during in-depth analysis of relevant signal components. The timeslot measurement in the trace mode allows simultaneous analysis of multiple equidistant timeslots.

Additionally, the R&S®NRPxxS/-Z2xx/-Z8x sensors support up to four independent measurement gates. Start time and length can be individually configured for each gate.



Measurement of eight timeslots in one shot with the R&S®NRPV



Statistical analysis of an LTE signal using the R&S®NRPV

The power sensor also provides a fence function for the timeslot and time gate modes. The fence can be configured separately for each gate or globally for all timeslots. This allows the user to keep track of the power at all times during the time segments of interest. Exclude times can be set to mask interfering signal components at the edges of a timeslot.

Power measurements in radiocommunications standards

Radiocommunications standards such as 3GPP LTE, 3GPP FDD and CDMA2000® exhibit very different power profiles depending on their channel utilization. Assessing these power profiles is a routine job with the power sensors in the R&S®NRP family. This is true no matter whether you need to accurately measure the average power, peak power, peak-to-average ratio in the time domain or you need fast statistical analysis to precisely determine the amplitude distribution.

Average power measurements are possible with all R&S®NRP power sensors. The R&S®NRPxxT thermal power sensors are used when highest accuracy is required. The R&S®NRPxxS/xxA/-Z2xx multipath sensors perform average power measurements very quickly over a dynamic range of up to 93 dB. This is true even for signals with a high peak-to-average ratio. Thanks to the patented multipath technology, measurements are always fast and accurate even at the limits of the measurement paths. The innovative sensor architecture eliminates measurement range switching as well as the associated discontinuity in the measured values and extended measurement times.

For power analysis, the R&S®NRP-Z8x wideband power sensors are available. With a maximum video bandwidth of 30 MHz, these sensors are ideal for analyzing noise-like signals in statistic mode. Exact determination of the amplitude statistics permits accurate peak, average and crest factor measurements.

Radar applications

The R&S®NRP-Z8x wideband power sensors with a maximum frequency of 44 GHz are ideal for time domain analysis of pulses. Automatic pulse analysis enables users to continuously monitor key pulse parameters such as rise/fall time, pulse width or pulse top without interaction. With a rise time of 13 ns, even steep edges can be measured. This performance is sufficient to measure most radar signals.

Even nonrepetitive pulse sequences where each pulse exhibits a different power level can be precisely measured.

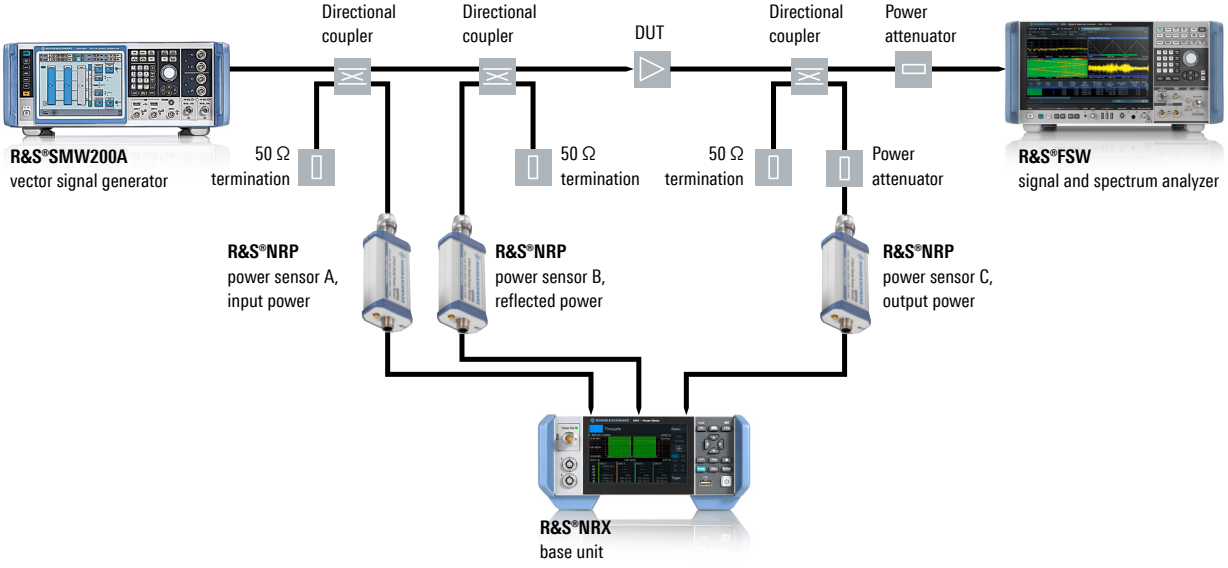
Using the sensor's buffered mode, the measurements are performed so fast that it is possible to reliably measure the power of all pulses even in the presence of high pulse repetition rates and short pulses. This ensures reliable detection of even rarely occurring signal phenomena.

Component tests with high throughput

In component testing, the focus is on precisely determining the input/output power, the gain, and the input impedance matching of the DUT. The R&S®NRP family provides an outstanding solution for such applications. Only one R&S®NRX base unit with up to four measurement channels is required for the simultaneous evaluation of the results delivered by the sensors. This makes it possible to correctly measure the input and output power of a power amplifier as well as to accurately determine the gain and input impedance matching since the R&S®NRX base unit automatically calculates the power ratios.

R&S®NRP-Z8x wideband power sensors are suitable for accurate measurement of pulsed radar systems.

Typical test setup for multicarrier power amplifier (MCPA) tests; calculation functions of the R&S®NRX allow impedance matching and gain to be determined



SPECIFICATIONS IN BRIEF

Specifications in brief			
Sensor type, connector	**Frequency range**	**Power measurement range, maximum input power**	**Impedance matching (SWR)**
Three-path diode power sensors			
R&S®NRP8S(N) N (m)	10 MHz to 8 GHz	100 pW to 200 mW (–70 dBm to +23 dBm)	10 MHz to 2.4 GHz: < 1.13 > 2.4 GHz to 8.0 GHz: < 1.20
R&S®NRP18S(N) N (m)	10 MHz to 18 GHz	100 pW to 200 mW (–70 dBm to +23 dBm)	10 MHz to 2.4 GHz: < 1.13 > 2.4 GHz to 8.0 GHz: < 1.20 > 8.0 GHz to 18.0 GHz: < 1.25
R&S®NRP33S(N) 3.5 mm (m)	10 MHz to 33 GHz	100 pW to 200 mW (–70 dBm to +23 dBm)	10 MHz to 2.4 GHz: < 1.13 > 2.4 GHz to 8.0 GHz: < 1.20 > 8.0 GHz to 18.0 GHz: < 1.25 > 18.0 GHz to 26.5 GHz: < 1.30 > 26.5 GHz to 33.0 GHz: < 1.35
R&S®NRP40S(N) 2.92 mm (m)	50 MHz to 40 GHz	100 pW to 100 mW (–70 dBm to +20 dBm)	50 MHz to 2.4 GHz: < 1.13 > 2.4 GHz to 8.0 GHz: < 1.20 > 8.0 GHz to 18.0 GHz: < 1.25 > 18.0 GHz to 26.5 GHz: < 1.30 > 26.5 GHz to 33.0 GHz: < 1.35 > 33 GHz to 40.0 GHz: < 1.37
R&S®NRP50S(N) 2.4 mm (m)	50 MHz to 50 GHz	100 pW to 100 mW (–70 dBm to +20 dBm)	50 MHz to 2.4 GHz: < 1.13 > 2.4 GHz to 8.0 GHz: < 1.20 > 8.0 GHz to 18.0 GHz: < 1.25 > 18.0 GHz to 26.5 GHz: < 1.30 > 26.5 GHz to 33.0 GHz: < 1.35 > 33 GHz to 40.0 GHz: < 1.37 > 40 GHz to 50.0 GHz: < 1.40
R&S®NRP67S(N) 1.85 mm (m)	50 MHz to 67 GHz	100 pW to 100 mW (–70 dBm to +20 dBm)	50 MHz to 200 MHz: < 1.30 > 200 MHz to 2.4 GHz: < 1.13 > 2.4 GHz to 8.0 GHz: < 1.20 > 8.0 GHz to 18.0 GHz: < 1.25 > 18.0 GHz to 26.5 GHz: < 1.30 > 26.5 GHz to 33.0 GHz: < 1.35 > 33.0 GHz to 40.0 GHz: < 1.37 > 40.0 GHz to 50.0 GHz: < 1.40 > 50.0 GHz to 67.0 GHz: < 1.68
High-power three-path diode power sensor			
R&S®NRP18S-10 N (m)	10 MHz to 18 GHz	1 nW to 2 W (–60 dBm to +33 dBm)	10 MHz to 2.4 GHz: < 1.14 > 2.4 GHz to 8.0 GHz: < 1.20 > 8.0 GHz to 12.4 GHz: < 1.25 > 12.4 GHz to 18.0 GHz: < 1.30
R&S®NRP18S-20 N (m)	10 MHz to 18 GHz	10 nW to 15 W (–50 dBm to +42 dBm)	10 MHz to 2.4 GHz: < 1.14 > 2.4 GHz to 8.0 GHz: < 1.25 > 8.0 GHz to 12.4 GHz: < 1.30 > 12.4 GHz to 18.0 GHz: < 1.41
R&S®NRP18S-25 N (m)	10 MHz to 18 GHz	30 nW to 30 W (–45 dBm to +45 dBm)	10 MHz to 2.4 GHz: < 1.14 > 2.4 GHz to 8.0 GHz: < 1.25 > 8.0 GHz to 12.4 GHz: < 1.30 > 12.4 GHz to 18.0 GHz: < 1.41
TVAC-compliant three-path diode power sensors			
R&S®NRP33SN-V 3.5 mm (m)	10 MHz to 33 GHz	100 pW to 200 mW (–70 dBm to +23 dBm)	10 MHz to 2.4 GHz: < 1.13 > 2.4 GHz to 8.0 GHz: < 1.20 > 8.0 GHz to 18.0 GHz: < 1.25 > 18.0 GHz to 26.5 GHz: < 1.30 > 26.5 GHz to 33.0 GHz: < 1.35
R&S®NRP67SN-V 1.85 mm (m)	50 MHz to 67 GHz	100 pW to 100 mW (–70 dBm to +20 dBm)	50 MHz to 200 MHz: < 1.30 > 200 MHz to 2.4 GHz: < 1.13 > 2.4 GHz to 8.0 GHz: < 1.20 > 8.0 GHz to 18.0 GHz: < 1.25 > 18.0 GHz to 26.5 GHz: < 1.30 > 26.5 GHz to 33.0 GHz: < 1.35 > 33.0 GHz to 40.0 GHz: < 1.37 > 40.0 GHz to 50.0 GHz: < 1.40 > 50.0 GHz to 67.0 GHz: < 1.68

Rise time, video bandwidth	Uncertainty for power measurements at +20 °C to +25 °C absolute (in dB)	relative (in dB)	Sensor type, connector
			Three-path diode power sensors
< 5 µs > 100 kHz	0.053 to 0.065	0.022 to 0.050	R&S®NRP8S(N) N (m)
	0.053 to 0.094	0.022 to 0.069	R&S®NRP18S(N) N (m)
	0.053 to 0.134	0.022 to 0.136	R&S®NRP33S(N) 3.5 mm (m)
	0.073 to 0.138	0.028 to 0.142	R&S®NRP40S(N) 2.92 mm (m)
	0.073 to 0.183	0.028 to 0.184	R&S®NRP50S(N) 2.4 mm (m)
	0.073 to 0.255	0.028 to 0.266	R&S®NRP67S(N) 1.85 mm (m)
			High-power three-path diode power sensor
< 5 µs > 100 kHz	0.083 to 0.198	0.022 to 0.087	R&S®NRP18S-10 N (m)
	0.083 to 0.198	0.022 to 0.087	R&S®NRP18S-20 N (m)
	0.083 to 0.219	0.022 to 0.087	R&S®NRP18S-25 N (m)
			TVAC-compliant three-path diode power sensor
< 5 µs > 100 kHz	0.053 to 0.134	0.022 to 0.136	R&S®NRP33SN-V 3.5 mm (m)
	0.073 to 0.255	0.028 to 0.266	R&S®NRP67SN-V 1.85 mm (m)

Specifications in brief

Sensor type, connector	Frequency range	Power measurement range, maximum input power	Impedance matching (SWR)
Thermal power sensors			
R&S®NRP18T(N) N (m)	DC to 18 GHz	300 nW to 100 mW (–35 dBm to +20 dBm)	DC to 100 MHz: < 1.03 > 100 MHz to 2.4 GHz: < 1.06 > 2.4 GHz to 12.4 GHz: < 1.13 > 12.4 GHz to 18.0 GHz: < 1.16
R&S®NRP33T(N) 3.5 mm (m)	DC to 33 GHz	300 nW to 100 mW (–35 dBm to +20 dBm)	DC to 100 MHz: < 1.03 > 100 MHz to 2.4 GHz: < 1.06 > 2.4 GHz to 12.4 GHz: < 1.13 > 12.4 GHz to 18.0 GHz: < 1.16 > 18.0 GHz to 26.5 GHz: < 1.22 > 26.5 GHz to 33.0 GHz: < 1.28
R&S®NRP40T(N) 2.92 mm (m)	DC to 40 GHz	300 nW to 100 mW (–35 dBm to +20 dBm)	DC to 100 MHz: < 1.03 > 100 MHz to 2.4 GHz: < 1.06 > 2.4 GHz to 12.4 GHz: < 1.13 > 12.4 GHz to 18.0 GHz: < 1.16 > 18.0 GHz to 26.5 GHz: < 1.22 > 26.5 GHz to 40.0 GHz: < 1.28
R&S®NRP50T(N) 2.4 mm (m)	DC to 50 GHz	300 nW to 100 mW (–35 dBm to +20 dBm)	DC to 100 MHz: < 1.03 > 100 MHz to 2.4 GHz: < 1.06 > 2.4 GHz to 12.4 GHz: < 1.13 > 12.4 GHz to 18.0 GHz: < 1.16 > 18.0 GHz to 26.5 GHz: < 1.22 > 26.5 GHz to 40.0 GHz: < 1.28 > 40.0 GHz to 50.0 GHz: < 1.30
R&S®NRP67T(N) 1.85 mm (m)	DC to 67 GHz	300 nW to 100 mW (–35 dBm to +20 dBm)	DC to 100 MHz: < 1.03 > 100 MHz to 2.4 GHz: < 1.06 > 2.4 GHz to 12.4 GHz: < 1.13 > 12.4 GHz to 18.0 GHz: < 1.16 > 18.0 GHz to 26.5 GHz: < 1.22 > 26.5 GHz to 40.0 GHz: < 1.28 > 40.0 GHz to 50.0 GHz: < 1.30 > 50.0 GHz to 67.0 GHz: < 1.35
R&S®NRP90T(N) 1.35 mm (m)	DC to 90 GHz	300 nW to 100 mW (–35 dBm to +20 dBm)	DC to 100 MHz: < 1.05 > 100 MHz to 2.4 GHz: < 1.08 > 2.4 GHz to 12.4 GHz: < 1.18 > 12.4 GHz to 18.0 GHz: < 1.23 > 18.0 GHz to 26.5 GHz: < 1.28 > 26.5 GHz to 40.0 GHz: < 1.38 > 40.0 GHz to 50.0 GHz: < 1.46 > 50.0 GHz to 67.0 GHz: < 1.56 > 67.0 GHz to 80.0 GHz: < 1.60 > 80.0 GHz to 90.0 GHz: < 1.66
R&S®NRP110T 1 mm (m)	DC to 110 GHz	300 nW to 100 mW (–35 dBm to +20 dBm)	DC to 100 MHz: < 1.05 > 100 MHz to 2.4 GHz: < 1.08 > 2.4 GHz to 12.4 GHz: < 1.18 > 12.4 GHz to 18.0 GHz: < 1.23 > 18.0 GHz to 26.5 GHz: < 1.28 > 26.5 GHz to 40.0 GHz: < 1.38 > 40.0 GHz to 50.0 GHz: < 1.46 > 50.0 GHz to 67.0 GHz: < 1.56 > 67.0 GHz to 80.0 GHz: < 1.60 > 80.0 GHz to 95.0 GHz: < 1.66 > 95.0 GHz to 110 GHz: < 1.70
Thermal waveguide power sensors			
R&S®NRP75TWG WR15	50 GHz to 75 GHz	300 nW to 100 mW (–35 dBm to +20 dBm)	
R&S®NRP90TWG WR12	60 GHz to 90 GHz	300 nW to 100 mW (–35 dBm to +20 dBm)	
R&S®NRP110TWG WR10	75 GHz to 110 GHz	300 nW to 100 mW (–35 dBm to +20 dBm)	

Rise time, video bandwidth	Uncertainty for power measurements at +20 °C to +25 °C		Sensor type, connector
	absolute (in dB)	relative (in dB)	
			Thermal power sensors
–	0.040 to 0.082	0.010	R&S®NRP18T(N) N (m)
	0.040 to 0.101	0.010	R&S®NRP33T(N) 3.5 mm (m)
	0.040 to 0.108	0.010	R&S®NRP40T(N) 2.92 mm (m)
	0.040 to 0.143	0.010	R&S®NRP50T(N) 2.4 mm (m)
	0.040 to 0.209	0.010	R&S®NRP67T(N) 1.85 mm (m)
	0.040 to 0.269	0.014	R&S®NRP90T(N) 1.35 mm (m)
	0.040 to 0.290	0.014	R&S®NRP110T 1 mm (m)
			Thermal waveguide power sensors
–	0.190	0.014	R&S®NRP75TWG WR15
	0.194	0.014	R&S®NRP90TWG WR12
	0.198	0.014	R&S®NRP110TWG WR10

