POWER METERS AND SENSORS FROM ROHDE&SCHWARZ

Precise and accurate

ROHDE&SCHWARZ

Make ideas real

POWER MEASUREMENT PORTFOLIO

THERMAL POWER SENSORS

Coaxial interface

R&S®NRPxxT(N) series

- Most accurate power measurements for reference applications and use in calibration labs
- Frequency range up to 110 GHz
- Dynamic range up to 55 dB
- 500 measurements/s in buffer mode
- USB, LAN interface

Waveguide interface

R&S®NRPxxTWG series

- Most accurate power measurements for reference applications and use in calibration labs with waveguide interface
- Frequency range up to 110 GHz
- Dynamic range up to 55 dB
- 500 measurements/s in buffer mode
- USB interface

DIODE POWER SENSORS

Three-path diode power sensors

R&S®NRPxxS(N) series

- Fast and accurate power measurements for CW and modulated signals
- Frequency range up to 67 GHz
- Dynamic range up to 93 dB
- 50 000 readings/s in continuous average mode
- USB, LAN interface
- R&S®NRP18S-10/20/25 with up to 25 dB upstream attenuation

Average power sensors

R&S®NRPxxA(N) series

- Accurate average power measurements for EMC applications
- Frequency range up to 18 GHz
- Dynamic range up to 93 dB
- Measures frequency bands down to 8 kHz
- USB, LAN interface

Wideband power sensors

R&S®NRP-Z8x

- Time domain analysis and automatic pulse analysis for radar applications and universal use
- Frequency range up to 44 GHz
- Dynamic range up to 80 dB
- 9000 measurements/s in buffer mode
- 30 MHz minimum video bandwidth
- USB interface

Two-path diode power sensors

R&S®NRP-Z211/-Z221

- Cost-effective solution for production applications
- Frequency range up to 18 GHz
- Dynamic range up to 80 dB
- Economic alternative to three-path diode sensors
- USB interface

CALIBRATION KITS

R&S®NRPC