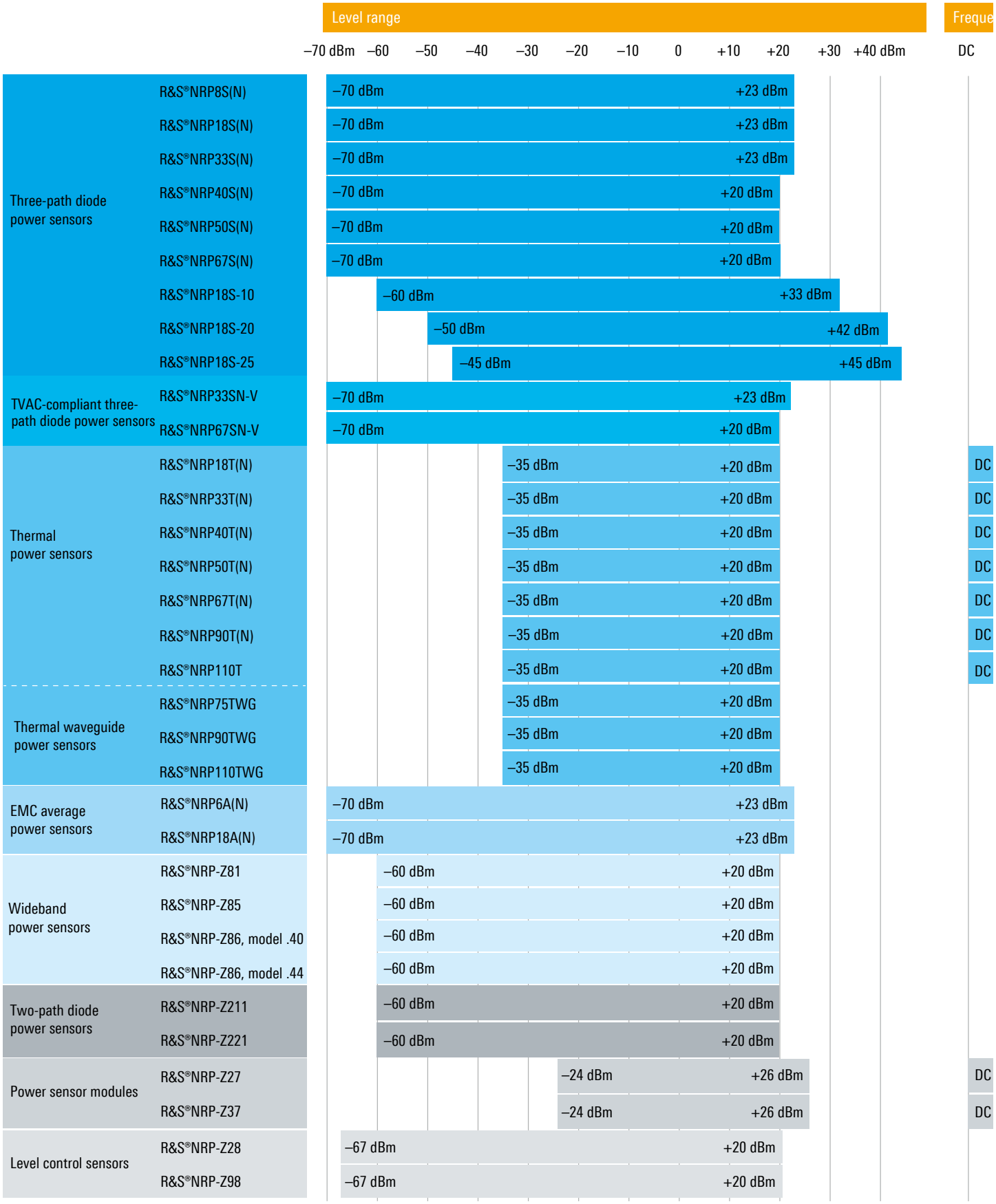
Specifications in brief

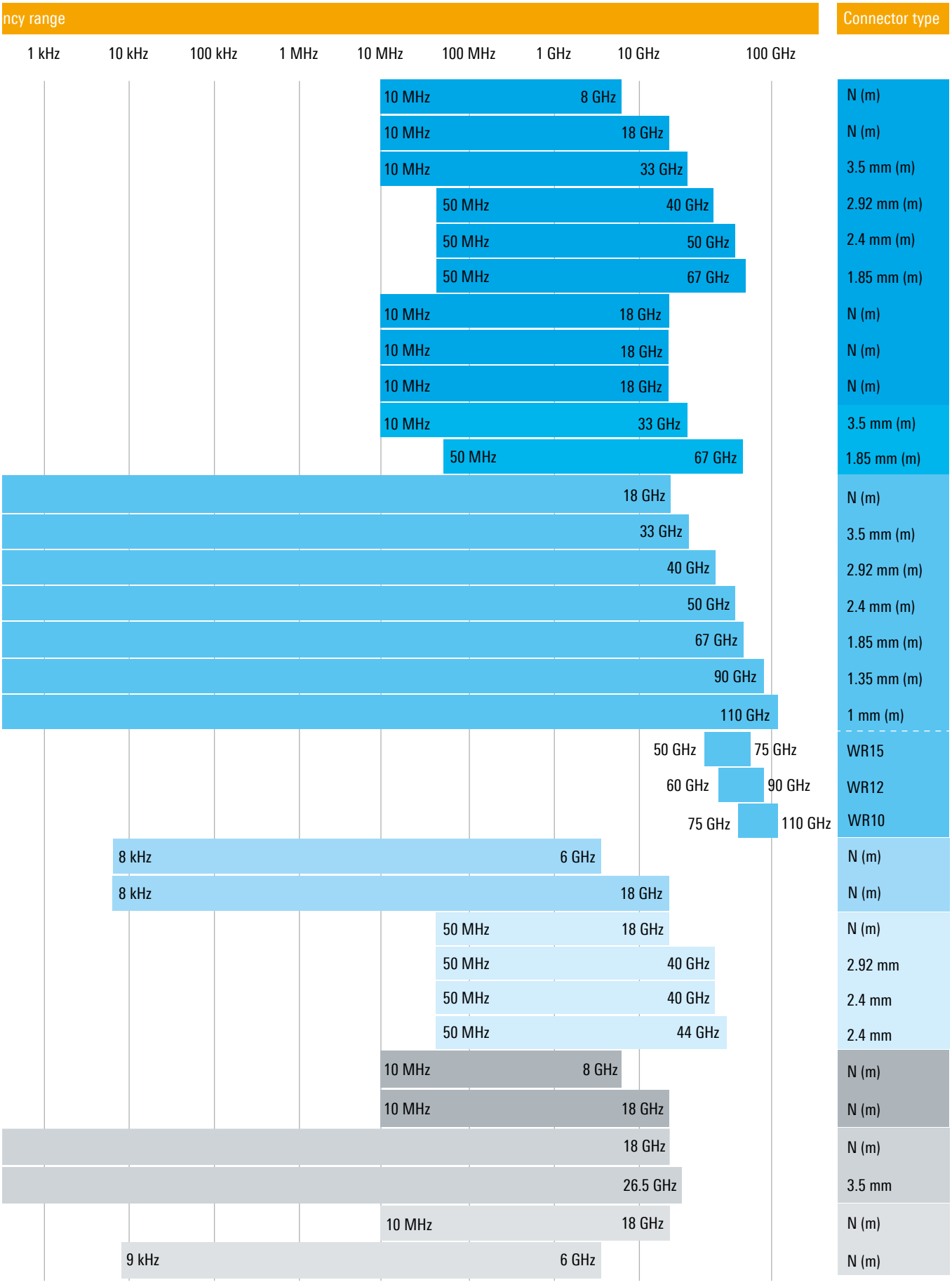
Sensor type, connector	Frequency range	Power measurement range, maximum input power	Impedance matching (SWR)
Average power sensors			
R&S®NRP6A(N) N (m)	8 kHz to 6 GHz	100 pW to 200 mW (–70 dBm to +23 dBm)	8 kHz to < 20 kHz: < 1.25 20 kHz to 2.4 GHz: < 1.13 > 2.4 GHz to 6 GHz: < 1.20
R&S®NRP18A(N) N (m)	8 kHz to 18 GHz	100 pW to 200 mW (–70 dBm to +23 dBm)	8 kHz to < 20 kHz: < 1.25 20 kHz to 2.4 GHz: < 1.13 > 2.4 GHz to 6 GHz: < 1.20 > 8 GHz to 18 GHz: < 1.25
Wideband power sensors			
R&S®NRP-Z81 N (m)	50 MHz to 18 GHz	1 nW to 100 mW (–60 dBm to +20 dBm) max. 200 mW (AVG)/ 1 W (PK, 1 µs)	50 MHz to 2.4 GHz: < 1.16 > 2.4 GHz to 8.0 GHz: < 1.20 > 8.0 GHz to 18.0 GHz: < 1.25
R&S®NRP-Z85 2.92 mm (m)	50 MHz to 40 GHz	1 nW to 100 mW (–60 dBm to +20 dBm) max. 200 mW (AVG)/ 1 W (PK, 1 µs)	50 MHz to 2.4 GHz: < 1.16 > 2.4 GHz to 8.0 GHz: < 1.20 > 8.0 GHz to 18.0 GHz: < 1.25 > 18.0 GHz to 26.5 GHz: < 1.30 > 26.5 GHz to 40.0 GHz: < 1.35
R&S®NRP-Z86 2.4 mm (m)	50 MHz to 40 GHz	1 nW to 100 mW (–60 dBm to +20 dBm) max. 200 mW (AVG)/ 1 W (PK, 1 µs)	50 MHz to 2.4 GHz: < 1.16 > 2.4 GHz to 8.0 GHz: < 1.20 > 8.0 GHz to 18.0 GHz: < 1.25 > 18.0 GHz to 26.5 GHz: < 1.30 > 26.5 GHz to 40.0 GHz: < 1.35
R&S®NRP-Z86 2.4 mm (m)	50 MHz to 44 GHz	1 nW to 100 mW (–60 dBm to +20 dBm) max. 200 mW (AVG)/ 1 W (PK, 1 µs)	50 MHz to 2.4 GHz: < 1.16 > 2.4 GHz to 8.0 GHz: < 1.20 > 8.0 GHz to 18.0 GHz: < 1.25 > 18.0 GHz to 26.5 GHz: < 1.30 > 26.5 GHz to 40.0 GHz: < 1.35 > 40.0 GHz to 44.0 GHz: < 1.40
Two-path diode power sensors			
R&S®NRP-Z211 N (m)	10 MHz to 8 GHz	1.0 nW to 100 mW (–60 dBm to +20 dBm) max. 400 mW (AVG)/ 2 W (PK, 10 µs)	10 MHz to 2.4 GHz: < 1.13 > 2.4 GHz to 8.0 GHz: < 1.20
R&S®NRP-Z221 N (m)	10 MHz to 18 GHz	1.0 nW to 100 mW (–60 dBm to +20 dBm) max. 400 mW (AVG)/ 2 W (PK, 10 µs)	10 MHz to 2.4 GHz: < 1.13 > 2.4 GHz to 8.0 GHz: < 1.20 > 8.0 GHz to 18.0 GHz: < 1.25
Power sensor modules			
R&S®NRP-Z27 N (m)	DC to 18 GHz	4 µW to 400 mW (–24 dBm to +26 dBm) max. 500 mW (AVG)/ 30 W (PK, 1 µs)	DC to 2.0 GHz: < 1.15 > 2.0 GHz to 4.2 GHz: < 1.18 > 4.2 GHz to 8.0 GHz: < 1.23 > 8.0 GHz to 12.4 GHz: < 1.25 > 12.4 GHz to 18.0 GHz: < 1.35
R&S®NRP-Z37 3.5 mm (m)	DC to 26.5 GHz	4 µW to 400 mW (–24 dBm to +26 dBm) max. 500 mW (AVG)/ 30 W (PK, 1 µs)	DC to 2.0 GHz: < 1.15 > 2.0 GHz to 4.2 GHz: < 1.18 > 4.2 GHz to 8.0 GHz: < 1.23 > 8.0 GHz to 12.4 GHz: < 1.25 > 12.4 GHz to 18.0 GHz: < 1.30 > 18.0 GHz to 26.5 GHz: < 1.45
Level control sensors			
R&S®NRP-Z28 N (m)	10 MHz to 18 GHz	200 pW to 100 mW (–67 dBm to +20 dBm) max. 700 mW (AVG)/ 4 W (PK, 10 µs)	10 MHz to 2.4 GHz: < 1.11 > 2.4 GHz to 4.0 GHz: < 1.15 > 4.0 GHz to 8.0 GHz: < 1.22 > 8.0 GHz to 18 GHz: < 1.30
R&S®NRP-Z98 N (m)	9 kHz to 6 GHz	200 pW to 100 mW (–67 dBm to +20 dBm) max. 700 mW (AVG)/ 4 W (PK, 10 µs)	9 kHz to 2.4 GHz: < 1.11 > 2.4 GHz to 4.0 GHz: < 1.15 > 4.0 GHz to 6.0 GHz: < 1.22

For data sheet, see PD 3607.0852.22

Rise time, video bandwidth	Uncertainty for power measurements at +20 °C to +25 °C absolute (in dB)	relative (in dB)	Sensor type, connector
			Average power sensors
–	0.051 to 0.056	0.022 to 0.050	R&S®NRP6A(N) N (m)
	0.051 to 0.094	0.022 to 0.069	R&S®NRP18A(N) N (m)
			Wideband power sensors
< 13 ns > 30 MHz	0.130 to 0.150	0.039 to 0.148	R&S®NRP-Z81 N (m)
	0.130 to 0.180	0.039 to 0.165	R&S®NRP-Z85 2.92 mm (m)
	0.130 to 0.180	0.039 to 0.165	R&S®NRP-Z86 2.4 mm (m)
	0.130 to 0.190	0.039 to 0.165	R&S®NRP-Z86 2.4 mm (m)
			Two-path diode power sensors
< 10 µs > 40 kHz	0.054 to 0.110	0.022 to 0.112	R&S®NRP-Z211 N (m)
	0.054 to 0.143	0.022 to 0.142	R&S®NRP-Z221 N (m)
			Power sensor modules
–	0.070 to 0.112	0.032	R&S®NRP-Z27 N (m)
	0.070 to 0.122	0.032	R&S®NRP-Z37 3.5 mm (m)
			Level control sensors
< 8 µs > 50 kHz	0.047 to 0.130	0.022 to 0.110	R&S®NRP-Z28 N (m)
–	0.047 to 0.083	0.022 to 0.066	R&S®NRP-Z98 N (m)

POWER SENSOR OVERVIEW




ncy range
Connector type
1 kHz
10 kHz
100 kHz
1 MHz
10 MHz
100 MHz
1 GHz
10 GHz
100 GHz
10 MHz 8 GHz N (m)
10 MHz 18 GHz N (m)
10 MHz 33 GHz 3.5 mm (m)
50 MHz 40 GHz 2.92 mm (m)
50 MHz 50 GHz 2.4 mm (m)
50 MHz 67 GHz 1.85 mm (m)
10 MHz 18 GHz N (m)
10 MHz 18 GHz N (m)
10 MHz 18 GHz N (m)
10 MHz 33 GHz 3.5 mm (m)
50 MHz 67 GHz 1.85 mm (m)
18 GHz N (m)
33 GHz 3.5 mm (m)
40 GHz 2.92 mm (m)
50 GHz 2.4 mm (m)
67 GHz 1.85 mm (m)
90 GHz 1.35 mm (m)
110 GHz 1 mm (m)
50 GHz 75 GHz WR15
60 GHz 90 GHz WR12
75 GHz 110 GHz WR10
8 kHz 6 GHz N (m)
8 kHz 18 GHz N (m)
50 MHz 18 GHz N (m)
50 MHz 40 GHz 2.92 mm
50 MHz 40 GHz 2.4 mm
50 MHz 44 GHz 2.4 mm
10 MHz 8 GHz N (m)
10 MHz 18 GHz N (m)
18 GHz N (m)
26.5 GHz 3.5 mm
10 MHz 18 GHz N (m)
9 kHz 6 GHz N (m)

ORDERING INFORMATION

Designation	Type	Order No.
Base unit		
Power meter	R&S®NRX	1424.7005.02
Options		
Second measurement channel	R&S®NRX-K2	1424.9208.02
Third and fourth measurement cannel	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/IEEE488 interface	R&S®NRX-B8	1424.8301.02
Sensor interface, for R&S®NRT	R&S®NRX-B9	1424.8601.02
Keysight emulation mode (N1911A/N1912A/N432A/E4418A/E4419A)	R&S®NRX-K301	1444.0041.02
Three-path diode power sensor		
100 pW to 200 mW, 10 MHz to 8 GHz	R&S®NRP8S	1419.0006.02
100 pW to 200 mW, 10 MHz to 8 GHz, LAN version	R&S®NRP8SN	1419.0012.02
100 pW to 200 mW, 10 MHz to 18 GHz	R&S®NRP18S	1419.0029.02
100 pW to 200 mW, 10 MHz to 18 GHz, LAN version	R&S®NRP18SN	1419.0035.02
100 pW to 200 mW, 10 MHz to 33 GHz	R&S®NRP33S	1419.0064.02
100 pW to 200 mW, 10 MHz to 33 GHz, LAN version	R&S®NRP33SN	1419.0070.02
100 pW to 100 mW, 50 MHz to 40 GHz	R&S®NRP40S	1419.0041.02
100 pW to 100 mW, 50 MHz to 40 GHz, LAN version	R&S®NRP40SN	1419.0058.02
100 pW to 100 mW, 50 MHz to 50 GHz	R&S®NRP50S	1419.0087.02
100 pW to 100 mW, 50 MHz to 50 GHz, LAN version	R&S®NRP50SN	1419.0093.02
100 pW to 100 mW, 50 MHz to 67 GHz	R&S®NRP67S	1424.6396.02
100 pW to 100 mW, 50 MHz to 67 GHz, LAN version	R&S®NRP67SN	1424.6409.02
High-power three-path diode power sensor		
1 nW to 2 W, 10 MHz to 18 GHz	R&S®NRP18S-10	1424.6721.02
10 nW to 15 W, 10 MHz to 18 GHz	R&S®NRP18S-20	1424.6738.02
30 nW to 30 W, 10 MHz to 18 GHz	R&S®NRP18S-25	1424.6744.02
TVAC-compliant three-path diode power sensor		
100 pW to 200 mW, 10 MHz to 33 GHz, LAN version, TVAC-compliant	R&S®NRP33SN-V	1419.0129.02
100 pW to 100 mW, 50 MHz to 67 GHz, LAN version, TVAC-compliant	R&S®NRP67SN-V	1424.6415.02
Thermal power sensors		
300 nW to 100 mW, DC to 18 GHz	R&S®NRP18T	1424.6115.02
300 nW to 100 mW, DC to 18 GHz, LAN version	R&S®NRP18TN	1424.6121.02
300 nW to 100 mW, DC to 33 GHz	R&S®NRP33T	1424.6138.02
300 nW to 100 mW, DC to 33 GHz, LAN version	R&S®NRP33TN	1424.6144.02
300 nW to 100 mW, DC to 40 GHz	R&S®NRP40T	1424.6150.02
300 nW to 100 mW, DC to 40 GHz, LAN version	R&S®NRP40TN	1424.6167.02
300 nW to 100 mW, DC to 50 GHz	R&S®NRP50T	1424.6173.02
300 nW to 100 mW, DC to 50 GHz, LAN version	R&S®NRP50TN	1424.6180.02
300 nW to 100 mW, DC to 67 GHz	R&S®NRP67T	1424.6196.02
300 nW to 100 mW, DC to 67 GHz, LAN version	R&S®NRP67TN	1424.6209.02
300 nW to 100 mW, DC to 90 GHz	R&S®NRP90T	1424.6473.02
300 nW to 100 mW, DC to 90 GHz, LAN version	R&S®NRP90TN	1424.6480.02
300 nW to 100 mW, DC to 110 GHz	R&S®NRP110T	1424.6215.02
Thermal waveguide power sensors		
300 nW to 100 mW, 50 GHz to 75 GHz	R&S®NRP75TWG	1700.2529.02
300 nW to 100 mW, 60 GHz to 90 GHz	R&S®NRP90TWG	1700.2312.02
300 nW to 100 mW, 75 GHz to 110 GHz	R&S®NRP110TWG	1173.8709.02

Designation	Type	Order No.
Average power sensors		
100 pW to 200 mW, 8 kHz to 6 GHz	R&S®NRP6A	1424.6796.02
100 pW to 200 mW, 8 kHz to 6 GHz, LAN version	R&S®NRP6AN	1424.6809.02
100 pW to 200 mW, 8 kHz to 18 GHz	R&S®NRP18A	1424.6815.02
100 pW to 200 mW, 8 kHz to 18 GHz, LAN version	R&S®NRP18AN	1424.6821.02
Wideband power sensors		
1 nW to 100 mW, 50 MHz to 18 GHz	R&S®NRP-Z81	1137.9009.02
1 nW to 100 mW, 50 MHz to 40 GHz (2.92 mm)	R&S®NRP-Z85	1411.7501.02
1 nW to 100 mW, 50 MHz to 40 GHz (2.4 mm)	R&S®NRP-Z86	1417.0109.40
1 nW to 100 mW, 50 MHz to 44 GHz (2.4 mm)	R&S®NRP-Z86	1417.0109.44
Two-path diode power sensors		
1 nW to 100 mW, 10 MHz to 8 GHz	R&S®NRP-Z211	1417.0409.02
1 nW to 100 mW, 10 MHz to 18 GHz	R&S®NRP-Z221	1417.0309.02
Power sensor modules		
4 µW to 400 mW, DC to 18 GHz	R&S®NRP-Z27	1169.4102.02
4 µW to 400 mW, DC to 26.5 GHz	R&S®NRP-Z37	1169.3206.02
Level control sensors		
200 pW to 100 mW, 9 kHz to 6 GHz	R&S®NRP-Z98	1170.8508.02
200 pW to 100 mW, 10 MHz to 18 GHz	R&S®NRP-Z28	1170.8008.02
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®NRPxxS(N)/T(N)/A(N) A minimum of one interface cable is required for power sensor operation.		
USB interface cable, length: 0.75 m	R&S®NRP-ZKU	1419.0658.02
USB interface cable, length: 1.50 m	R&S®NRP-ZKU	1419.0658.03
USB interface cable, length: 3.00 m	R&S®NRP-ZKU	1419.0658.04
USB interface cable, length: 5.00 m	R&S®NRP-ZKU	1419.0658.05
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
Recommended extras for waveguide connectors		
Torque wrench SW 3/32 (for waveguide screws)	R&S®ZCTW	1175.2014.02
Recommended extras for R&S®NRP110T		
Waveguide bracket for R&S®NRP110T	R&S®NRP-ZBW	1700.2141.02
WR15 to 1 mm (f) adapter	R&S®WCA75	3626.1044.02
WR12 to 1 mm (f) adapter	R&S®WCA90	3626.1050.02
WR10 to 1 mm (f) adapter	R&S®WCA110	3626.1067.02

Designation	Type	Order No.
Recommended extras for R&S®NRP-Zxx		
USB adapter cable (passive), length: 2 m	R&S®NRP-Z4	1146.8001.02
USB adapter cable (passive), length: 0.5 m	R&S®NRP-Z4	1146.8001.04
USB adapter cable (passive), length: 0.15 m	R&S®NRP-Z4	1146.8001.06
USB adapter cable (passive), length: 1 m, for panel mounting	R&S®NRP-Z4	1146.8001.11
Sensor hub	R&S®NRP-Z5	1146.7740.02
Recommended extras for R&S®NRPxxSN-V		
Ethernet cable (air side cable), MicroD (m) to RJ-45, length: 1.5 m	R&S®NRP-ZKASMD	1425.2420.02
Ethernet power sensor cable, air side, connectors: MicroD (m) to RJ-45, length: 3 m	R&S®NRP-ZKASMD	1425.2420.03
Ethernet power sensor cable, air side, connectors: MicroD (m) to RJ-45, length: 5 m	R&S®NRP-ZKASMD	1425.2420.05
Ethernet power sensor cable, air side, connectors: MicroD (m) to RJ-45, length: 15 m	R&S®NRP-ZKASMD	1425.2420.15
Ethernet power sensor cable, air side, connectors: MicroD (m) to RJ-45, length: 30 m	R&S®NRP-ZKASMD	1425.2420.30
Ethernet power sensor cable, air side, connectors: MicroD (m) to RJ-45, length: 60 m	R&S®NRP-ZKASMD	1425.2420.60
Ethernet cable for TVAC applications, RJ-45 to Micro-D, length: 1.5 m	R&S®NRP-ZKVSMD	1425.2413.02
Ethernet cable for TVAC applications, RJ-45 to Micro-D, length: 3 m	R&S®NRP-ZKVSMD	1425.2413.03
Ethernet cable for TVAC applications, RJ-45 to Micro-D, length: 5 m	R&S®NRP-ZKVSMD	1425.2413.05
Ethernet cable for TVAC applications, RJ-45 to Micro-D, length: 15 m	R&S®NRP-ZKVSMD	1425.2413.15
Ethernet cable for TVAC applications, RJ-45 to Micro-D, length: 30 m	R&S®NRP-ZKVSMD	1425.2413.30
Ethernet cable for TVAC applications, RJ-45 to Micro-D, length: 60 m	R&S®NRP-ZKVSMD	1425.2413.60
Ethernet cable for TVAC applications, 2 × RJ-45, length: 1.5 m	R&S®NRP-ZKVSRJ	1425.2407.02
Ethernet cable for TVAC applications, 2 × RJ-45, length: 3 m	R&S®NRP-ZKVSRJ	1425.2407.03
Ethernet cable for TVAC applications, 2 × RJ-45, length: 5 m	R&S®NRP-ZKVSRJ	1425.2407.05
Ethernet cable for TVAC applications, 2 × RJ-45,length: 15 m	R&S®NRP-ZKVSRJ	1425.2407.15
Ethernet cable for TVAC applications, 2 × RJ-45, length: 30 m	R&S®NRP-ZKVSRJ	1425.2407.30
Ethernet cable for TVAC applications, 2 × RJ-45, length: 60 m	R&S®NRP-ZKVSRJ	1425.2407.60
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®NRX-B1, R&S®NRPxxS(N), R&S®NRPxxA(N), R&S®NRPxxT(N) and R&S®NRPxxTWG	R&S®NRP-ACA	1419.0812.00

Warranty		
R&S®NRX base unit, power sensors and R&S®NRP-Z5		3 years
All other items [1]		1 year
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	

[1] For options installed, the remaining base unit warranty applies if longer than 1 year. Exception: all batteries have a 1 year warranty.

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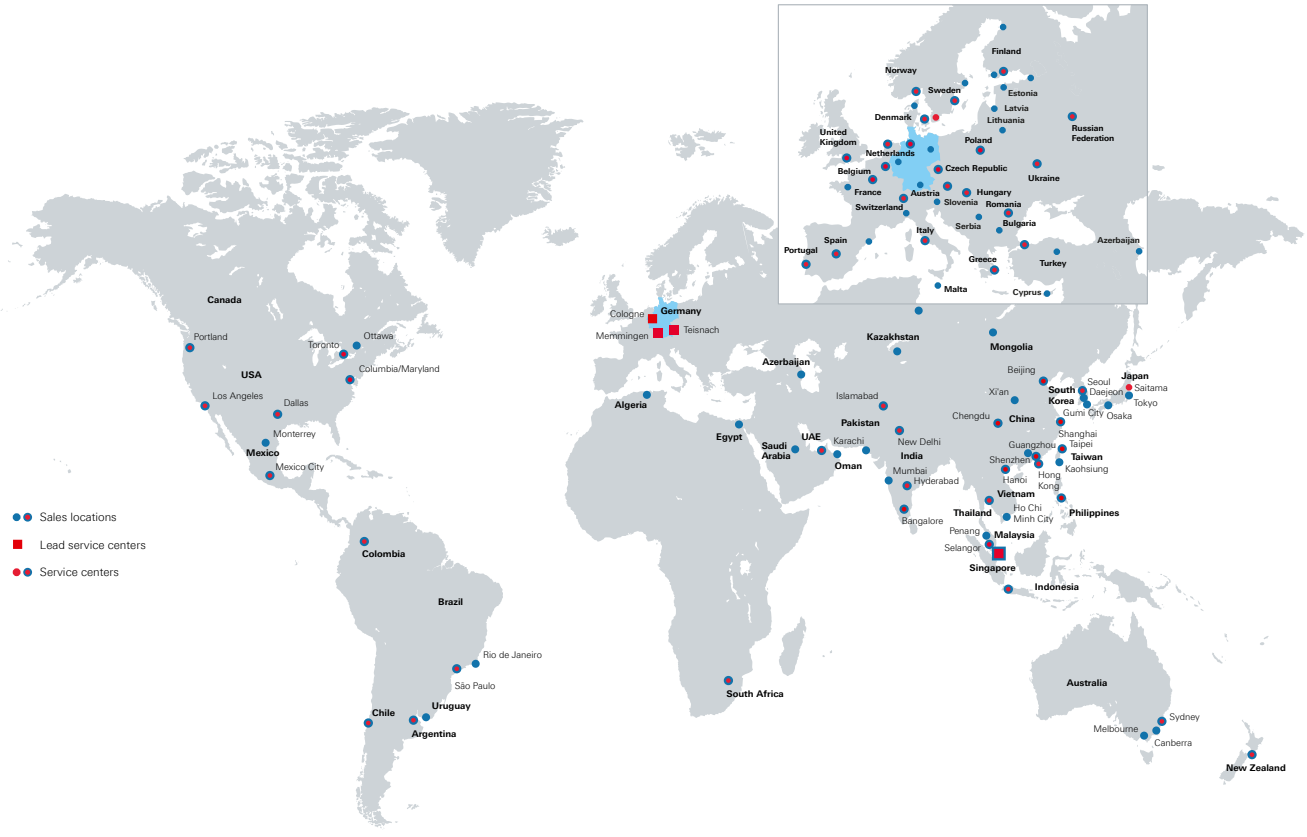
User risks are reduced to a minimum at all project stages:

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



ervice that adds value

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

Rohde&Schwarz

The Rohde&Schwarz technology group is among the trailblazers when it comes to paving the way for a safer and connected world with its leading solutions in test&measurement, technology systems, and networks&cybersecurity. Founded more than 85 years ago, the group is a reliable partner for industry and government customers around the globe. The independent company is headquartered in Munich, Germany and has an extensive sales and service network with locations in more than 70 countries.

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- Environmental compatibility and eco-footprint
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PD 5213.5539.12 | Version 11.00 | August 2021 (sk)
R&S®NRP Power Meter Family
Data without tolerance limits is not binding | Subject to change

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5213553912

R&S®NRP POWER METER FAMILY

3 year warranty

Specifications

Data Sheet
Version 11.00

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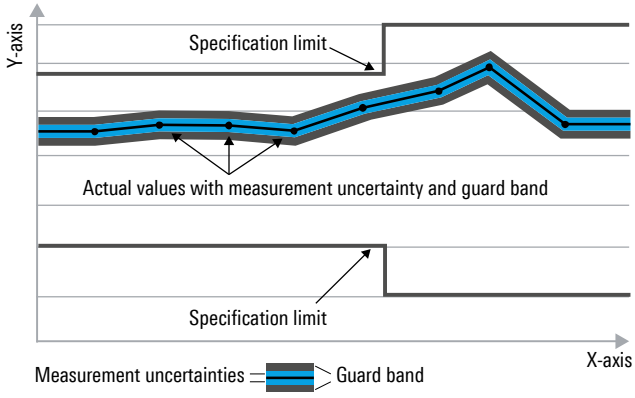
Definitions

Product data applies under the following conditions:

- Three hours storage at the expected operating temperature followed by 30 minutes warm-up, unless otherwise stated
- Specified environmental conditions met
- Recommended calibration interval adhered to
- All internal automatic adjustments performed, if applicable

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



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

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

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

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

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

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

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

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 bits per second (Gbps), million bits per second (Mbps), thousand bits 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 of the R&S®NRP power sensors

Sensor type R&S®	Frequency range	Power range, max. average power / peak envelope power	Connector type
Three-path diode power sensors			
NRP8S(N)	10 MHz to 8 GHz	100 pW to 200 mW (–70 dBm to +23 dBm) max. 1 W (AVG) / 2 W (PK, 10 µs)	N (m)
NRP18S(N)	10 MHz to 18 GHz	100 pW to 200 mW (–70 dBm to +23 dBm) max. 1 W (AVG) / 2 W (PK, 10 µs)	N (m)
NRP33S(N)/ NRP33SN-V	10 MHz to 33 GHz	100 pW to 200 mW (–70 dBm to +23 dBm) max. 1 W (AVG) / 2 W (PK, 10 µs)	3.50 mm (m)
NRP40S(N)	50 MHz to 40 GHz	100 pW to 100 mW (–70 dBm to +20 dBm) max. 200 mW (AVG) / 1 W (PK, 10 µs)	2.92 mm (m)
NRP50S(N)	50 MHz to 50 GHz	100 pW to 100 mW (–70 dBm to +20 dBm) max. 200 mW (AVG) / 1 W (PK, 10 µs)	2.40 mm (m)
NRP67S(N) NRP67SN-V	50 MHz to 67 GHz	100 pW to 100 mW (–70 dBm to +20 dBm) max. 200 mW (AVG) / 1 W (PK, 10 µs)	1.85 mm (m)
High-power three-path diode power sensors			
NRP18S-10	10 MHz to 18 GHz	1 nW to 2 W (−60 dBm to +33 dBm) max. 3 W (AVG) / 20 W (PK, 10 µs)	N (m)
NRP18S-20	10 MHz to 18 GHz	10 nW to 15 W (−50 dBm to +42 dBm) max. 18 W (AVG) / 100 W (PK, 10 µs)	N (m)
NRP18S-25	10 MHz to 18 GHz	30 nW to 30 W (−45 dBm to +45 dBm) max. 36 W (AVG) / 300 W (PK, 10 µs)	N (m)
Average power sensors			
NRP6A(N)	8 kHz to 6 GHz	100 pW to 200 mW (–70 dBm to +23 dBm) max. 1 W (AVG) / 2 W (PK, 10 µs)	N (m)
NRP18A(N)	8 kHz to 18 GHz	100 pW to 200 mW (–70 dBm to +23 dBm) max. 1 W (AVG) / 2 W (PK, 10 µs)	N (m)
Thermal power sensors			
NRP18T(N)	DC to 18 GHz	300 nW to 100 mW (–35 dBm to +20 dBm) max. 300 mW (AVG) / 20 W (PK, 1 µs)	N (m)
NRP33T(N)	DC to 33 GHz	300 nW to 100 mW (–35 dBm to +20 dBm) max. 300 mW (AVG) / 10 W (PK, 1 µs)	3.50 mm (m)
NRP40T(N)	DC to 40 GHz	300 nW to 100 mW (–35 dBm to +20 dBm) max. 300 mW (AVG) / 10 W (PK, 1 µs)	2.92 mm (m)
NRP50T(N)	DC to 50 GHz	300 nW to 100 mW (–35 dBm to +20 dBm) max. 300 mW (AVG) / 10 W (PK, 1 µs)	2.40 mm (m)
NRP67T(N)	DC to 67 GHz	300 nW to 100 mW (–35 dBm to +20 dBm) max. 300 mW (AVG) / 10 W (PK, 1 µs)	1.85 mm (m)
NRP90T(N)	DC to 90 GHz	300 nW to 100 mW (–35 dBm to +20 dBm) max. 300 mW (AVG) / 10 W (PK, 1 µs)	1.35 mm (m)
NRP110T	DC to 110 GHz	300 nW to 100 mW (–35 dBm to +20 dBm) max. 300 mW (AVG) / 10 W (PK, 1 µs)	1.00 mm (m)
Thermal waveguide power sensors			
NRP75TWG	50 GHz to 75 GHz	300 nW to 100 mW (–35 dBm to +20 dBm) max. 300 mW (AVG) / 10 W (PK, 1 µs)	WR15
NRP90TWG	60 GHz to 90 GHz	300 nW to 100 mW (–35 dBm to +20 dBm) max. 300 mW (AVG) / 10 W (PK, 1 µs)	WR12
NRP110TWG	75 GHz to 110 GHz	300 nW to 100 mW (–35 dBm to +20 dBm) max. 300 mW (AVG) / 10 W (PK, 1 µs)	WR10

Specifications in brief of the R&S®NRP power sensors

Sensor type R&S®	Impedance matching (SWR)	Rise time Video BW	Zero offset (typ.)	Noise (typ.)	Uncertainty for power measurements at +20 °C to +25 °C	
					absolute (in dB)	relative (in dB)
Three-path diode power sensors						
NRP8S(N)	10 MHz to 2.4 GHz: < 1.13 > 2.4 GHz to 8.0 GHz: < 1.20				*0.053 to 0.065*	*0.022 to 0.050*
NRP18S(N)	10 MHz to 2.4 GHz: < 1.13 > 2.4 GHz to 8.0 GHz: < 1.20 > 8.0 GHz to 18.0 GHz: < 1.25				*0.053 to 0.094*	*0.022 to 0.069*
NRP33S(N)/ NRP33SN-V	10 MHz to 2.4 GHz: < 1.13 > 2.4 GHz to 8.0 GHz: < 1.20 > 8.0 GHz to 18.0 GHz: < 1.25 > 18.0 GHz to 26.5 GHz: < 1.30 > 26.5 GHz to 33.0 GHz: < 1.35				*0.053 to 0.134*	*0.022 to 0.136*
NRP40S(N)	50 MHz to 2.4 GHz: < 1.13 > 2.4 GHz to 8.0 GHz: < 1.20 > 8.0 GHz to 18.0 GHz: < 1.25 > 18.0 GHz to 26.5 GHz: < 1.30 > 26.5 GHz to 33.0 GHz: < 1.35 > 33.0 GHz to 40.0 GHz: < 1.37	< 5 µs > 100 kHz	28 pW	20 pW	*0.073 to 0.138*	*0.028 to 0.142*
NRP50S(N)	50 MHz to 2.4 GHz: < 1.13 > 2.4 GHz to 8.0 GHz: < 1.20 > 8.0 GHz to 18.0 GHz: < 1.25 > 18.0 GHz to 26.5 GHz: < 1.30 > 26.5 GHz to 33.0 GHz: < 1.35 > 33.0 GHz to 40.0 GHz: < 1.37 > 40.0 GHz to 50.0 GHz: < 1.40				*0.073 to 0.183*	*0.028 to 0.184*
NRP67S(N) NRP67SN-V	50 MHz to 200 MHz: < 1.30 > 200 MHz to 2.4 GHz: < 1.13 > 2.4 GHz to 8.0 GHz: < 1.20 > 8.0 GHz to 18.0 GHz: < 1.25 > 18.0 GHz to 26.5 GHz: < 1.30 > 26.5 GHz to 33.0 GHz: < 1.35 > 33.0 GHz to 40.0 GHz: < 1.37 > 40.0 GHz to 50.0 GHz: < 1.40 > 50.0 GHz to 67.0 GHz: < 1.68				*0.073 to 0.255*	*0.028 to 0.266*
High-power three-path diode power sensors						
NRP18S-10	10 MHz to 2.4 GHz: < 1.14 > 2.4 GHz to 8.0 GHz: < 1.20 > 8.0 GHz to 12.4 GHz: < 1.25 > 12.4 GHz to 18.0 GHz: < 1.30		320 pW	230 pW	*0.083 to 0.198*	*0.022 to 0.087*
NRP18S-20	10 MHz to 2.4 GHz: < 1.14 > 2.4 GHz to 8.0 GHz: < 1.25 > 8.0 GHz to 12.4 GHz: < 1.30 > 12.4 GHz to 18.0 GHz: < 1.41	< 5 µs > 100 kHz	3.4 nW	2.4 nW	*0.083 to 0.198*	*0.022 to 0.087*
NRP18S-25	10 MHz to 2.4 GHz: < 1.14 > 2.4 GHz to 8.0 GHz: < 1.25 > 8.0 GHz to 12.4 GHz: < 1.30 > 12.4 GHz to 18.0 GHz: < 1.41		12 nW	8 nW	*0.083 to 0.219*	*0.022 to 0.087*
Average power sensors						
NRP6A(N)	8 kHz to < 20 kHz: < 1.25 20 kHz to 2.4 GHz: < 1.13 > 2.4 GHz to 6.0 GHz: < 1.20				*0.051 to 0.056*	*0.022 to 0.050*
NRP18A(N)	8 kHz to < 20 kHz: < 1.25 20 kHz to 2.4 GHz: < 1.13 > 2.4 GHz to 8.0 GHz: < 1.20 > 8.0 GHz to 18.0 GHz: < 1.25	–	28 pW	20 pW	*0.051 to 0.094*	*0.022 to 0.069*

Sensor type R&S®	Impedance matching (SWR)	Rise time Video BW	Zero offset (typ.)	Noise (typ.)	Uncertainty for power measurements at +20 °C to +25 °C	
					absolute (in dB)	relative (in dB)
Thermal power sensors						
NRP18T(N)	DC to 100 MHz: < 1.03 > 100 MHz to 2.4 GHz: < 1.06 > 2.4 GHz to 12.4 GHz: < 1.13 > 12.4 GHz to 18.0 GHz: < 1.16				*0.040 to 0.082*	*0.010*
NRP33T(N)	DC to 100 MHz: < 1.03 > 100 MHz to 2.4 GHz: < 1.06 > 2.4 GHz to 12.4 GHz: < 1.13 > 12.4 GHz to 18.0 GHz: < 1.16 > 18.0 GHz to 26.5 GHz: < 1.22 > 26.5 GHz to 33.0 GHz: < 1.28				*0.040 to 0.101*	*0.010*
NRP40T(N)	DC to 100 MHz: < 1.03 > 100 MHz to 2.4 GHz: < 1.06 > 2.4 GHz to 12.4 GHz: < 1.13 > 12.4 GHz to 18.0 GHz: < 1.16 > 18.0 GHz to 26.5 GHz: < 1.22 > 26.5 GHz to 40.0 GHz: < 1.28				*0.040 to 0.108*	*0.010*
NRP50T(N)	DC to 100 MHz: < 1.03 > 100 MHz to 2.4 GHz: < 1.06 > 2.4 GHz to 12.4 GHz: < 1.13 > 12.4 GHz to 18.0 GHz: < 1.16 > 18.0 GHz to 26.5 GHz: < 1.22 > 26.5 GHz to 40.0 GHz: < 1.28 > 40.0 GHz to 50.0 GHz: < 1.30				*0.040 to 0.143*	*0.010*
NRP67T(N)	DC to 100 MHz: < 1.03 > 100 MHz to 2.4 GHz: < 1.06 > 2.4 GHz to 12.4 GHz: < 1.13 > 12.4 GHz to 18.0 GHz: < 1.16 > 18.0 GHz to 26.5 GHz: < 1.22 > 26.5 GHz to 40.0 GHz: < 1.28 > 40.0 GHz to 50.0 GHz: < 1.30 > 50.0 GHz to 67.0 GHz: < 1.35	–	15 nW	15 nW	*0.040 to 0.209*	*0.010*
NRP90T(N)	DC to 100 MHz: < 1.05 > 100 MHz to 2.4 GHz: < 1.08 > 2.4 GHz to 12.4 GHz: < 1.18 > 12.4 GHz to 18.0 GHz: < 1.23 > 18.0 GHz to 26.5 GHz: < 1.28 > 26.5 GHz to 40.0 GHz: < 1.38 > 40.0 GHz to 50.0 GHz: < 1.46 > 50.0 GHz to 67.0 GHz: < 1.56 > 67.0 GHz to 80.0 GHz: < 1.60 > 80.0 GHz to 90.0 GHz: < 1.66				*0.041 to 0.269*	*0.010 to 0.014*
NRP110T	DC to 100 MHz: < 1.05 > 100 MHz to 2.4 GHz: < 1.08 > 2.4 GHz to 12.4 GHz: < 1.18 > 12.4 GHz to 18.0 GHz: < 1.23 > 18.0 GHz to 26.5 GHz: < 1.28 > 26.5 GHz to 40.0 GHz: < 1.38 > 40.0 GHz to 50.0 GHz: < 1.46 > 50.0 GHz to 67.0 GHz: < 1.56 > 67.0 GHz to 80.0 GHz: < 1.60 > 80.0 GHz to 95.0 GHz: < 1.66 > 95.0 GHz to 110 GHz: < 1.70				*0.041 to 0.290*	*0.010 to 0.014*
Thermal waveguide power sensors						
NRP75TWG	50 GHz to 75 GHz: < 1.35	–	20 nW	20 nW	*0.190*	*0.014*
NRP90TWG	60 GHz to 90 GHz: < 1.35				*0.194*	*0.014*
NRP110TWG	75 GHz to 110 GHz: < 1.35				*0.198*	*0.014*

Multipath diode power sensors

R&S®NRP8S(N)/18S(N)/33S(N) three-path diode power sensors, R&S®NRP33SN-V TVAC-compliant three-path diode power sensor

Specifications from 10 MHz to 8 GHz apply to the R&S®NRP8S(N).
Specifications from 10 MHz to 18 GHz apply to the R&S®NRP18S(N).
Specifications from 10 MHz to 33 GHz apply to the R&S®NRP33S(N)/NRP33SN-V.

Frequency range	R&S®NRP8S(N)	10 MHz to 8 GHz	
	R&S®NRP18S(N)	10 MHz to 18 GHz	
	R&S®NRP33S(N)/NRP33SN-V	10 MHz to 33 GHz	
Impedance matching (SWR)	10 MHz to 2.4 GHz	< 1.13 (1.11)	( ): +15 °C to +35 °C
	> 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 33.0 GHz	< 1.35 (1.33)	
Power measurement range	continuous average	100 pW to 200 mW (–70 dBm to +23 dBm)	
	burst average	300 nW to 200 mW (–35 dBm to +23 dBm)	
	timeslot/gate average	300 pW to 200 mW (–65 dBm to +23 dBm) [1]	
	trace	2 nW to 200 mW (–57 dBm to +23 dBm) [2]	
Maximum power	average power	1 W (+30 dBm) AVG, max. 10 V DC	
	peak envelope power	2 W (+33 dBm) for max. 10 µs	
Measurement subranges	path 1	–70 dBm to –15 dBm	
	path 2	–53 dBm to +5 dBm	
	path 3	–33 dBm to +23 dBm	
Transition regions	with automatic path selection [3]	(–20 ± 1) dBm to (–14 ± 1) dBm (0 ± 1) dBm to (+6 ± 1) dBm	
Dynamic response	video bandwidth	> 100 kHz (150 kHz)	( ): +15 °C to +35 °C
	rise time 10 %/90 %	< 5 µs (3 µs)	
Acquisition	sample rate (continuous)	2 Msps	
	accuracy of time base	±5 ppm	
Triggering	internal		
	threshold level range	–38 dBm to +23 dBm	
	threshold level accuracy	identical to uncertainty for absolute power measurements	
	threshold level hysteresis	0 dB to 10 dB	
	dropout [4]	0 s to 10 s	
	external	EXTernal[1]: R&S®NRX/NRP2 or R&S®NRP-Z5	
		EXTernal2: coaxial trigger I/O	
	slope (external, internal)	pos./neg.	
	delay	–5 s to +10 s	
	hold-off	0 s to 10 s	
	resolution (delay, hold-off, dropout)	0.5 µs (sample period)	
	source	INTernal, EXTernal[1], EXTernal2, IMMediate, BUS, HOLD	
Zero offset	initial, without zeroing		( ): typical at 1 GHz +15 °C to +35 °C [ ]: at frequencies ≤ 18 GHz
	path 1	< 250 [235] (50) pW	
	path 2	< 10.5 [10.3] (2.2) nW	
	path 3	< 1.10 [0.93] (0.19) µW	
	after external zeroing [5]		
	path 1	< 53 [49] (28) pW	
	path 2	< 2.2 [2.1] (1.3) nW	
	path 3	< 224 [192] (108) nW	
Zero drift [6]	path 1	< 13 [12] (2) pW	
	path 2	< 0.6 [0.5] (0.1) nW	
	path 3	< 54 [47] (8) nW	
Measurement noise [7]	path 1	< 37 [35] (20) pW	
	path 2	< 1.6 [1.5] (0.9) nW	
	path 3	< 158 [136] (76) nW	

Uncertainty for absolute power measurements [8] in dB

10 MHz to < 20 MHz

0.224	*0.187*	*0.181*
0.098	*0.087*	*0.085*
0.058	*0.053*	*0.053*

–70 –20 0 +23
Power level in dBm

20 MHz to < 100 MHz

0.195	*0.177*	*0.172*
0.089	*0.085*	*0.083*
0.055	*0.054*	*0.054*

–70 –20 0 +23
Power level in dBm

0 °C to +50 °C
+15 °C to +35 °C
+20 °C to +25 °C

100 MHz to 2.4 GHz

0.161	*0.168*	*0.163*
0.084	*0.086*	*0.085*
0.060	*0.059*	*0.060*

–70 –20 0 +23
Power level in dBm

> 2.4 GHz to 8 GHz

0.162	*0.168*	*0.164*
0.088	*0.089*	*0.088*
0.065	*0.063*	*0.064*

–70 –20 0 +23
Power level in dBm

0 °C to +50 °C
+15 °C to +35 °C
+20 °C to +25 °C

> 8 GHz to 12.4 GHz

0.166	*0.172*	*0.166*
0.096	*0.096*	*0.095*
0.076	*0.073*	*0.074*

–70 –20 0 +23
Power level in dBm

> 12.4 GHz to 18 GHz

0.174	*0.182*	*0.178*
0.110	*0.111*	*0.112*
0.092	*0.090*	*0.094*

–70 –20 0 +23
Power level in dBm

0 °C to +50 °C
+15 °C to +35 °C
+20 °C to +25 °C

> 18 GHz to 26.5 GHz

0.178	*0.194*	*0.196*
0.112	*0.117*	*0.125*
0.093	*0.093*	*0.105*

–70 –20 0 +23
Power level in dBm

> 26.5 GHz to 33 GHz

0.194	*0.217*	*0.226*
0.131	*0.138*	*0.155*
0.114	*0.114*	*0.134*

–70 –20 0 +23
Power level in dBm

0 °C to +50 °C
+15 °C to +35 °C
+20 °C to +25 °C

Uncertainty for relative power measurements [9] in dB

10 MHz to < 20 MHz

Power level in dBm	–70	–20	–14	0	+6	+23	
+23	0.267	0.239	0.027				0 °C to +50 °C
	0.107	0.097	0.026				+15 °C to +35 °C
+6	0.047	0.041	0.026				+20 °C to +25 °C
0	0.260	0.028	0.239				0 °C to +50 °C
	0.103	0.024	0.097				+15 °C to +35 °C
–14	0.044	0.023	0.041				+20 °C to +25 °C
–20	0.022	0.260	0.267				0 °C to +50 °C
	0.022	0.103	0.107				+15 °C to +35 °C
–70	0.022	0.044	0.047				+20 °C to +25 °C

20 MHz to < 100 MHz

Power level in dBm	–70	–20	–14	0	+6	+23	
+23	0.242	0.228	0.027				0 °C to +50 °C
	0.100	0.096	0.026				+15 °C to +35 °C
+6	0.045	0.041	0.026				+20 °C to +25 °C
0	0.235	0.028	0.228				0 °C to +50 °C
	0.097	0.024	0.096				+15 °C to +35 °C
–14	0.043	0.023	0.041				+20 °C to +25 °C
–20	0.022	0.235	0.242				0 °C to +50 °C
	0.022	0.097	0.100				+15 °C to +35 °C
–70	0.022	0.043	0.045				+20 °C to +25 °C

100 MHz to 2.4 GHz

Power level in dBm	–70	–20	–14	0	+6	+23	
+23	0.213	0.217	0.027				0 °C to +50 °C
	0.093	0.093	0.026				+15 °C to +35 °C
+6	0.045	0.040	0.026				+20 °C to +25 °C
0	0.208	0.028	0.217				0 °C to +50 °C
	0.090	0.024	0.093				+15 °C to +35 °C
–14	0.043	0.023	0.040				+20 °C to +25 °C
–20	0.022	0.208	0.213				0 °C to +50 °C
	0.022	0.090	0.093				+15 °C to +35 °C
–70	0.022	0.043	0.045				+20 °C to +25 °C

> 2.4 GHz to 8 GHz

Power level in dBm	–70	–20	–14	0	+6	+23	
+23	0.211	0.214	0.027				0 °C to +50 °C
	0.095	0.093	0.026				+15 °C to +35 °C
+6	0.050	0.042	0.026				+20 °C to +25 °C
0	0.205	0.028	0.214				0 °C to +50 °C
	0.092	0.024	0.093				+15 °C to +35 °C
–14	0.047	0.023	0.042				+20 °C to +25 °C
–20	0.022	0.205	0.211				0 °C to +50 °C
	0.022	0.092	0.095				+15 °C to +35 °C
–70	0.022	0.047	0.050				+20 °C to +25 °C

> 8 GHz to 12.4 GHz

Power level in dBm	–70	–20	–14	0	+6	+23	
+23	0.212	0.215	0.029				0 °C to +50 °C
	0.099	0.097	0.027				+15 °C to +35 °C
+6	0.056	0.048	0.027				+20 °C to +25 °C
0	0.207	0.029	0.215				0 °C to +50 °C
	0.095	0.025	0.097				+15 °C to +35 °C
–14	0.052	0.024	0.048				+20 °C to +25 °C
–20	0.022	0.207	0.212				0 °C to +50 °C
	0.022	0.095	0.099				+15 °C to +35 °C
–70	0.022	0.052	0.056				+20 °C to +25 °C

> 12.4 GHz to 18 GHz

Power level in dBm	–70	–20	–14	0	+6	+23	
+23	0.219	0.223	0.034				0 °C to +50 °C
	0.109	0.108	0.033				+15 °C to +35 °C
+6	0.069	0.064	0.032				+20 °C to +25 °C
0	0.212	0.031	0.223				0 °C to +50 °C
	0.102	0.027	0.108				+15 °C to +35 °C
–14	0.061	0.026	0.064				+20 °C to +25 °C
–20	0.022	0.212	0.219				0 °C to +50 °C
	0.022	0.102	0.109				+15 °C to +35 °C
–70	0.022	0.061	0.069				+20 °C to +25 °C

> 18 GHz to 26.5 GHz

Power level in dBm	–70	–20	–14	0	+6	+23	
+23	0.242	0.254	0.049				0 °C to +50 °C
	0.134	0.139	0.049				+15 °C to +35 °C
+6	0.098	0.099	0.049				+20 °C to +25 °C
0	0.231	0.038	0.254				0 °C to +50 °C
	0.119	0.034	0.139				+15 °C to +35 °C
–14	0.079	0.032	0.099				+20 °C to +25 °C
–20	0.022	0.231	0.242				0 °C to +50 °C
	0.022	0.119	0.134				+15 °C to +35 °C
–70	0.022	0.079	0.098				+20 °C to +25 °C

> 26.5 GHz to 33 GHz

Power level in dBm	–70	–20	–14	0	+6	+23	
+23	0.268	0.288	0.067				0 °C to +50 °C
	0.162	0.174	0.067				+15 °C to +35 °C
+6	0.129	0.136	0.067				+20 °C to +25 °C
0	0.252	0.047	0.288				0 °C to +50 °C
	0.137	0.042	0.174				+15 °C to +35 °C
–14	0.096	0.040	0.136				+20 °C to +25 °C
–20	0.023	0.252	0.268				0 °C to +50 °C
	0.023	0.137	0.162				+15 °C to +35 °C
–70	0.023	0.096	0.129				+20 °C to +25 °C

R&S®NRP40S(N)/50S(N)/67S(N) three-path diode power sensors, R&S®NRP67SN-V TVAC-compliant three-path diode power sensor

Specifications from 50 MHz to 40 GHz apply to the R&S®NRP40S(N).
Specifications from 50 MHz to 50 GHz apply to the R&S®NRP50S(N).
Specifications from 50 MHz to 67 GHz apply to the R&S®NRP67S(N)/NRP67SN-V.

Frequency range	R&S®NRP40S(N)	50 MHz to 40 GHz	
	R&S®NRP50S(N)	50 MHz to 50 GHz	
	R&S®NRP67S(N)/NRP67SN-V	50 MHz to 67 GHz	
Impedance matching (SWR)	R&S®NRP40S(N), R&S®NRP50S(N)		
	50 MHz to 2.4 GHz	< 1.13 (1.11)	( ): +15 °C to +35 °C
	> 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 33.0 GHz	< 1.35 (1.33)	
	> 33.0 GHz to 40.0 GHz	< 1.37 (1.35)	
	> 40.0 GHz to 50.0 GHz	< 1.40 (1.38)	
	R&S®NRP67S(N), R&S®NRP67SN-V		
	50 MHz to 200 MHz	< 1.30 (1.28)	( ): +15 °C to +35 °C
	> 200 MHz to 2.4 GHz	< 1.13 (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 33.0 GHz	< 1.35 (1.33)	
	> 33.0 GHz to 40.0 GHz	< 1.37 (1.35)	
	> 40.0 GHz to 50.0 GHz	< 1.40 (1.38)	
	> 50.0 GHz to 67.0 GHz	< 1.68 (1.66)	
Power measurement range	continuous average	100 pW to 100 mW (–70 dBm to +20 dBm)	
	burst average	300 nW to 100 mW (–35 dBm to +20 dBm)	
	timeslot/gate average	300 pW to 100 mW (–65 dBm to +20 dBm) [1]	
	trace	2 nW to 100 mW (–57 dBm to +20 dBm) [2]	
Maximum power	average power	0.2 W (+23 dBm) AVG, max. 10 V DC	
	peak envelope power	1 W (+30 dBm) for max. 10 µs	
Measurement subranges	path 1	–70 dBm to –15 dBm	
	path 2	–53 dBm to +5 dBm	
	path 3	–33 dBm to +20 dBm	
Transition regions	with automatic path selection [3]	(–20 ± 1) dBm to (–14 ± 1) dBm (0 ± 1) dBm to (+6 ± 1) dBm	
Dynamic response	video bandwidth	> 100 kHz (150 kHz)	( ): +15 °C to +35 °C
	rise time 10 %/90 %	< 5 µs (3 µs)	
Acquisition	sample rate (continuous)	2 Msps	
	accuracy of time base	±5 ppm	
Triggering	internal		
	threshold level range	–38 dBm to +20 dBm	
	threshold level accuracy	identical to uncertainty for absolute power measurements	
	threshold level hysteresis	0 dB to 10 dB	
	dropout [4]	0 s to 10 s	
	external	EXTernal[1]: R&S®NRX/NRP2 or R&S®NRP-Z5	
		EXTernal2: coaxial trigger I/O	
	slope (external, internal)	pos./neg.	
	delay	–5 s to +10 s	
	hold-off	0 s to 10 s	
	resolution (delay, hold-off, dropout)	0.5 µs (sample period)	
	source	INTernal, EXTernal[1], EXTernal2, IMMediate, BUS, HOLD	

Zero offset	initial, without zeroing		( ): typical at 1 GHz +15 °C to +35 °C [ ]: at frequencies ≤ 18 GHz
	path 1	< 280 [235] (50) pW	
	path 2	< 26.3 [22.0] (4.8) nW	
	path 3	< 1.34 [1.06] (0.23) µW	
	after external zeroing [5]		
	path 1	< 58 [49] (28) pW	
	path 2	< 5.5 [4.6] (2.7) nW	
	path 3	< 280 [220] (130) nW	
Zero drift [6]	path 1	< 14 [12] (2) pW	
	path 2	< 1.3 [1.1] (0.2) nW	
	path 3	< 67 [53] (9) nW	
Measurement noise [7]	path 1	< 41 [35] (20) pW	
	path 2	< 3.9 [3.3] (1.9) nW	
	path 3	< 196 [155] (90) nW	

Uncertainty for absolute power measurements [8] in dB

50 MHz to < 200 MHz

0.241	*0.196*	*0.193*
0.113	*0.098*	*0.099*
0.077	*0.073*	*0.077*

–70 –20 0 +20
Power level in dBm

200 MHz to 8 GHz

0.162	*0.172*	*0.171*
0.095	*0.094*	*0.097*
0.081	*0.074*	*0.078*

–70 –20 0 +20
Power level in dBm

0 °C to +50 °C
+15 °C to +35 °C
+20 °C to +25 °C

> 8 GHz to 12.4 GHz

0.152	*0.157*	*0.157*
0.103	*0.098*	*0.101*
0.090	*0.081*	*0.086*

–70 –20 0 +20
Power level in dBm

> 12.4 GHz to 18 GHz

0.165	*0.167*	*0.168*
0.117	*0.111*	*0.114*
0.104	*0.095*	*0.100*

–70 –20 0 +20
Power level in dBm

0 °C to +50 °C
+15 °C to +35 °C
+20 °C to +25 °C

> 18 GHz to 26.5 GHz

0.176	*0.176*	*0.180*
0.122	*0.114*	*0.120*
0.107	*0.095*	*0.103*

–70 –20 0 +20
Power level in dBm

> 26.5 GHz to 33 GHz

0.196	*0.196*	*0.203*
0.139	*0.131*	*0.140*
0.123	*0.111*	*0.122*

–70 –20 0 +20
Power level in dBm

0 °C to +50 °C
+15 °C to +35 °C
+20 °C to +25 °C

> 33 GHz to 40 GHz

0.216	*0.217*	*0.229*
0.152	*0.145*	*0.159*
0.134	*0.122*	*0.138*

–70 –20 0 +20
Power level in dBm

> 40 GHz to 50 GHz

0.257	*0.260*	*0.279*
0.188	*0.184*	*0.205*
0.169	*0.160*	*0.183*

–70 –20 0 +20
Power level in dBm

0 °C to +50 °C
+15 °C to +35 °C
+20 °C to +25 °C

> 50 GHz to 67 GHz

0.318	*0.327*	*0.357*
0.242	*0.243*	*0.278*
0.221	*0.217*	*0.255*

0 °C to +50 °C
+15 °C to +35 °C
+20 °C to +25 °C

Uncertainty for relative power measurements [9] in dB

50 MHz to < 200 MHz

	–70	–20	–14	0	+6	+20	
+20	0.285	0.252	0.046				0 °C to +50 °C
	0.127	0.117	0.045				+15 °C to +35 °C
+6	0.081	0.077	0.045				+20 °C to +25 °C
0	0.277	0.040	0.252				0 °C to +50 °C
	0.121	0.038	0.117				+15 °C to +35 °C
–14	0.073	0.038	0.077				+20 °C to +25 °C
–20	0.028	0.277	0.285				0 °C to +50 °C
	0.028	0.121	0.127				+15 °C to +35 °C
–70	0.028	0.073	0.081				+20 °C to +25 °C

Power level in dBm

200 MHz to < 8 GHz

	–70	–20	–14	0	+6	+20	
+20	0.214	0.221	0.047				0 °C to +50 °C
	0.109	0.109	0.047				+15 °C to +35 °C
+6	0.083	0.077	0.047				+20 °C to +25 °C
0	0.206	0.040	0.221				0 °C to +50 °C
	0.102	0.038	0.109				+15 °C to +35 °C
–14	0.076	0.038	0.077				+20 °C to +25 °C
–20	0.029	0.206	0.214				0 °C to +50 °C
	0.029	0.102	0.109				+15 °C to +35 °C
–70	0.029	0.076	0.083				+20 °C to +25 °C

Power level in dBm

> 8 GHz to 12.4 GHz

	–70	–20	–14	0	+6	+20	
+20	0.195	0.199	0.050				0 °C to +50 °C
	0.111	0.108	0.049				+15 °C to +35 °C
+6	0.086	0.080	0.049				+20 °C to +25 °C
0	0.187	0.041	0.199				0 °C to +50 °C
	0.104	0.039	0.108				+15 °C to +35 °C
–14	0.079	0.039	0.080				+20 °C to +25 °C
–20	0.029	0.187	0.195				0 °C to +50 °C
	0.029	0.104	0.111				+15 °C to +35 °C
–70	0.029	0.079	0.086				+20 °C to +25 °C

Power level in dBm

> 12.4 GHz to 18 GHz

	–70	–20	–14	0	+6	+20	
+20	0.203	0.205	0.054				0 °C to +50 °C
	0.117	0.113	0.054				+15 °C to +35 °C
+6	0.092	0.085	0.054				+20 °C to +25 °C
0	0.194	0.043	0.205				0 °C to +50 °C
	0.109	0.041	0.113				+15 °C to +35 °C
–14	0.083	0.041	0.085				+20 °C to +25 °C
–20	0.030	0.194	0.203				0 °C to +50 °C
	0.030	0.109	0.117				+15 °C to +35 °C
–70	0.030	0.083	0.092				+20 °C to +25 °C

Power level in dBm

> 18 GHz to 26.5 GHz

	–70	–20	–14	0	+6	+20	
+20	0.226	0.227	0.064				0 °C to +50 °C
	0.134	0.130	0.064				+15 °C to +35 °C
+6	0.106	0.099	0.064				+20 °C to +25 °C
0	0.214	0.048	0.227				0 °C to +50 °C
	0.122	0.046	0.130				+15 °C to +35 °C
–14	0.092	0.046	0.099				+20 °C to +25 °C
–20	0.032	0.214	0.226				0 °C to +50 °C
	0.032	0.122	0.134				+15 °C to +35 °C
–70	0.032	0.092	0.106				+20 °C to +25 °C

Power level in dBm

> 26.5 GHz to 33 GHz

	–70	–20	–14	0	+6	+20	
+20	0.252	0.254	0.074				0 °C to +50 °C
	0.153	0.151	0.074				+15 °C to +35 °C
+6	0.122	0.117	0.074				+20 °C to +25 °C
0	0.236	0.054	0.254				0 °C to +50 °C
	0.135	0.052	0.151				+15 °C to +35 °C
–14	0.101	0.051	0.117				+20 °C to +25 °C
–20	0.034	0.236	0.252				0 °C to +50 °C
	0.034	0.135	0.153				+15 °C to +35 °C
–70	0.034	0.101	0.122				+20 °C to +25 °C

Power level in dBm

> 33 GHz to 40 GHz

+20	*0.285*	*0.289*	*0.088*
	0.176	*0.179*	*0.087*
+6	*0.141*	*0.142*	*0.087*
0	*0.263*	*0.062*	*0.289*
	0.151	*0.060*	*0.179*
–14	*0.111*	*0.059*	*0.142*
–20	*0.036*	*0.263*	*0.285*
	0.036	*0.151*	*0.176*
–70	*0.036*	*0.111*	*0.141*

–70 –20 –14 0 +6 +20

Power level in dBm

> 40 GHz to 50 GHz

+20	*0.336*	*0.344*	*0.110*	0 °C to +50 °C
	0.214	*0.224*	*0.110*	+15 °C to +35 °C
+6	*0.174*	*0.184*	*0.109*	+20 °C to +25 °C
0	*0.304*	*0.077*	*0.344*	0 °C to +50 °C
	0.174	*0.074*	*0.224*	+15 °C to +35 °C
–14	*0.126*	*0.073*	*0.184*	+20 °C to +25 °C
–20	*0.040*	*0.304*	*0.336*	0 °C to +50 °C
	0.040	*0.174*	*0.214*	+15 °C to +35 °C
–70	*0.040*	*0.126*	*0.174*	+20 °C to +25 °C

–70 –20 –14 0 +6 +20

Power level in dBm

> 50 GHz to 67 GHz

+20	*0.419*	*0.436*	*0.152*	0 °C to +50 °C
	0.280	*0.307*	*0.151*	+15 °C to +35 °C
+6	*0.233*	*0.266*	*0.151*	+20 °C to +25 °C
0	*0.365*	*0.109*	*0.436*	0 °C to +50 °C
	0.210	*0.105*	*0.307*	+15 °C to +35 °C
–14	*0.150*	*0.103*	*0.266*	+20 °C to +25 °C
–20	*0.047*	*0.365*	*0.419*	0 °C to +50 °C
	0.047	*0.210*	*0.280*	+15 °C to +35 °C
–70	*0.047*	*0.150*	*0.233*	+20 °C to +25 °C

R&S®NRP18S-10 high-power three-path diode power sensor

Specifications apply when the power sensor is operated together with the RF power attenuator supplied. Please refer to the specifications of the R&S®NRP18S when operating the power sensor section alone.

Frequency range		10 MHz to 18 GHz	
Impedance matching (SWR)	10 MHz to 2.4 GHz	< 1.14	
	> 2.4 GHz to 8.0 GHz	< 1.20	
	> 8.0 GHz to 12.4 GHz	< 1.25	
	> 12.4 GHz to 18.0 GHz	< 1.30	
Power measurement range	continuous average	1 nW to 2 W (−60 dBm to +33 dBm)	
	burst average	3 µW to 2 W (−25 dBm to +33 dBm)	
	timeslot/gate average	3 nW to 2 W (−55 dBm to +33 dBm) [1]	
	trace	20 nW to 2 W (−47 dBm to +33 dBm) [2]	
Maximum power	average power	3 W (+35 dBm) AVG	
	peak envelope power	20 W (+43 dBm) for max. 10 µs	
Measurement subranges	path 1	−60 dBm to −5 dBm	
	path 2	−43 dBm to +15 dBm	
	path 3	−23 dBm to +33 dBm	
Transition regions	with automatic path selection [3]	(−10 ± 1.5) dBm to (−4 ± 1.5) dBm (10 ± 1.5) dBm to (+16 ± 1.5) dBm	
Dynamic response	video bandwidth	> 100 kHz (150 kHz)	( ): +15 °C to +35 °C
	rise time 10 %/90 %	< 5 µs (3 µs)	
Acquisition	sample rate (continuous)	2 Msps	
	accuracy of time base	±5 ppm	
Triggering	internal		
	threshold level range	−27 dBm to +33 dBm	
	threshold level accuracy	identical to uncertainty for absolute power measurements	
	threshold level hysteresis	0 dB to 10 dB	
	dropout [4]	0 s to 10 s	
	external	EXTernal[1]: R&S®NRX/NRP2 or R&S®NRP-Z5	
		EXTernal2: coaxial trigger I/O	
	slope (external, internal)	pos./neg.	
	delay	−5 s to +10 s	
	hold-off	0 s to 10 s	
	resolution (delay, hold-off, dropout)	0.5 µs (sample period)	
	source	INTernal, EXTernal[1], EXTernal2, IMMediate, BUS, HOLD	
Zero offset	initial, without zeroing		( ): typical at 1 GHz +15 °C to +35 °C
	path 1	< 2.9 (0.6) nW	
	path 2	< 120 (25) nW	
	path 3	< 12.3 (2.2) µW	
	after external zeroing [5]		
	path 1	< 600 (320) pW	
	path 2	< 26 (14) nW	
	path 3	< 2.6 (1.2) µW	
Zero drift [6]	path 1	< 145 (23) pW	
	path 2	< 6.0 (1.0) nW	
	path 3	< 615 (90) nW	
Measurement noise [7]	path 1	< 425 (230) pW	
	path 2	< 18 (10) nW	
	path 3	< 1.8 (0.9) µW	

Uncertainty for absolute power measurements [8] in dB

10 MHz to < 100 MHz

0.238	*0.218*	*0.244*	*0.268*	0 °C to +50 °C
0.117	*0.140*	*0.179*	*0.210*	+15 °C to +35 °C
0.083	*0.120*	*0.163*	*0.198*	+20 °C to +25 °C
−60	+20	+30	+32	+33

Power level in dBm

100 MHz to 2.4 GHz

0.186	*0.195*	*0.212*	*0.228*	0 °C to +50 °C
0.108	*0.127*	*0.153*	*0.174*	+15 °C to +35 °C
0.085	*0.109*	*0.138*	*0.162*	+20 °C to +25 °C
−60	+20	+30	+32	+33

Power level in dBm

> 2.4 GHz to 12.4 GHz

0.193	*0.205*	*0.221*	*0.237*	0 °C to +50 °C
0.128	*0.145*	*0.168*	*0.188*	+15 °C to +35 °C
0.103	*0.124*	*0.150*	*0.176*	+20 °C to +25 °C
−60	+20	+30	+32	+33

Power level in dBm

> 12.4 GHz to 18 GHz

0.208	*0.219*	*0.234*	*0.249*	0 °C to +50 °C
0.147	*0.162*	*0.183*	*0.201*	+15 °C to +35 °C
0.123	*0.140*	*0.164*	*0.190*	+20 °C to +25 °C
−60	+20	+30	+32	+33

Power level in dBm

Uncertainty for relative power measurements [9, 10] in dB

10 MHz to < 100 MHz

+30	*0.356*	*0.316*	*0.028*	0 °C to +50 °C
	0.162	*0.147*	*0.026*	+15 °C to +35 °C
+16	*0.076*	*0.069*	*0.026*	+20 °C to +25 °C
+10	*0.347*	*0.032*	*0.316*	0 °C to +50 °C
	0.157	*0.025*	*0.147*	+15 °C to +35 °C
−4	*0.073*	*0.024*	*0.069*	+20 °C to +25 °C
−10	*0.022*	*0.347*	*0.356*	0 °C to +50 °C
	0.022	*0.157*	*0.162*	+15 °C to +35 °C
−60	*0.022*	*0.073*	*0.076*	+20 °C to +25 °C
	−60	−10 −4	+10 +16	+30

Power level in dBm

100 MHz to < 2.4 GHz

+30	*0.273*	*0.278*	*0.028*	0 °C to +50 °C
	0.136	*0.138*	*0.026*	+15 °C to +35 °C
+16	*0.068*	*0.067*	*0.026*	+20 °C to +25 °C
+10	*0.266*	*0.032*	*0.278*	0 °C to +50 °C
	0.133	*0.025*	*0.138*	+15 °C to +35 °C
−4	*0.066*	*0.024*	*0.067*	+20 °C to +25 °C
−10	*0.022*	*0.266*	*0.273*	0 °C to +50 °C
	0.022	*0.133*	*0.136*	+15 °C to +35 °C
−60	*0.022*	*0.066*	*0.068*	+20 °C to +25 °C
	−60	−10 −4	+10 +16	+30

Power level in dBm

> 2.4 GHz to 12.4 GHz

+30	*0.269*	*0.274*	*0.030*	0 °C to +50 °C
	0.139	*0.140*	*0.028*	+15 °C to +35 °C
+16	*0.076*	*0.072*	*0.027*	+20 °C to +25 °C
+10	*0.262*	*0.033*	*0.274*	0 °C to +50 °C
	0.136	*0.026*	*0.140*	+15 °C to +35 °C
−4	*0.073*	*0.024*	*0.072*	+20 °C to +25 °C
−10	*0.022*	*0.262*	*0.269*	0 °C to +50 °C
	0.022	*0.136*	*0.139*	+15 °C to +35 °C
−60	*0.022*	*0.073*	*0.076*	+20 °C to +25 °C
	−60	−10 −4	+10 +16	+30

> 12.4 GHz to 18 GHz

+30	*0.275*	*0.280*	*0.034*	0 °C to +50 °C
	0.148	*0.150*	*0.033*	+15 °C to +35 °C
+16	*0.087*	*0.085*	*0.033*	+20 °C to +25 °C
+10	*0.266*	*0.035*	*0.280*	0 °C to +50 °C
	0.142	*0.028*	*0.150*	+15 °C to +35 °C
−4	*0.080*	*0.026*	*0.085*	+20 °C to +25 °C
−10	*0.022*	*0.266*	*0.275*	0 °C to +50 °C
	0.022	*0.142*	*0.148*	+15 °C to +35 °C
−60	*0.022*	*0.080*	*0.087*	+20 °C to +25 °C
	−60	−10 −4	+10 +16	+30

R&S®NRP18S-20 high-power three-path diode power sensor

Specifications apply when the power sensor is operated together with the RF power attenuator supplied. Please refer to the specifications of the R&S®NRP18S when operating the power sensor section alone.

Frequency range		10 MHz to 18 GHz	
Impedance matching (SWR)	10 MHz to 2.4 GHz	< 1.14	
	> 2.4 GHz to 8.0 GHz	< 1.25	
	> 8.0 GHz to 12.4 GHz	< 1.30	
	> 12.4 GHz to 18.0 GHz	< 1.41	
Power measurement range	continuous average	10 nW to 15 W (−50 dBm to +42 dBm)	
	burst average	30 µW to 15 W (−15 dBm to +42 dBm)	
	timeslot/gate average	30 nW to 15 W (−45 dBm to +42 dBm) [1]	
	trace	200 nW to 15 W (−37 dBm to +42 dBm) [2]	
Maximum power	average power	18 W (+42.5 dBm) AVG	
	peak envelope power	100 W (+50 dBm) for max. 10 µs	
Measurement subranges	path 1	−50 dBm to +5 dBm	
	path 2	−33 dBm to +25 dBm	
	path 3	−13 dBm to +42 dBm	
Transition regions	with automatic path selection [3]	(0 ± 1.75) dBm to (+6 ± 1.75) dBm (20 ± 1.75) dBm to (+26 ± 1.75) dBm	
Dynamic response	video bandwidth	> 100 kHz (150 kHz)	( ): +15 °C to +35 °C
	rise time 10 %/90 %	< 5 µs (3 µs)	
Acquisition	sample rate (continuous)	2 Msps	
	accuracy of time base	±5 ppm	
Triggering	Internal		
	threshold level range	−17 dBm to +42 dBm	
	threshold level accuracy	identical to uncertainty for absolute power measurements	
	threshold level hysteresis	0 dB to 10 dB	
	dropout [4]	0 s to 10 s	
	external	EXTernal[1]: R&S®NRX/NRP2 or R&S®NRP-Z5	
		EXTernal2: coaxial trigger I/O	
	slope (external, internal)	pos./neg.	
	delay	−5 s to +10 s	
	hold-off	0 s to 10 s	
	resolution (delay, hold-off, dropout)	0.5 µs (sample period)	
	source	INTernal, EXTernal[1], EXTernal2, IMMediate, BUS, HOLD	
Zero offset	initial, without zeroing		( ): typical at 1 GHz +15 °C to +35 °C
	path 1	< 30 (6) nW	
	path 2	< 1.30 (0.26) µW	
	path 3	< 130 (23) µW	
	after external zeroing [5]		
	path 1	< 6.3 (3.4) nW	
	path 2	< 270 (150) nW	
	path 3	< 27 (13) µW	
Zero drift [6]	path 1	< 1.5 (0.24) nW	
	path 2	< 63 (11) nW	
	path 3	< 6.5 (1.0) µW	
Measurement noise [7]	path 1	< 4.5 (2.4) nW	
	path 2	< 190 (110) nW	
	path 3	< 19 (9) µW	

Uncertainty for absolute power measurements [8] in dB

10 MHz to < 100 MHz

0 °C to +50 °C	*0.256*	*0.223*	*0.244*	*0.276*
+15 °C to +35 °C	*0.124*	*0.123*	*0.157*	*0.204*
+20 °C to +25 °C	*0.083*	*0.090*	*0.133*	*0.186*
	−50	+30	+36	+40	+42

Power level in dBm

100 MHz to 2.4 GHz

0 °C to +50 °C	*0.208*	*0.208*	*0.226*	*0.253*
+15 °C to +35 °C	*0.116*	*0.121*	*0.149*	*0.188*
+20 °C to +25 °C	*0.085*	*0.093*	*0.127*	*0.172*
	−50	+30	+36	+40	+42

Power level in dBm

> 2.4 GHz to 12.4 GHz

0 °C to +50 °C	*0.218*	*0.221*	*0.237*	*0.264*
+15 °C to +35 °C	*0.140*	*0.145*	*0.169*	*0.204*
+20 °C to +25 °C	*0.107*	*0.113*	*0.143*	*0.183*
	−50	+30	+36	+40	+42

Power level in dBm

> 12.4 GHz to 18 GHz

0 °C to +50 °C	*0.236*	*0.239*	*0.254*	*0.279*
+15 °C to +35 °C	*0.165*	*0.169*	*0.189*	*0.222*
+20 °C to +25 °C	*0.130*	*0.135*	*0.160*	*0.198*
	−50	+30	+36	+40	+42

Power level in dBm

Uncertainty for relative power measurements [9, 10] in dB

10 MHz to < 100 MHz

+40	*0.356*	*0.316*	*0.028*	0 °C to +50 °C
	0.162	*0.147*	*0.026*	+15 °C to +35 °C
+26	*0.076*	*0.069*	*0.026*	+20 °C to +25 °C
+20	*0.347*	*0.032*	*0.316*	0 °C to +50 °C
	0.157	*0.025*	*0.147*	+15 °C to +35 °C
+6	*0.073*	*0.024*	*0.069*	+20 °C to +25 °C
0	*0.022*	*0.347*	*0.356*	0 °C to +50 °C
	0.022	*0.157*	*0.162*	+15 °C to +35 °C
−50	*0.022*	*0.073*	*0.076*	+20 °C to +25 °C
	−50	0	+6	+20	+26	+40	

Power level in dBm

100 MHz to < 2.4 GHz

+40	*0.273*	*0.278*	*0.028*	0 °C to +50 °C
	0.136	*0.138*	*0.026*	+15 °C to +35 °C
+26	*0.068*	*0.067*	*0.026*	+20 °C to +25 °C
+20	*0.266*	*0.032*	*0.278*	0 °C to +50 °C
	0.133	*0.025*	*0.138*	+15 °C to +35 °C
+6	*0.066*	*0.024*	*0.067*	+20 °C to +25 °C
0	*0.022*	*0.266*	*0.273*	0 °C to +50 °C
	0.022	*0.133*	*0.136*	+15 °C to +35 °C
−50	*0.022*	*0.066*	*0.068*	+20 °C to +25 °C
	−50	0	+6	+20	+26	+40	

Power level in dBm

> 2.4 GHz to 12.4 GHz

+40	*0.269*	*0.274*	*0.030*	0 °C to +50 °C
	0.139	*0.140*	*0.028*	+15 °C to +35 °C
+26	*0.076*	*0.072*	*0.027*	+20 °C to +25 °C
+20	*0.262*	*0.033*	*0.274*	0 °C to +50 °C
	0.136	*0.026*	*0.140*	+15 °C to +35 °C
+6	*0.073*	*0.024*	*0.072*	+20 °C to +25 °C
0	*0.022*	*0.262*	*0.269*	0 °C to +50 °C
	0.022	*0.136*	*0.139*	+15 °C to +35 °C
−50	*0.022*	*0.073*	*0.076*	+20 °C to +25 °C
	−50	0	+6	+20	+26	+40	

> 12.4 GHz to 18 GHz

+40	*0.275*	*0.280*	*0.034*	0 °C to +50 °C
	0.148	*0.150*	*0.033*	+15 °C to +35 °C
+26	*0.087*	*0.085*	*0.033*	+20 °C to +25 °C
+20	*0.266*	*0.035*	*0.280*	0 °C to +50 °C
	0.142	*0.028*	*0.150*	+15 °C to +35 °C
+6	*0.080*	*0.026*	*0.085*	+20 °C to +25 °C
0	*0.022*	*0.266*	*0.275*	0 °C to +50 °C
	0.022	*0.142*	*0.148*	+15 °C to +35 °C
−50	*0.022*	*0.080*	*0.087*	+20 °C to +25 °C
	−50	0	+6	+20	+26	+40	

R&S®NRP18S-25 high-power three-path diode power sensor

Specifications apply when the power sensor is operated together with the RF power attenuator supplied. Please refer to the specifications of the R&S®NRP18S when operating the power sensor section alone.

Frequency range		10 MHz to 18 GHz	
Impedance matching (SWR)	10 MHz to 2.4 GHz	< 1.14	
	> 2.4 GHz to 8.0 GHz	< 1.25	
	> 8.0 GHz to 12.4 GHz	< 1.30	
	> 12.4 GHz to 18.0 GHz	< 1.41	
Power measurement range	continuous average	30 nW to 30 W (−45 dBm to +45 dBm)	
	burst average	100 µW to 30 W (−10 dBm to +45 dBm)	
	timeslot/gate average	100 nW to 30 W (−40 dBm to +45 dBm) [1]	
	trace	600 nW to 30 W (−32 dBm to +45 dBm) [2]	
Maximum power	average power	36 W (+45.5 dBm) AVG	
	peak envelope power	300 W (+55 dBm) for max. 10 µs	
Measurement subranges	path 1	−45 dBm to +10 dBm	
	path 2	−28 dBm to +30 dBm	
	path 3	−8 dBm to +45 dBm	
Transition regions	with automatic path selection [3]	(+5 ± 2) dBm to (+11 ± 2) dBm (25 ± 2) dBm to (+31 ± 2) dBm	
Dynamic response	video bandwidth	> 100 kHz (150 kHz)	( ): +15 °C to +35 °C
	rise time 10 %/90 %	< 5 µs (3 µs)	
Acquisition	sample rate (continuous)	2 Msps	
	accuracy of time base	±5 ppm	
Triggering	Internal		
	threshold level range	−12 dBm to +45 dBm	
	threshold level accuracy	identical to uncertainty for absolute power measurements	
	threshold level hysteresis	0 dB to 10 dB	
	dropout [4]	0 s to 10 s	
	external	EXTernal[1]: R&S®NRX/NRP2 or R&S®NRP-Z5	
		EXTernal2: coaxial trigger I/O	
	slope (external, internal)	pos./neg.	
	delay	−5 s to +10 s	
	hold-off	0 s to 10 s	
	resolution (delay, hold-off, dropout)	0.5 µs (sample period)	
	source	INTernal, EXTernal[1], EXTernal2, IMMediate, BUS, HOLD	
Zero offset	initial, without zeroing		( ): typical at 1 GHz +15 °C to +35 °C
	path 1	< 100 (20) nW	
	path 2	< 4.2 (0.9) µW	
	path 3	< 430 (80) µW	
	after external zeroing [5]		
	path 1	< 21 (12) nW	
	path 2	< 880 (500) nW	
	path 3	< 90 (44) µW	
Zero drift [6]	path 1	< 5.1 (0.8) nW	
	path 2	< 210 (35) nW	
	path 3	< 22 (3) µW	
Measurement noise [7]	path 1	< 15 (8) nW	
	path 2	< 620 (350) nW	
	path 3	< 64 (31) µW	

Uncertainty for absolute power measurements [8] in dB

10 MHz to < 100 MHz

0.268	*0.242*	*0.264*	*0.303*	0 °C to +50 °C
0.129	*0.135*	*0.171*	*0.227*	+15 °C to +35 °C
0.083	*0.101*	*0.146*	*0.209*	+20 °C to +25 °C

−45 +35 +40 +43 +45
Power level in dBm

100 MHz to 2.4 GHz

0.224	*0.227*	*0.247*	*0.282*	0 °C to +50 °C
0.122	*0.133*	*0.165*	*0.214*	+15 °C to +35 °C
0.087	*0.102*	*0.141*	*0.196*	+20 °C to +25 °C

−45 +35 +40 +43 +45
Power level in dBm

> 2.4 GHz to 12.4 GHz

0.233	*0.239*	*0.258*	*0.292*	0 °C to +50 °C
0.145	*0.155*	*0.183*	*0.228*	+15 °C to +35 °C
0.108	*0.121*	*0.155*	*0.207*	+20 °C to +25 °C

−45 +35 +40 +43 +45
Power level in dBm

> 12.4 GHz to 18 GHz

0.250	*0.255*	*0.273*	*0.305*	0 °C to +50 °C
0.169	*0.177*	*0.202*	*0.244*	+15 °C to +35 °C
0.131	*0.141*	*0.171*	*0.219*	+20 °C to +25 °C

−45 +35 +40 +43 +45
Power level in dBm

Uncertainty for relative power measurements [9, 10] in dB

10 MHz to < 100 MHz

+43	*0.356*	*0.316*	*0.028*	0 °C to +50 °C
	0.162	*0.147*	*0.026*	+15 °C to +35 °C
+31	*0.076*	*0.069*	*0.026*	+20 °C to +25 °C
+25	*0.347*	*0.032*	*0.316*	0 °C to +50 °C
	0.157	*0.025*	*0.147*	+15 °C to +35 °C
+11	*0.073*	*0.024*	*0.069*	+20 °C to +25 °C
+5	*0.022*	*0.347*	*0.356*	0 °C to +50 °C
	0.022	*0.157*	*0.162*	+15 °C to +35 °C
−45	*0.022*	*0.073*	*0.076*	+20 °C to +25 °C

−45 +5 +11 +25 +31 +43
Power level in dBm

100 MHz to < 2.4 GHz

+43	*0.273*	*0.278*	*0.028*	0 °C to +50 °C
	0.136	*0.138*	*0.026*	+15 °C to +35 °C
+31	*0.068*	*0.067*	*0.026*	+20 °C to +25 °C
+25	*0.266*	*0.032*	*0.278*	0 °C to +50 °C
	0.133	*0.025*	*0.138*	+15 °C to +35 °C
+11	*0.066*	*0.024*	*0.067*	+20 °C to +25 °C
+5	*0.022*	*0.266*	*0.273*	0 °C to +50 °C
	0.022	*0.133*	*0.136*	+15 °C to +35 °C
−45	*0.022*	*0.066*	*0.068*	+20 °C to +25 °C

−45 +5 +11 +25 +31 +43
Power level in dBm

> 2.4 GHz to 12.4 GHz

+43	*0.269*	*0.274*	*0.030*	0 °C to +50 °C
	0.139	*0.140*	*0.028*	+15 °C to +35 °C
+31	*0.076*	*0.072*	*0.027*	+20 °C to +25 °C
+25	*0.262*	*0.033*	*0.274*	0 °C to +50 °C
	0.136	*0.026*	*0.140*	+15 °C to +35 °C
+11	*0.073*	*0.024*	*0.072*	+20 °C to +25 °C
+5	*0.022*	*0.262*	*0.269*	0 °C to +50 °C
	0.022	*0.136*	*0.139*	+15 °C to +35 °C
−45	*0.022*	*0.073*	*0.076*	+20 °C to +25 °C

−45 +5 +11 +25 +31 +43

> 12.4 GHz to 18 GHz

+43	*0.275*	*0.280*	*0.034*	0 °C to +50 °C
	0.148	*0.150*	*0.033*	+15 °C to +35 °C
+31	*0.087*	*0.085*	*0.033*	+20 °C to +25 °C
+25	*0.266*	*0.035*	*0.280*	0 °C to +50 °C
	0.142	*0.028*	*0.150*	+15 °C to +35 °C
+11	*0.080*	*0.026*	*0.085*	+20 °C to +25 °C
+5	*0.022*	*0.266*	*0.275*	0 °C to +50 °C
	0.022	*0.142*	*0.148*	+15 °C to +35 °C
−45	*0.022*	*0.080*	*0.087*	+20 °C to +25 °C

−45 +5 +11 +25 +31 +43

Additional characteristics of the R&S®NRPxxS(N)/18S-10/18S-20/18S-25 three-path diode power sensors and the R&S®NRP33SN-V/67SN-V TVAC-compliant three-path diode power sensors

Sensor type	R&S®NRPxxS(N)	three-path diode power sensor
	R&S®NRP18S-10/-20/-25	three-path diode power sensor with preceding RF power attenuator
	R&S®NRP33SN-V R&S®NRP67SN-V	three-path diode power sensor for use in thermal vacuum
Measurand		power of incident wave
		power of source (DUT) into 50 Ω [11]
RF connector	R&S®NRP8S(N)/NRP18S(N) R&S®NRP18S-10/-20/-25	N (male)
	R&S®NRP33S(N) R&S®NRP33SN-V	3.5 mm (male)
	R&S®NRP40S(N)	2.92 mm (male)
	R&S®NRP50S(N)	2.4 mm (male)
	R&S®NRP67S(N) R&S®NRP67SN-V	1.85 mm (male)
RF attenuation [12]	R&S®NRPxxS(N) R&S®NRP33SN-V R&S®NRP67SN-V	not applicable
	R&S®NRP18S-10	10 dB
	R&S®NRP18S-20	20 dB
	R&S®NRP18S-25	25 dB
Measurement functions	stationary and recurring waveforms	continuous average
		burst average
		timeslot/gate average
		trace
	single events	burst average
		timeslot/gate average
		trace
Continuous average function	measurand	mean power over recurring acquisition interval
	aperture	10 µs to 2.0 s (20 ms default)
	window function	uniform or von Hann [13]
	duty cycle correction [14]	0.001 % to 100.0 %
	capacity of measurement buffer [15]	1 to 8192 results
Burst average function	measurand	mean power over burst portion of recurring signal (trigger settings required)
	detectable burst width [16]	5 µs to 8 s
	minimum gap between bursts	5 µs
	dropout period [17] for burst end detection	1 µs to 300 ms
	exclusion periods [18]	
	start	0 s to 1 s
	end	0 s to 1 s
	resolution (dropout and exclusion periods)	0.5 µs (sample period)
Timeslot/gate average function	measurand	mean power over individual timeslots/gates
	number of timeslots/gates	1 to 32 (consecutive)
	nominal length	10 µs to 0.1 s
	start of first timeslot/gate	at delayed trigger event
	exclusion periods	
	start	0 s to 1 s
	end	0 s to 1 s
	resolution (nominal length and exclusion periods)	0.5 µs (sample period)
Trace function	measurand	mean, random, maximum and minimum power over pixel length
	acquisition	
	length	10 µs to 3.0 s
	start (referenced to delayed trigger)	–3.0 s to 3.0 s
	result	
	pixel	1 to 100 000
	resolution	≥ 0.5 µs (sample period)

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	1, 2, 4, 6, 8, 10 to 65536 (1 or all even numbers between 2 and 65536)	
	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 result output, independent of averaging number	
	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 [19]	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	
	total number of frequencies	≤ 80000	
Gamma correction	function	removes the influence of impedance mismatch from the measurement result so that the measurand corresponds to the power of the source (DUT) into 50 Ω	
	parameters	magnitude and phase of reflection coefficient of source (DUT)	
Frequency response correction	function	takes the frequency response of the sensor section and of the RF power attenuator into account (if applicable)	
	parameter	center frequency of test signal	
	residual uncertainty	see specification of calibration uncertainty and uncertainty for absolute and relative power measurements	
Measurement times [20] Av: averaging number	continuous average		
	single measurements	2 × (aperture + 100 µs) × Av + t_z	
	buffered measurements without averaging	2 × (aperture + 116 µs) × buffer size + t_z t_z = 2 ms (typ.)	
Zeroing (duration)		5.3 s	
Measurement error due to modulation [21]	general	depends on CCDF and RF bandwidth of test signal	
	WCDMA (3GPP test model 1 to 64)		
	worst case	–0.02 dB to +0.05 dB	
	typical	–0.01 dB to +0.03 dB	
	E-UTRA test model 1.1 (E-TM1.1), 20 MHz		
	worst case	–0.03 dB to +0.08 dB	
	typical	–0.02 dB to +0.05 dB	
Change of input reflection coefficient with respect to power [22]	R&S®NRP8S(N)/18S(N)/33S(N)/33SN-V/18S-10/18S-20/18S-25		
	10 MHz to 2.4 GHz	< 0.02 (0.01)	( ): +15 °C to +35 °C
	> 2.4 GHz	< 0.03 (0.02)	
	R&S®NRP40S(N)/50S(N) /67S(N)/67SN-V		
	50 MHz to 8.0 GHz	< 0.04 (0.02)	( ): levels ≤ 10 dBm
	> 8.0 GHz to 18.0 GHz	< 0.06 (0.03)	
	> 18.0 GHz to 26.5 GHz	< 0.07 (0.04)	
	> 26.5 GHz to 33.0 GHz	< 0.08 (0.05)	
	> 33.0 GHz to 40.0 GHz	< 0.09 (0.06)	
	> 40.0 GHz to 50.0 GHz	< 0.11 (0.07)	
	> 50.0 GHz to 67.0 GHz	< 0.12 (0.08)	

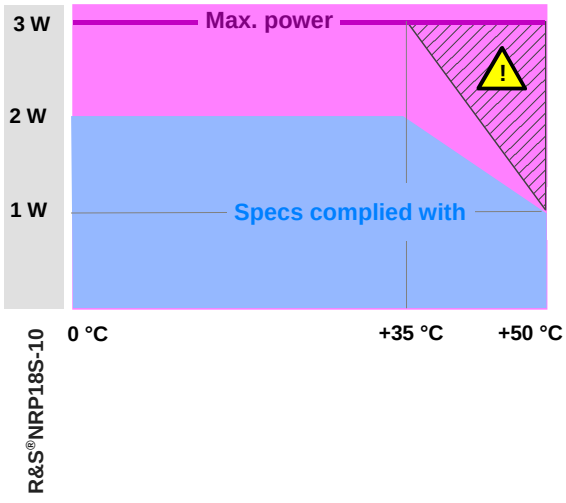
Calibration uncertainty [23]	R&S®NRP8S(N)/18S(N)/33S(N) R&S®NRP33SN-V	path 1	path 2	path 3
	10 MHz to < 100 MHz	*0.058 dB*	*0.052 dB*	*0.053 dB*
	100 MHz to 2.4 GHz	*0.060 dB*	*0.058 dB*	*0.058 dB*
	> 2.4 GHz to 8.0 GHz	*0.065 dB*	*0.062 dB*	*0.063 dB*
	> 8.0 GHz to 12.4 GHz	*0.075 dB*	*0.071 dB*	*0.072 dB*
	> 12.4 GHz to 18.0 GHz	*0.092 dB*	*0.088 dB*	*0.089 dB*
	> 18.0 GHz to 26.5 GHz	*0.093 dB*	*0.089 dB*	*0.090 dB*
	> 26.5 GHz to 33.0 GHz	*0.113 dB*	*0.108 dB*	*0.109 dB*
	R&S®NRP40S(N)/50S(N)/67S(N) R&S®NRP67SN-V	path 1	path 2	path 3
	50 MHz to < 200 MHz	*0.076 dB*	*0.070 dB*	*0.071 dB*
	200 MHz to 8.0 GHz	*0.080 dB*	*0.071 dB*	*0.072 dB*
	> 8.0 GHz to 12.4 GHz	*0.089 dB*	*0.079 dB*	*0.080 dB*
	> 12.4 GHz to 18.0 GHz	*0.104 dB*	*0.093 dB*	*0.094 dB*
	> 18.0 GHz to 26.5 GHz	*0.107 dB*	*0.092 dB*	*0.093 dB*
	> 26.5 GHz to 33.0 GHz	*0.123 dB*	*0.107 dB*	*0.108 dB*
	> 33.0 GHz to 40.0 GHz	*0.133 dB*	*0.115 dB*	*0.117 dB*
	> 40.0 GHz to 50.0 GHz	*0.168 dB*	*0.150 dB*	*0.152 dB*
	> 50.0 GHz to 67.0 GHz	*0.220 dB*	*0.199 dB*	*0.202 dB*
	R&S®NRP18S-10/-20/-25 [24]	path 1	path 2	path 3
	10 MHz to < 100 MHz	*0.083 dB*	*0.078 dB*	*0.079 dB*
	100 MHz to 2.4 GHz	*0.084 dB*	*0.083 dB*	*0.083 dB*
	> 2.4 GHz to 8.0 GHz	*0.088 dB*	*0.086 dB*	*0.087 dB*
	> 8.0 GHz to 12.4 GHz	*0.096 dB*	*0.093 dB*	*0.094 dB*
	> 12.4 GHz to 18.0 GHz	*0.111 dB*	*0.108 dB*	*0.109 dB*
Host interface	mechanical	8-pin male M12 connector (A-coded)		
	power supply	+5 V/0.5 A (USB high-power device)		
	speed	supports high-speed and full-speed modes according to the specification		
	remote control protocols	supports USB test and measurement device class (USBTMC) and legacy mode for compatibility with R&S®NRP-Zxx power sensors		
	trigger input EXTernal[1]	differential (0 V/+3.3 V)		
	reference clock			
	signal level	LVDS		
	frequency	20 MHz		
	permissible total cable length	≤ 5 m		
Ethernet interface only for R&S®NRPxxSN types and the R&S®NRP33SN-V/67SN-V	mechanical	RJ-45 jack		
	power supply	power over Ethernet (PoE) class 1 device		
	speed	10/100/1000 Mbit/s		
	remote control protocols	VXI11, HiSLIP (high-speed LAN instrument protocol), SCPI-RAW (port 5025)		
	permissible cable length	≤ 100 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 to +6 V		
	output	≥ 2 V into 50 Ω load, max. 5.3 V		

Vacuum-specific characteristics of the R&S®NRP33SN-V/67SN-V	recommended bake-out procedure	vacuum bake for 100 h at +85 °C and $P < 10^{-5}$ mbar
	typical mass loss during bake-out	85 mg
Mounting of R&S®NRPxxSN-V onto a baseplate for technical drawings see Appendix	general data	Two threaded through-holes are provided for mounting the sensor to a baseplate. Using a low-outgassing thermal interface material such as graphite foil is highly recommended.
	distance between mounting holes	2" (50.8 mm)
	thread standard	UNC 8-32
	thread length	¼ " (6.35 mm)
Dimensions (W × H × L)	R&S®NRPxxS	48 mm × 30 mm × 138 mm (1.89 in × 1.18 in × 5.43 in)
	R&S®NRPxxSN, R&S®NRP33SN-V/67SN-V	73 mm × 26 mm × 146 mm (2.87 in × 1.02 in × 5.75 in)
	R&S®NRP18S-10	48 mm × 30 mm × 184 mm (1.89 in × 1.18 in × 7.25 in)
	R&S®NRP18S-20	53 mm × 46 mm × 252 mm (2.09 in × 1.82 in × 9.93 in)
	R&S®NRP18S-25	53 mm × 46 mm × 310 mm (2.09 in × 1.82 in × 12.21 in)
Weight	R&S®NRPxxS	< 0.20 kg (0.44 lb)
	R&S®NRPxxSN, R&S®NRP33SN-V/67SN-V	< 0.35 kg (0.77 lb)
	R&S®NRP18S-10	< 0.27 kg (0.59 lb)
	R&S®NRP18S-20	< 0.37 kg (0.81 lb)
	R&S®NRP18S-25	< 0.47 kg (1.02 lb)

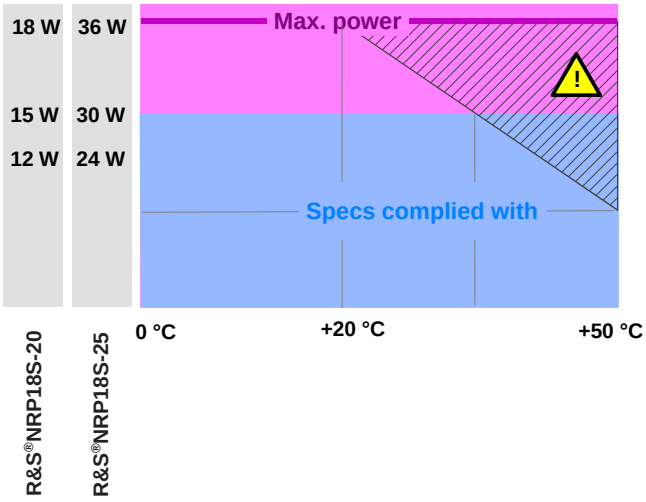
Power rating of the R&S®NRP18S-10/-20/-25

Hatched area: The maximum surface temperatures permitted by IEC 1010-1 are exceeded. Provide protection against inadvertent contacting or apply only a short-term load to the power sensor.

R&S®NRP18S-10



R&S®NRP18S-20/-25



Average power sensors

R&S®NRP6A(N)/18A(N) average power sensors

Specifications from 8 kHz to 6 GHz apply to the R&S®NRP6A(N).
Specifications from 8 kHz to 18 GHz apply to the R&S®NRP18A(N).

Frequency range	R&S®NRP6A(N)	8 kHz to 6 GHz	
	R&S®NRP18A(N)	8 kHz to 18 GHz	
Impedance matching (SWR)	8 kHz to < 20 kHz	< 1.25 (1.23)	( ): +15 °C to +35 °C
	20 kHz to 2.4 GHz	< 1.13 (1.11)	
	> 2.4 GHz to 8.0 GHz	< 1.20 (1.18)	
	> 8.0 GHz to 18.0 GHz	< 1.25 (1.23)	
Power measurement range		100 pW to 200 mW (–70 dBm to +23 dBm)	
Maximum power	average power	1 W (+30 dBm) AVG, max. 10 V DC	
	peak envelope power	2 W (+33 dBm) for max. 10 µs	
Measurement subranges	path 1	–70 dBm to –15 dBm	
	path 2	–53 dBm to +5 dBm	
	path 3	–33 dBm to +23 dBm	
Transition regions	with automatic path selection [3]	(–20 ± 1) dBm to (–14 ± 1) dBm (0 ± 1) dBm to (+6 ± 1) dBm	
Dynamic response	rise time 10 %/90 %	< 5 ms	
Acquisition	sample rate (continuous)	2 Msps	
	accuracy of time base	±5 ppm	
Zero offset	initial, without zeroing		( ): typical at 1 GHz +15 °C to +35 °C
	path 1	< 235 (50) pW	
	path 2	< 10.3 (2.2) nW	
	path 3	< 0.93 (0.19) µW	
	after external zeroing [5]		
	path 1	< 49 (28) pW	
	path 2	< 2.1 (1.3) nW	
	path 3	< 192 (108) nW	
Zero drift [6]	path 1	< 12 (2) pW	
	path 2	< 0.5 (0.1) nW	
	path 3	< 47 (8) nW	
Measurement noise [7]	path 1	< 35 (20) pW	
	path 2	< 1.5 (0.9) nW	
	path 3	< 136 (76) nW	

Uncertainty for absolute power measurements [8] in dB

8 kHz to < 20 kHz

0.238	*0.229*	*0.223*
0.093	*0.093*	*0.089*
0.052	*0.052*	*0.051*

–70 –20 0 +23
Power level in dBm

20 kHz to < 100 MHz

0.166	*0.171*	*0.166*
0.080	*0.082*	*0.081*
0.054	*0.053*	*0.054*

–70 –20 0 +23
Power level in dBm

0 °C to +50 °C
+15 °C to +35 °C
+20 °C to +25 °C

100 MHz to 2.4 GHz

0.161	*0.168*	*0.163*
0.081	*0.083*	*0.082*
0.054	*0.054*	*0.054*

–70 –20 0 +23
Power level in dBm

> 2.4 GHz to 8 GHz

0.158	*0.165*	*0.160*
0.082	*0.083*	*0.081*
0.056	*0.055*	*0.055*

–70 –20 0 +23
Power level in dBm

0 °C to +50 °C
+15 °C to +35 °C
+20 °C to +25 °C

> 8 GHz to 12.4 GHz

0.166	*0.172*	*0.166*
0.096	*0.096*	*0.095*
0.076	*0.073*	*0.074*

–70 –20 0 +23
Power level in dBm

> 12.4 GHz to 18 GHz

0.174	*0.182*	*0.178*
0.110	*0.111*	*0.112*
0.092	*0.090*	*0.094*

–70 –20 0 +23
Power level in dBm

0 °C to +50 °C
+15 °C to +35 °C
+20 °C to +25 °C

Uncertainty for relative power measurements [9] in dB

8 kHz to < 20 kHz

+23	0.299	0.292	0.027	0 °C to +50 °C
	0.107	0.105	0.026	+15 °C to +35 °C
+6	0.046	0.041	0.026	+20 °C to +25 °C
0	0.293	0.029	0.292	0 °C to +50 °C
	0.104	0.024	0.105	+15 °C to +35 °C
–14	0.044	0.023	0.041	+20 °C to +25 °C
–20	0.022	0.293	0.299	0 °C to +50 °C
	0.022	0.104	0.107	+15 °C to +35 °C
–70	0.022	0.044	0.046	+20 °C to +25 °C

–70 –20 –14 0 +6 +23
Power level in dBm

20 kHz to < 100 MHz

+23	0.220	0.222	0.027	0 °C to +50 °C
	0.094	0.093	0.026	+15 °C to +35 °C
+6	0.044	0.040	0.026	+20 °C to +25 °C
0	0.214	0.028	0.222	0 °C to +50 °C
	0.091	0.024	0.093	+15 °C to +35 °C
–14	0.042	0.023	0.040	+20 °C to +25 °C
–20	0.022	0.214	0.220	0 °C to +50 °C
	0.022	0.091	0.094	+15 °C to +35 °C
–70	0.022	0.042	0.044	+20 °C to +25 °C

–70 –20 –14 0 +6 +23
Power level in dBm

100 MHz to 2.4 GHz

+23	0.213	0.217	0.027	0 °C to +50 °C
	0.093	0.093	0.026	+15 °C to +35 °C
+6	0.045	0.040	0.026	+20 °C to +25 °C
0	0.208	0.028	0.217	0 °C to +50 °C
	0.090	0.024	0.093	+15 °C to +35 °C
–14	0.043	0.023	0.040	+20 °C to +25 °C
–20	0.022	0.208	0.213	0 °C to +50 °C
	0.022	0.090	0.093	+15 °C to +35 °C
–70	0.022	0.043	0.045	+20 °C to +25 °C

–70 –20 –14 0 +6 +23
Power level in dBm

> 2.4 GHz to 8 GHz

+23	0.211	0.214	0.027	0 °C to +50 °C
	0.095	0.093	0.026	+15 °C to +35 °C
+6	0.050	0.042	0.026	+20 °C to +25 °C
0	0.205	0.028	0.214	0 °C to +50 °C
	0.092	0.024	0.093	+15 °C to +35 °C
–14	0.047	0.023	0.042	+20 °C to +25 °C
–20	0.022	0.205	0.211	0 °C to +50 °C
	0.022	0.092	0.095	+15 °C to +35 °C
–70	0.022	0.047	0.050	+20 °C to +25 °C

–70 –20 –14 0 +6 +23
Power level in dBm

> 8 GHz to 12.4 GHz

+23	0.212	0.215	0.029	0 °C to +50 °C
	0.099	0.097	0.027	+15 °C to +35 °C
+6	0.056	0.048	0.027	+20 °C to +25 °C
0	0.207	0.029	0.215	0 °C to +50 °C
	0.095	0.025	0.097	+15 °C to +35 °C
–14	0.052	0.024	0.048	+20 °C to +25 °C
–20	0.022	0.207	0.212	0 °C to +50 °C
	0.022	0.095	0.099	+15 °C to +35 °C
–70	0.022	0.052	0.056	+20 °C to +25 °C

–70 –20 –14 0 +6 +23
Power level in dBm

> 12.4 GHz to 18 GHz

+23	0.219	0.223	0.034	0 °C to +50 °C
	0.109	0.108	0.033	+15 °C to +35 °C
+6	0.069	0.064	0.032	+20 °C to +25 °C
0	0.212	0.031	0.223	0 °C to +50 °C
	0.102	0.027	0.108	+15 °C to +35 °C
–14	0.061	0.026	0.064	+20 °C to +25 °C
–20	0.022	0.212	0.219	0 °C to +50 °C
	0.022	0.102	0.109	+15 °C to +35 °C
–70	0.022	0.061	0.069	+20 °C to +25 °C

–70 –20 –14 0 +6 +23
Power level in dBm

Additional characteristics of the R&S®NRPxxA(N) average power sensors

Sensor type		three-path diode power sensor
Measurand		power of incident wave
		power of source (DUT) into 50 Ω [11]
RF connector		N (male)
Measurement functions	stationary and recurring waveforms	continuous average
Continuous average function	measurand	mean power over recurring acquisition interval
	aperture	10 µs to 2.0 s (20 ms default)
	window function	uniform or von Hann [13]
	duty cycle correction [14]	0.001 % to 100.0 %
	capacity of measurement buffer [15]	1 to 8192 results
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	1, 2, 4, 6, 8, 10 to 65536 (1 or all even numbers between 2 and 65536)
	auto on/once	
	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 result output, independent of averaging number
	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
	total number of frequencies	≤ 80000
Gamma correction	function	removes the influence of impedance mismatch from the measurement result so that the measurand corresponds to the power of the source (DUT) into 50 Ω
	parameters	magnitude and phase of reflection coefficient of source (DUT)
Frequency response correction	function	takes the frequency response of the sensor section and of the RF power attenuator into account (if applicable)
	parameter	center frequency of test signal
	residual uncertainty	see specification of calibration uncertainty and uncertainty for absolute and relative power measurements
Measurement time [20] Av: averaging number	continuous average	
	single measurements	2 × (aperture + 5 ms) × Av –5 ms + t_z t_z = 2 ms (typ.)
Zeroing (duration)		6.6 s
Measurement error due to modulation [21]	general	depends on CCDF and RF bandwidth of test signal
	WCDMA (3GPP test model 1 to 64)	
	worst case	–0.02 dB to +0.05 dB
	typical	–0.01 dB to +0.03 dB
	E-UTRA test model 1.1 (E-TM1.1), 20 MHz	
	worst case	–0.03 dB to +0.08 dB
	typical	–0.02 dB to +0.05 dB

Change of input reflection co-efficient with respect to power [22]	8 kHz to 2.4 GHz	< 0.02 (0.01)	( ): +15 °C to +35 °C	
	> 2.4 GHz	< 0.03 (0.02)		
Calibration uncertainty [23]		path 1	path 2	path 3
	8 kHz to < 20 kHz	*0.052 dB*	*0.050 dB*	*0.050 dB*
	20 kHz to < 100 MHz	*0.055 dB*	*0.052 dB*	*0.053 dB*
	100 MHz to 2.40 GHz	*0.054 dB*	*0.052 dB*	*0.053 dB*
	> 2.4 GHz to 8.0 GHz	*0.056 dB*	*0.053 dB*	*0.053 dB*
	> 8.0 GHz to 12.4 GHz	*0.065 dB*	*0.062 dB*	*0.062 dB*
	> 12.4 GHz to 18.0 GHz	*0.076 dB*	*0.073 dB*	*0.075 dB*
Host interface	mechanical	8-pin male M12 connector (A-coded)		
	power supply	+5 V/0.5 A (USB high-power device)		
	speed	supports high-speed and full-speed modes according to the specification		
	remote control protocols	supports USB test and measurement device class (USBTMC) and legacy mode for compatibility with R&S®NRP-Zxx power sensors		
	trigger input EXTernal[1]	differential (0 V/+3.3 V)		
	reference clock			
	signal level	LVDS		
	frequency	20 MHz		
	permissible total cable length	≤ 5 m		
Ethernet interface only for R&S®NRPxxAN types	mechanical	RJ-45 jack		
	power supply	power over Ethernet (PoE) class 1 device		
	speed	10/100/1000 Mbit/s		
	remote control protocols	VXI11, HiSLIP (high-speed LAN instrument protocol), SCPI-RAW (port 5025)		
	permissible cable length	≤ 100 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 to +6 V		
	output	≥ 2 V into 50 Ω load, max. 5.3 V		
Dimensions (W × H × L)	R&S®NRPxxA	48 mm × 30 mm × 138 mm (1.89 in × 1.18 in × 5.43 in)		
	R&S®NRPxxAN	73 mm × 26 mm × 146 mm (2.87 in × 1.02 in × 5.75 in)		
Weight	R&S®NRPxxA	< 0.20 kg (0.44 lb)		
	R&S®NRPxxAN	< 0.35 kg (0.77 lb)		

Thermal power sensors

R&S®NRP18T(N)/33T(N)/40T(N)/50T(N)/67T(N) thermal power sensors

Specifications from DC to 18 GHz apply to the R&S®NRP18T(N).
Specifications from DC to 33 GHz apply to the R&S®NRP33T(N).
Specifications from DC to 40 GHz apply to the R&S®NRP40T(N).
Specifications from DC to 50 GHz apply to the R&S®NRP50T(N).
Specifications from DC to 67 GHz apply to the R&S®NRP67T(N).

Frequency range	R&S®NRP18T(N)	DC to 18 GHz		
	R&S®NRP33T(N)	DC to 33 GHz		
	R&S®NRP40T(N)	DC to 40 GHz		
	R&S®NRP50T(N)	DC to 50 GHz		
	R&S®NRP67T(N)	DC to 67 GHz		
Impedance matching (SWR)	DC to 100 MHz	< 1.03		
	> 100 MHz to 2.4 GHz	< 1.06		
	> 2.4 GHz to 12.4 GHz	< 1.13		
	> 12.4 GHz to 18.0 GHz	< 1.16		
	> 18.0 GHz to 26.5 GHz	< 1.22		
	> 26.5 GHz to 33.0 GHz	< 1.28		
	> 33.0 GHz to 40.0 GHz	< 1.28		
	> 40.0 GHz to 44.0 GHz	< 1.30		
	> 44.0 GHz to 50.0 GHz	< 1.30		
	> 50.0 GHz to 67.0 GHz	< 1.35		
Power measurement range		300 nW to 100 mW (–35 dBm to +20 dBm), continuous, in a single range		
Maximum power	average power	0.3 W (+25 dBm), continuous		
	peak envelope power			
	R&S®NRP18T(N)	20 W (43 dBm) for max. 1 µs		
	R&S®NRP33T(N)/40T(N)/ 50T(N)/67T(N)	10 W (40 dBm) for max. 1 µs		
Acquisition	sample rate	50 ksps (sigma-delta)		
	accuracy of time base	±5 ppm		
Zero offset	after external zeroing [5]	< 25 nW (typ. 15 nW at 1 GHz)		
Zero drift [6]		< 8 nW		
Measurement noise [7]		< 25 nW (typ. 15 nW at 1 GHz)		
Uncertainty for absolute power measurements [25]		+20 °C to +25 °C	+15 °C to +35 °C	0 °C to +50 °C
	DC to 100 MHz	*0.040 dB*	*0.046 dB*	*0.067 dB*
	> 100 MHz to 2.4 GHz	*0.048 dB*	*0.053 dB*	*0.072 dB*
	> 2.4 GHz to 8.0 GHz	*0.054 dB*	*0.059 dB*	*0.079 dB*
	> 8.0 GHz to 12.4 GHz	*0.063 dB*	*0.068 dB*	*0.085 dB*
	> 12.4 GHz to 18.0 GHz	*0.082 dB*	*0.086 dB*	*0.100 dB*
	> 18.0 GHz to 26.5 GHz	*0.086 dB*	*0.086 dB*	*0.102 dB*
	> 26.5 GHz to 33.0 GHz	*0.101 dB*	*0.105 dB*	*0.121 dB*
	> 33.0 GHz to 40.0 GHz	*0.108 dB*	*0.112 dB*	*0.127 dB*
	> 40.0 GHz to 44.0 GHz	*0.138 dB*	*0.141 dB*	*0.155 dB*
	> 44.0 GHz to 50.0 GHz	*0.143 dB*	*0.146 dB*	*0.159 dB*
	> 50.0 GHz to 59.0 GHz	*0.206 dB*	*0.208 dB*	*0.220 dB*
	> 59.0 GHz to 67.0 GHz	*0.209 dB*	*0.212 dB*	*0.223 dB*
Uncertainty for relative power measurements [26]		*0.010 dB*		

R&S®NRP90T(N)/110T thermal power sensors

Specifications from DC to 90 GHz apply to the R&S®NRP90T(N).
Specifications from DC to 110 GHz apply to the R&S®NRP110T.

Frequency range	R&S®NRP90T(N)	DC to 90 GHz (calibrated up to 98 GHz [27])		
	R&S®NRP110T	DC to 110 GHz		
Impedance matching (SWR)	DC to 100 MHz	< 1.05		
	> 100 MHz to 2.4 GHz	< 1.08		
	> 2.4 GHz to 12.4 GHz	< 1.18		
	> 12.4 GHz to 18.0 GHz	< 1.23		
	> 18.0 GHz to 26.5 GHz	< 1.28		
	> 26.5 GHz to 40.0 GHz	< 1.38		
	> 40.0 GHz to 50.0 GHz	< 1.46		
	> 50.0 GHz to 67.0 GHz	< 1.56		
	> 67.0 GHz to 80.0 GHz	< 1.60		
	> 80.0 GHz to 95.0 GHz	< 1.66		
	> 95.0 GHz to 110.0 GHz	< 1.70		
Power measurement range		300 nW to 100 mW (–35 dBm to +20 dBm), continuous, in a single range		
Maximum power	average power	0.3 W (+25 dBm), continuous		
	peak envelope power	10 W (40 dBm) for max. 1 µs		
Acquisition	sample rate	50 ksps (sigma-delta)		
	accuracy of time base	±5 ppm		
Zero offset	after external zeroing [5]	< 34 nW (typ. 15 nW at 1 GHz)		
Zero drift [6]		< 11 nW		
Measurement noise [7]		< 34 nW (typ. 15 nW at 1 GHz)		
Uncertainty for absolute power measurements [25, 27]		+20 °C to +25 °C	+15 °C to +35 °C	0 °C to +50 °C
	DC to 100 MHz	*0.041 dB*	*0.047 dB*	*0.068 dB*
	> 100 MHz to 2.4 GHz	*0.051 dB*	*0.057 dB*	*0.074 dB*
	> 2.4 GHz to 12.4 GHz	*0.074 dB*	*0.078 dB*	*0.093 dB*
	> 12.4 GHz to 18.0 GHz	*0.098 dB*	*0.101 dB*	*0.113 dB*
	> 18.0 GHz to 26.5 GHz	*0.099 dB*	*0.103 dB*	*0.115 dB*
	> 26.5 GHz to 40.0 GHz	*0.118 dB*	*0.122 dB*	*0.135 dB*
	> 40.0 GHz to 50.0 GHz	*0.166 dB*	*0.169 dB*	*0.182 dB*
	> 50.0 GHz to 59.0 GHz	*0.226 dB*	*0.229 dB*	*0.244 dB*
	> 59.0 GHz to 67.0 GHz	*0.231 dB*	*0.235 dB*	*0.249 dB*
	> 67.0 GHz to 80.0 GHz	*0.251 dB*	*0.255 dB*	*0.270 dB*
	> 80.0 GHz to 95.0 GHz	*0.269 dB*	*0.273 dB*	*0.289 dB*
	> 95.0 GHz to 110.0 GHz	*0.290 dB*	*0.294 dB*	*0.311 dB*
Uncertainty for relative power measurements [26]	DC to 67.0 GHz	*0.010 dB*		
	> 67.0 GHz to 110.0 GHz	*0.014 dB*		

Additional characteristics of the R&S®NRP18T(N)/33T(N)/40T(N)/50T(N)/67T(N)/90T(N)/110T thermal power sensors

Sensor type		thermoelectric power sensor
Measurand		power of incident wave
		power of source (DUT) into 50 Ω [11]
RF connector	R&S®NRP18T(N)	N (male)
	R&S®NRP33T(N)	3.50 mm (male)
	R&S®NRP40T(N)	2.92 mm (male)
	R&S®NRP50T(N)	2.40 mm (male)
	R&S®NRP67T(N)	1.85 mm (male)
	R&S®NRP90T(N)	1.35 mm (male)
	R&S®NRP110T	1.00 mm (male)
Measurement function	stationary and recurring waveforms	continuous average
Continuous average function	measurand	mean power over recurring acquisition interval
	aperture	0.5 ms to 300 ms (5 ms default)
	window function	uniform or von Hann [13]
	duty cycle correction [14]	0.001 % to 100.0 %
	capacity of measurement buffer [15]	1 to 8192 results
Averaging filter	modes	auto off (fixed averaging number)
		auto on (continuously auto-adapted)
		auto once (automatically fixed once)
	auto off	
	averaging number	1, 2, 4, 6, 8, 10 to 65536 (1 or all even numbers between 2 and 65536)
	auto on/once	
	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 result output, independent of averaging number
	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
	frequencies	0 to 999
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 and relative power measurements
Measurement time [20] Av: averaging number	continuous average single measurements	2 × (aperture + 300 µs) × Av + t_z + t_d t_z : = 4 ms (typ.) t_d must be taken into account when auto delay is active
	delay time t_d	
	R&S®NRP18T(N)	80 ms
	R&S®NRP33T(N)/40T(N)/50T(N)/ 67T(N)/90T(N)/110T	40 ms
Zeroing (duration)		10 s
Change of input reflection co-efficient with respect to power [22]	only for power levels > 15 dBm	< 0.005

Calibration uncertainty [28]	R&S®NRP18T(N)/33T(N)/40T(N)/50T(N)/67T(N)	
	DC to 100 MHz	*0.040 dB*
	> 100 MHz to 2.4 GHz	*0.047 dB*
	> 2.4 GHz to 8.0 GHz	*0.054 dB*
	> 8.0 GHz to 12.4 GHz	*0.063 dB*
	> 12.4 GHz to 18.0 GHz	*0.082 dB*
	> 18.0 GHz to 26.5 GHz	*0.085 dB*
	> 26.5 GHz to 33.0 GHz	*0.101 dB*
	> 33.0 GHz to 40.0 GHz	*0.108 dB*
	> 40.0 GHz to 44.0 GHz	*0.138 dB*
	> 44.0 GHz to 50.0 GHz	*0.143 dB*
	> 50.0 GHz to 59.0 GHz	*0.190 dB*
	> 59.0 GHz to 67.0 GHz	*0.193 dB*
	R&S®NRP90T(N)/110T	
	DC to 100 MHz	*0.041 dB*
	> 100 MHz to 2.4 GHz	*0.051 dB*
	> 2.4 GHz to 12.4 GHz	*0.074 dB*
	> 12.4 GHz to 18.0 GHz	*0.098 dB*
	> 18.0 GHz to 26.5 GHz	*0.099 dB*
	> 26.5 GHz to 40.0 GHz	*0.118 dB*
	> 40.0 GHz to 50.0 GHz	*0.166 dB*
	> 50.0 GHz to 59.0 GHz	*0.211 dB*
	> 59.0 GHz to 67.0 GHz	*0.217 dB*
	> 67.0 GHz to 80.0 GHz	*0.220 dB*
	> 80.0 GHz to 95.0 GHz	*0.240 dB*
	> 95.0 GHz to 110.0 GHz	*0.263 dB*
Linearity [29]	DC to 67.0 GHz	*0.007 dB*
	> 67.0 GHz to 110.0 GHz	*0.010 dB*
Temperature effect [30]	DC to 100 MHz	< 0.002 dB/K
	> 100 MHz to 50.0 GHz	< 0.003 dB/K
	> 50.0 GHz to 110.0 GHz	< 0.004 dB/K
Host interface	mechanical	8-pin male M12 connector (A-coded)
	power supply	+5 V/0.5 A (USB high-power device)
	speed	supports high-speed and full-speed modes according to the specification
	remote control protocols	supports USB test and measurement device class (USBTMC) and legacy mode for compatibility with R&S®NRP-Zxx power sensors
	trigger input EXTernal[1]	differential (0 V/+3.3 V)
	reference clock	
	signal level	LVDS
	frequency	20 MHz
	permissible total cable length	≤ 5 m
Ethernet interface only for R&S®NRPxxTN types	mechanical	RJ-45 jack
	power supply	power over Ethernet (PoE) class 1 device
	speed	10/100/1000 Mbit/s
	remote control protocols	VXI11, HiSLIP (high-speed LAN instrument protocol), SCPI-RAW (port 5025)
	permissible cable length	≤ 100 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)	R&S®NRPxxT	48 mm × 30 mm × 138 mm (1.89 in × 1.18 in × 5.43 in)
	R&S®NRPxxTN	73 mm × 26 mm × 146 mm (2.87 in × 1.02 in × 5.75 in)
Weight	R&S®NRPxxT	< 0.20 kg (0.44 lb)
	R&S®NRPxxTN	< 0.35 kg (0.77 lb)

Thermal waveguide power sensors

R&S®NRP75TWG/90TWG/110TWG thermal waveguide power sensors

Specifications from 50 GHz to 75 GHz apply to the R&S®NRP75TWG.
Specifications from 60 GHz to 90 GHz apply to the R&S®NRP90TWG.
Specifications from 75 GHz to 110 GHz apply to the R&S®NRP110TWG.

Frequency range	R&S®NRP75TWG	50 GHz to 75 GHz		
	R&S®NRP90TWG	60 GHz to 90 GHz		
	R&S®NRP110TWG	75 GHz to 110 GHz		
Impedance matching (SWR)		< 1.35		
Power measurement range		300 nW to 100 mW (–35 dBm to +20 dBm), continuous, in a single range		
Maximum power	average power	0.3 W (+25 dBm), continuous		
	peak envelope power	10 W (40 dBm) for max. 1 µs		
Acquisition	sample rate	50 ksps (sigma-delta)		
	accuracy of time base	±5 ppm		
Zero offset	after external zeroing [5]	< 28 nW (typ. 20 nW)		
Zero drift [6]		< 10 nW		
Measurement noise [7]		< 28 nW (typ. 20 nW)		
Uncertainty for absolute power measurements [25]		+20 °C to +25 °C	+15 °C to +35 °C	0 °C to +50 °C
	R&S®NRP75TWG, 50 GHz to 75 GHz	*0.190 dB*	*0.193 dB*	*0.204 dB*
	R&S®NRP90TWG, 60 GHz to 90 GHz	*0.194 dB*	*0.197 dB*	*0.208 dB*
	R&S®NRP110TWG, 75 GHz to 110 GHz	*0.198 dB*	*0.201 dB*	*0.212 dB*
Uncertainty for relative power measurements [26]		*0.014 dB*		

Additional characteristics of the R&S®NRP75TWG/90TWG/110TWG thermal waveguide power sensors

Sensor type		thermoelectric power sensor
Measurand		power of incident wave
		power of source (DUT) into matched waveguide [11]
RF connector	R&S®NRP75TWG	WR15
	R&S®NRP90TWG	WR12
	R&S®NRP110TWG	WR10
Measurement function	stationary and recurring waveforms	continuous average
Continuous average function	measurand	mean power over recurring acquisition interval
	aperture	0.5 ms to 300 ms (5 ms default)
	window function	uniform or von Hann [13]
	duty cycle correction [14]	0.001 % to 100.0 %
	capacity of measurement buffer [15]	1 to 8192 results
Averaging filter	modes	auto off (fixed averaging number)
		auto on (continuously auto-adapted)
		auto once (automatically fixed once)
	auto off	
	averaging number	1, 2, 4, 6, 8, 10 to 65536 (1 or all even numbers between 2 and 65536)
	auto on/once	
	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 result output, independent of averaging number
	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
	frequencies	0 to 999
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 and relative power measurements
Measurement time [20] Av: averaging number	continuous average single measurements	2 × (aperture + 300 µs) × Av + t_z + t_d t_z : = 4 ms (typ.) t_d must be taken into account when auto delay is active
	delay time t_d	150 ms
Zeroing (duration)		10 s
Change of input reflection co-efficient with respect to power [22]	only for power levels > 15 dBm	< 0.005

Calibration uncertainty [28]	R&S®NRP75TWG	
	50 GHz to 75 GHz	*0.180 dB*
	R&S®NRP90TWG	
	60 GHz to 90 GHz	*0.184 dB*
	R&S®NRP110TWG	
	75 GHz to 110 GHz	*0.188 dB*
Linearity [29]		*0.010 dB*
Temperature effect [30]		< 0.004 dB/K
Host interface	mechanical	8-pin male M12 connector (A-coded)
	power supply	+5 V/0.5 A (USB high-power device)
	speed	supports high-speed and full-speed modes according to the specification
	remote control protocols	supports USB test and measurement device class (USBTMC) and legacy mode for compatibility with R&S®NRP-Zxx power sensors
	trigger input EXTernal[1]	differential (0 V/+3.3 V)
	reference clock	
	signal level	LVDS
	frequency	20 MHz
	permissible total cable length	≤ 5 m
Ethernet interface only for R&S®NRPxxTN types	mechanical	RJ-45 jack
	power supply	power over Ethernet (PoE) class 1 device
	speed	10/100/1000 Mbit/s
	remote control protocols	VXI11, HiSLIP (high-speed LAN instrument protocol), SCPI-RAW (port 5025)
	permissible cable length	≤ 100 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 × 128 mm (1.89 in × 1.18 in × 5.04 in)
Weight		< 0.20 kg (0.44 lb)

Accessories for R&S®NRP power sensors

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 (type A receptacle), e.g. on a PC, USB hub or a Rohde & Schwarz instrument.

Connectors	sensor side	8-pin female M12 connector (A-coded)
	host side	USB type 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-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 a Rohde & Schwarz instrument providing a 6-pole circular receptacle for R&S®NRP power sensors.

Connectors	sensor side	8-pin female 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/-Z3/-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 NRX to sensors A, B, C and D.

Connectors	sensor side	8-pin female 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.

R&S®NRP-ZKVSRJ Ethernet cables for TVAC applications

The R&S®NRP-ZKVSRJ Gigabit Ethernet cables are used to connect the R&S®NRP33SN-V and R&S®NRP67SN-V power sensors to a PoE-capable Ethernet switch, a PoE injector or to the vacuum side of an RJ-45 vacuum feedthrough.

Connectors		2 × RJ-45
Length	model .02	1.50 m
	model .03	3.00 m
	model .05	5.00 m
	model .15	15.00 m
	model .30	30.00 m
	model .60	60.00 m
Electrical specifications	cable category	Cat. 6
	conductor type	26 AWG (stranded)
Temperature range	operating and non-operating	–40 °C to +120 °C
Vacuum-specific specifications	insulation and sheath material	FEP
	bake-out procedure (performed in factory)	vacuum bake for 72 h at (100 ± 10) °C and $P < 5 \cdot 10^{-4}$ mbar, in line with MSFC-SPEC-684
	packaging	metalized polyester foil, vacuum welded

R&S®NRP-ZKVSMD Ethernet cables for TVAC applications

The R&S®NRP-ZKVSMD Gigabit Ethernet cables are used to connect the R&S®NRP33SN-V and R&S®NRP67SN-V power sensors to the vacuum side of a 9-pole Micro-D (f) vacuum feedthrough. They are complemented by the R&S®NRP-ZKASMD air side cables.

Connectors		1 × RJ-45
		1 × Micro-D (m), in line with MIL-DTL-83513
Length	model .02	1.50 m
	model .03	3.00 m
	model .05	5.00 m
	model .15	15.00 m
	model .30	30.00 m
	model .60	60.00 m
Electrical specifications	cable category	Cat. 6
	conductor type	26 AWG (stranded)
Temperature range	operating and non-operating	–40 °C to +120 °C
Vacuum-specific specifications	insulation and sheath material	FEP
	bake-out procedure (performed in factory)	vacuum bake for 72 h at (100 ± 10) °C and $P < 5 \cdot 10^{-4}$ mbar, in line with MSFC-SPEC-684
	packaging	metalized polyester foil, vacuum welded

R&S®NRP-ZKASMD Ethernet cables (air side cables)

The R&S®NRP-ZKASMD Gigabit Ethernet cables are used to connect the air side of a 9-pole Micro-D (f) vacuum feedthrough to a PoE-capable Ethernet switch, a PoE injector, etc. The pinout of the Micro-D connector matches the R&S®NRP-ZKVSMD vacuum side cables.

Connectors		1 × Micro-D (m), in line with MIL-DTL-83513
		1 × RJ-45
Length	model .02	1.50 m
	model .03	3.00 m
	model .05	5.00 m
	model .15	15.00 m
	model .30	30.00 m
	model .60	60.00 m
Electrical specifications	cable category	Cat. 6
	conductor type	26 AWG (stranded)
Temperature range	operating and non-operating	–20 °C to +120 °C
Vacuum-specific specifications	insulation and sheath material	FEP
	bake-out procedure (performed in factory)	none

The R&S®NRP-ZKASMD cables have a visible marking that identifies them as air side cables. Though they are not designed for vacuum use and are not vacuum baked in factory, their FEP insulation and sheathing prevents serious contamination of the vacuum chamber through inadvertent vacuum-side use.

General data for R&S®NRP power sensors and accessories

Temperature [31]	R&S®NRPxxS(N), R&S®NRP18S-10/-20/-25 R&S®NRPxxT(N), R&S®NRPxxA(N), R&S®NRP-ZKx	
	operating temperature range	0 °C to +50 °C
	permissible temperature range	–10 °C to +55 °C
	storage temperature range	–40 °C to +85 °C
	R&S®NRP33SN-V/67SN-V	
	operating temperature range	0 °C to +50 °C
	permissible temperature range	–10 °C to +60 °C
	storage temperature range	–40 °C to +85 °C
Climatic resistance	damp heat	+25 °C/+55 °C cyclic at 95 % relative humidity with restrictions: noncondensing, 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	R&S®NRPxxS(N), R&S®NRP18S-10/-20/-25 R&S®NRPxxT(N), R&S®NRPxxA(N), R&S®NRP-ZKx	
	operating	max. 2000 m
	transport	max. 15000 m
Air pressure	R&S®NRP33SN-V/67SN-V	
	operating [32]	0 hPa to 1060 hPa
	transport	0 hPa to 1060 hPa
Electromagnetic compatibility		applied harmonized standards: • EN 61326-1 • EN 61326-2-1 • EN 55011 (class B)
Calibration interval	recommended	2 years

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, 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 [33], 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 [33]	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	
	digital values	selectable in four steps: • 1 dB/1.0 %/2 ½ digits (W, quotient) • 0.1 dB/1.0 %/2 ½ digits (W, quotient) • 0.01 dB/0.1 %/3 ½ digits (W, quotient) • 0.001 dB/0.01 %/4 ½ digits (W, quotient)
	bargraph	depending on user-definable scale end values
	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 (female)
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 (female)
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
	Out 2 (analog output 2)	recorder output; user-definable linear relation to measurement result
	electrical characteristics	see Out 1
	connector	BNC (female)
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 63Hz 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 61326-2-1 • EN 55011 (class B) • EN 55022 (class B) • EN 61000-3-2 • EN 61000-3-3
Electrical safety	EU: in line with Low Voltage Directive 2006/95/EC	applied harmonized standard: EN 61010-1
	USA	UL 61010-1
	Canada	CAN/CSA-C22.2 No. 61010-1
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)

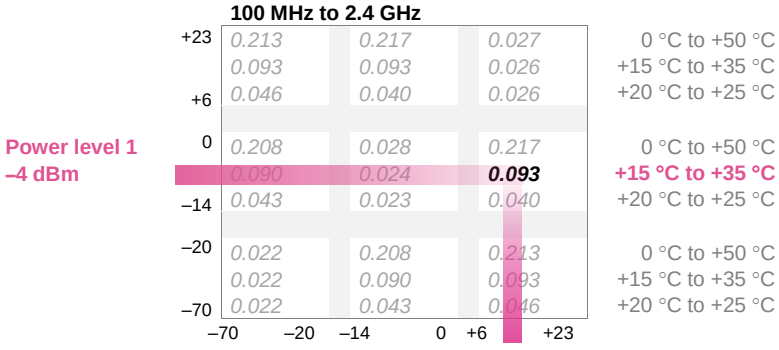
Options for the R&S®NRX base unit

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	*1.00 %* at 50 MHz, 0 dBm *1.30 %* at 50 MHz, −20 dBm, −10 dBm, +10 dBm, +20 dBm *1.50 %* at 1 GHz
	pulse repetition frequency	10 kHz ± 5 ppm [34]
	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 (female) 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/IEEE488 interface	application	provides a GPIB/IEEE488 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
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)

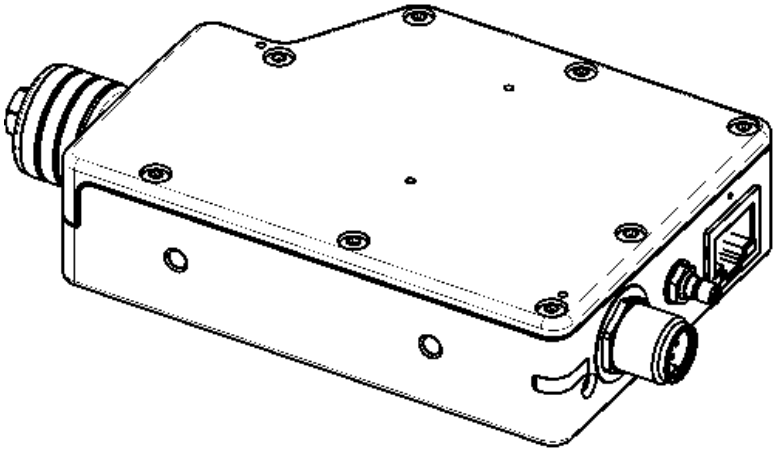
Appendix

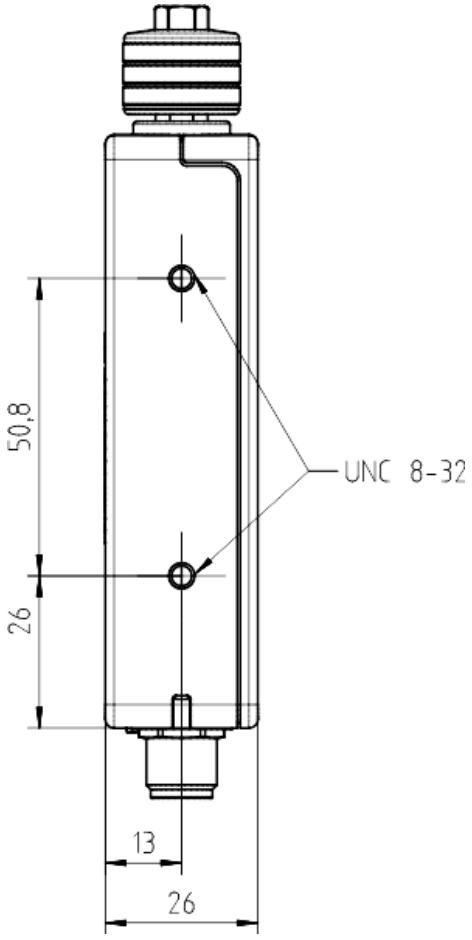
Reading the uncertainty of multipath power sensors for relative power measurements

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.



Technical drawings of the R&S®NRP33SN-V/-67SN-V TVAC-compliant three-path diode power sensor





Dimensions in mm

Ordering information

Designation	Type	Order No.
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/IEEE488 interface	R&S®NRX-B8	1424.8301.02
Sensor interface, for R&S®NRT	R&S®NRX-B9	1424.8601.02
Three-path diode power sensors		
100 pW to 200 mW, 10 MHz to 8 GHz	R&S®NRP8S	1419.0006.02
100 pW to 200 mW, 10 MHz to 8 GHz, LAN version	R&S®NRP8SN	1419.0012.02
100 pW to 200 mW, 10 MHz to 18 GHz	R&S®NRP18S	1419.0029.02
100 pW to 200 mW, 10 MHz to 18 GHz, LAN version	R&S®NRP18SN	1419.0035.02
100 pW to 200 mW, 10 MHz to 33 GHz	R&S®NRP33S	1419.0064.02
100 pW to 200 mW, 10 MHz to 33 GHz, LAN version	R&S®NRP33SN	1419.0070.02
100 pW to 100 mW, 50 MHz to 40 GHz	R&S®NRP40S	1419.0041.02
100 pW to 100 mW, 50 MHz to 40 GHz, LAN version	R&S®NRP40SN	1419.0058.02
100 pW to 100 mW, 50 MHz to 50 GHz	R&S®NRP50S	1419.0087.02
100 pW to 100 mW, 50 MHz to 50 GHz, LAN version	R&S®NRP50SN	1419.0093.02
100 pW to 100 mW, 50 MHz to 67 GHz	R&S®NRP67S	1424.6396.02
100 pW to 100 mW, 50 MHz to 67 GHz, LAN version	R&S®NRP67SN	1424.6409.02
High-power three-path diode power sensors		
1 nW to 2 W, 10 MHz to 18 GHz	R&S®NRP18S-10	1424.6721.02
10 nW to 15 W, 10 MHz to 18 GHz	R&S®NRP18S-20	1424.6738.02
30 nW to 30 W, 10 MHz to 18 GHz	R&S®NRP18S-25	1424.6744.02
TVAC-compliant three-path diode power sensor		
100 pW to 200 mW, 10 MHz to 33 GHz, LAN version, TVAC-compliant	R&S®NRP33SN-V	1419.0129.02
100 pW to 100 mW, 50 MHz to 67 GHz, LAN version, TVAC-compliant	R&S®NRP67SN-V	1424.6415.02
Thermal power sensors		
300 nW to 100 mW, DC to 18 GHz	R&S®NRP18T	1424.6115.02
300 nW to 100 mW, DC to 18 GHz, LAN version	R&S®NRP18TN	1424.6121.02
300 nW to 100 mW, DC to 33 GHz	R&S®NRP33T	1424.6138.02
300 nW to 100 mW, DC to 33 GHz, LAN version	R&S®NRP33TN	1424.6144.02
300 nW to 100 mW, DC to 40 GHz	R&S®NRP40T	1424.6150.02
300 nW to 100 mW, DC to 40 GHz, LAN version	R&S®NRP40TN	1424.6167.02
300 nW to 100 mW, DC to 50 GHz	R&S®NRP50T	1424.6173.02
300 nW to 100 mW, DC to 50 GHz, LAN version	R&S®NRP50TN	1424.6180.02
300 nW to 100 mW, DC to 67 GHz	R&S®NRP67T	1424.6196.02
300 nW to 100 mW, DC to 67 GHz, LAN version	R&S®NRP67TN	1424.6209.02
300 nW to 100 mW, DC to 90 GHz	R&S®NRP90T	1424.6473.02
300 nW to 100 mW, DC to 90 GHz, LAN version	R&S®NRP90TN	1424.6480.02
300 nW to 100 mW, DC to 110 GHz	R&S®NRP110T	1424.6215.02
Thermal waveguide power sensors		
300 nW to 100 mW, 50 GHz to 75 GHz	R&S®NRP75TWG	1700.2529.02
300 nW to 100 mW, 60 GHz to 90 GHz	R&S®NRP90TWG	1700.2312.02
300 nW to 100 mW, 75 GHz to 110 GHz	R&S®NRP110TWG	1173.8709.02
Average power sensors		
100 pW to 200 mW, 8 kHz to 6 GHz	R&S®NRP6A	1424.6796.02
100 pW to 200 mW, 8 kHz to 6 GHz, LAN version	R&S®NRP6AN	1424.6809.02
100 pW to 200 mW, 8 kHz to 18 GHz	R&S®NRP18A	1424.6815.02
100 pW to 200 mW, 8 kHz to 18 GHz, LAN version	R&S®NRP18AN	1424.6821.02

Designation	Type	Order No.
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®NRPxxS(N)/T(N)/A(N) A minimum of one interface cable is required for power sensor operation.		
USB interface cable, length: 0.75 m	R&S®NRP-ZKU	1419.0658.02
USB interface cable, length: 1.50 m	R&S®NRP-ZKU	1419.0658.03
USB interface cable, length: 3.00 m	R&S®NRP-ZKU	1419.0658.04
USB interface cable, length: 5.00 m	R&S®NRP-ZKU	1419.0658.05
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
Ethernet cable for TVAC applications, 2 × RJ-45, length: 1.50 m	R&S®NRP-ZKVSRJ	1425.2407.02
Ethernet cable for TVAC applications, 2 × RJ-45, length: 3.00 m	R&S®NRP-ZKVSRJ	1425.2407.03
Ethernet cable for TVAC applications, 2 × RJ-45, length: 5.00 m	R&S®NRP-ZKVSRJ	1425.2407.05
Ethernet cable for TVAC applications, 2 × RJ-45, length: 15.00 m	R&S®NRP-ZKVSRJ	1425.2407.15
Ethernet cable for TVAC applications, 2 × RJ-45, length: 30.00 m	R&S®NRP-ZKVSRJ	1425.2407.30
Ethernet cable for TVAC applications, 2 × RJ-45, length: 60.00 m	R&S®NRP-ZKVSRJ	1425.2407.60
Ethernet cable for TVAC applications, RJ-45 to Micro-D, length: 1.50 m	R&S®NRP-ZKVSMD	1425.2413.02
Ethernet cable for TVAC applications, RJ-45 to Micro-D, length: 3.00 m	R&S®NRP-ZKVSMD	1425.2413.03
Ethernet cable for TVAC applications, RJ-45 to Micro-D, length: 5.00 m	R&S®NRP-ZKVSMD	1425.2413.05
Ethernet cable for TVAC applications, RJ-45 to Micro-D, length: 15.00 m	R&S®NRP-ZKVSMD	1425.2413.15
Ethernet cable for TVAC applications, RJ-45 to Micro-D, length: 30.00 m	R&S®NRP-ZKVSMD	1425.2413.30
Ethernet cable for TVAC applications, RJ-45 to Micro-D, length: 60.00 m	R&S®NRP-ZKVSMD	1425.2413.60
Ethernet cable (air side cable), Micro-D to RJ-45, length: 1.50 m	R&S®NRP-ZKASMD	1425.2420.02
Ethernet cable (air side cable), Micro-D to RJ-45, length: 3.00 m	R&S®NRP-ZKASMD	1425.2420.03
Ethernet cable (air side cable), Micro-D to RJ-45, length: 5.00 m	R&S®NRP-ZKASMD	1425.2420.05
Ethernet cable (air side cable), Micro-D to RJ-45, length: 15.00 m	R&S®NRP-ZKASMD	1425.2420.15
Ethernet cable (air side cable), Micro-D to RJ-45, length: 30.00 m	R&S®NRP-ZKASMD	1425.2420.30
Ethernet cable (air side cable), Micro-D to RJ-45, length: 60.00 m	R&S®NRP-ZKASMD	1425.2420.60
Sensor hub	R&S®NRP-Z5	1146.7740.02
Recommended extras for waveguide connectors		
Torque wrench SW 3/32 (for waveguide screws)	R&S®ZCTW	1175.2014.02
Recommended extras for R&S®NRP110T		
Waveguide bracket for R&S®NRP110T	R&S®NRP-ZBW	1700.2141.02
WR15 to 1 mm (f) adapter	R&S®WCA75	3626.1044.02
WR12 to 1 mm (f) adapter	R&S®WCA90	3626.1050.02
WR10 to 1 mm (f) adapter	R&S®WCA110	3626.1067.02

Designation	Type	Order No.
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®NRX-B1, R&S®NRPxxS(N), R&S®NRPxxA(N), R&S®NRPxxT(N) and R&S®NRPxxTWG	R&S®NRP-ACA	1419.0812.00

Warranty		
R&S®NRX base unit, power sensors and R&S®NRP-Z5		3 years
All other items [35]		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 [36]. Necessary calibration and adjustments carried out during repairs are also covered.

Extended warranty with calibration (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 [36] 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 [36] 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] Specifications apply to timeslots/gates with a duration of 12.5 % referenced to the signal period (duty cycle 1:8). For other waveforms, the following equation applies: lower measurement limit = lower measurement limit for continuous average mode / √(duty cycle).

[2] With a resolution of 256 pixel.

[3] Specifications apply to the default transition setting of 0 dB. The transition regions can be shifted by as much as –20 dB using an adequate offset.

[4] 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.

[5] Specifications expressed as an expanded uncertainty with a confidence level of 95 % (two standard deviations). For calculating zero offsets at higher confidence levels, use the properties of the normal distribution (e.g. 99.7 % confidence level for three standard deviations).

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

[7] Two standard deviations at 10.24 s integration time in continuous average mode, with aperture time set to default value.
The 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. Multiplying the noise specifications by √(10.24 s/integration time) yields the noise contribution at other integration times. Using a von Hann window function increases noise by a factor of 1.22.

[8] Expanded uncertainty (k = 2) for absolute power measurements on CW signals with automatic path selection and the default transition setting of 0 dB. Specifications include calibration uncertainty, linearity 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 can be neglected for power levels above –40 dBm. The contribution of measurement noise depends on power and integration time and can be neglected below 0.01 dB.

Example: The uncertainty of a power measurement at 3.2 nW (–55 dBm) and 1.9 GHz is to be determined for an R&S®NRP8S. The ambient temperature is +29 ºC and the averaging number is set to 32 in the continuous average mode with an aperture time of 20 ms.

Since path 1 is used for the measurement, the typical absolute uncertainty due to zero offset is 28 pW (typical) after external zeroing, which corresponds to a relative measurement uncertainty of

$$10\ \mathrm{lg}\frac{3.2\ \mathrm{nW}+28\ \mathrm{pW}}{3.2\ \mathrm{nW}}\ \mathrm{dB} = 0.038\ \mathrm{dB}.$$

Using the formula in footnote 7, the absolute noise contribution of path 1 is typically 20 pW × √(10.24 s/(32 × 2 × 0.02 s)) = 56.6 pW, which corresponds to a relative measurement uncertainty of

$$10\ \mathrm{lg}\frac{3.2\ \mathrm{nW}+56.6\ \mathrm{pW}}{3.2\ \mathrm{nW}}\ \mathrm{dB} = 0.076\ \mathrm{dB}.$$

Combined with the uncertainty of 0.084 dB for absolute power measurements under the given conditions, the total expanded uncertainty is

$$\sqrt{0.038^2+0.076^2+0.084^2}\ \mathrm{dB} = 0.119\ \mathrm{dB}.$$

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 with automatic path selection and a default transition setting of 0 dB. For reading the measurement uncertainty diagrams of universal, average and level control sensors, see the Appendix.

Specifications include calibration uncertainty (only if different paths are affected), linearity 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 can be neglected for power levels above –40 dBm. The contribution of measurement noise depends on power and integration time and can be neglected below 0.01 dB.

Example: The uncertainty of a power step from 0.5 mW (–3 dBm) to 10 nW (–50 dBm) at 5.4 GHz is to be determined for an R&S®NRP8S. The ambient temperature is +20 ºC and the averaging number is set to 16 for both measurements in the continuous average mode with an aperture time of 20 ms. For the calculation of total uncertainty, the relative contribution of noise, zero offset and zero drift must be taken into account for both measurements. In this example, all contributions at –3 dBm and the effect of zero drift at –50 dBm have been neglected.

Since path 1 is used for the –50 dBm measurement, the typical absolute uncertainty due to zero offset is 28 pW after external zeroing, which corresponds to a relative measurement uncertainty of

$$10\ \mathrm{lg}\frac{10\ \mathrm{nW}+28\ \mathrm{pW}}{10\ \mathrm{nW}}\ \mathrm{dB} = 0.012\ \mathrm{dB}.$$

Using the formula in footnote 7, the absolute noise contribution of path 1 is typically 20 pW × √(10.24 s/(16 × 2 × 0.02 s)) = 80 pW, which corresponds to a relative measurement uncertainty of

$$10\ \mathrm{lg}\frac{10\ \mathrm{nW}+80\ \mathrm{pW}}{10\ \mathrm{nW}}\ \mathrm{dB} = 0.035\ \mathrm{dB}.$$

Combined with the uncertainty of 0.050 dB for relative power measurements under the given conditions, the total expanded uncertainty is

$$\sqrt{0.012^2+0.035^2+0.050^2}\ \mathrm{dB} = 0.062\ \mathrm{dB}.$$

[10] Specifications are based on the assumption that the measurements follow each other so fast (at intervals of no more than 10 s) that the temperature of the power attenuator does not change significantly. In the case of the R&S®NRP18S-10, the average power must not exceed 1 W to be compliant with accuracy specifications for relative power measurements. For the R&S®NRP18S-20, the maximum average power is 10 W. For the R&S®NRP18S-20, maximum average power is 20 W for compliance with the specifications for relative power measurements.

[11] Gamma correction activated.

[12] Preceding sensor section (nominal value).

[13] 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.

[14] For measuring the power of periodic bursts based on an average power measurement.

[15] 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.

[16] For moving mode, the maximum burst width of a single burst is 8 s. For repeat mode the mean burst length is limited to 8 s/averaging number.

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

[18] To exclude unwanted portions of the signal from the measurement result.

[19] If embedding is used in conjunction with the R&S®NRP18S-10/-20/-25, the data of the RF power attenuator preceding the sensor section is taken into account (automatically upon power-up of the sensor).

[20] Specifications are valid for repeat mode, extending from the beginning to the end of all transfers. The actual values depend on the host system, therefore typical values are specified. They have been measured with a USB connection including one USB hub using the USBTMC protocol and an Ethernet network including one PoE switch using the HiSLIP protocol. For R&S®NRPxxT(N) sensors the specified measurement time is valid for an aperture time less than 100 ms.

[21] Measurement error referenced to a CW signal of equal power and frequency. Specifications apply up to +20 dBm for automatic path selection or within a subrange to the maximum level of the subrange minus 3 dB.

[22] Change of the reflection coefficient (error vector magnitude) referenced to 0 dBm. Applies to the R&S®NRPxxS(N) and the sensor section of the R&S®NRP18S-10/-20/-25.

[23] Expanded uncertainty (k = 2) for absolute power measurements on CW signals at the calibration level within a temperature range from +20 °C to +25 °C and at the calibration frequencies. Specifications include zero offset and measurement noise (up to a 2σ value of 0.004 dB). The calibration level is –20 dBm for path 1 and 0 dBm for paths 2 and 3 and the sensor section of the R&S®NRP18S-10/-20/-25.

[24] Specifications include sensor section and RF power attenuator.

[25] Expanded uncertainty (k = 2) for absolute power measurements. Specifications include calibration uncertainty, linearity and temperature effect. Zero offset and measurement noise must additionally be taken into account when measuring low powers, whereas zero drift is negligible over the entire measurement range. As a rule of thumb, the contribution of zero offset can be neglected for power levels above –20 dBm if external zeroing has been applied. The contribution of measurement noise can be neglected below 0.01 dB.

Example: The power to be measured with an R&S®NRP50TN is 5 µW (–23 dBm) at 48 GHz; ambient temperature +29 ºC; averaging number set to 64 in continuous average mode with an aperture time of 5 ms (default).

The absolute uncertainty due to zero offset (after external zeroing) is 25 nW, which corresponds to a relative measurement uncertainty of

$$10 \lg \frac{5\ \mu W + 25\ nW}{5\ \mu W}\ dB = 0.022\ dB.$$

Using the formula in footnote 7, the absolute noise contribution is 25 nW × √(10.24 s/(64 × 2 × 0.005 s)) = 100 nW, which corresponds to a relative measurement uncertainty of

$$10 \lg \frac{5\ \mu W + 100\ nW}{5\ \mu W}\ dB = 0.086\ dB.$$

Combined with the value of 0.149 dB specified for the uncertainty of absolute power measurements at 48 GHz and +29 ºC ambient temperature, the total expanded uncertainty is

$$\sqrt{0.149^2 + 0.022^2 + 0.086^2}\ dB = 0.173\ dB.$$

[26] Expanded uncertainty (k = 2) for relative power measurements on CW signals of the same frequency. Specifications include linearity and temperature effect. Zero offset and measurement noise must additionally be taken into account when measuring low powers, whereas zero drift is negligible over the entire measurement range. As a rule of thumb, the contribution of zero offset can be neglected for power levels above –20 dBm if external zeroing has been applied. The contribution of measurement noise can be neglected below 0.01 dB. See also the example in footnote 9 for taking into account zero offset and noise with relative measurements.

[27] For R&S®NRP90T(N) absolute accuracy is calibrated up to 98 GHz. Reflection of the sensors is calibrated up to 90 GHz. The specified absolute uncertainty for R&S®NRP90T(N) is valid up to 90 GHz. The uncertainty from 90 GHz to 98 GHz is approximately 0.45 dB.

[28] Expanded uncertainty (k = 2) for absolute power measurements at the calibration level (0 dBm) within a temperature range from +20 °C to +25 °C and at the calibration frequencies. Specifications include zero offset and measurement noise (up to a 2σ value of 0.004 dB).

[29] Expanded uncertainty for relative power measurements referenced to the calibration level (0 dBm), excluding zero offset, zero drift and measurement noise.

[30] Error of an absolute power measurement with respect to temperature.

[31] 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.

[32] To operate the R&S®NRP33SN-V/67SN-V at an air pressure below 795 hPa the sensor has to be mounted onto a temperature-controlled baseplate. In this case the temperature of the baseplate is regarded as the ambient temperature of the sensor.

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

[34] Guaranteed by design and the specifications of the internal oscillator.

[35] For options installed, the remaining base unit warranty applies if longer than 1 year. Exception: all batteries have a 1 year warranty.

[36] 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
Customized and flexible
Uncompromising quality
Long-term dependability

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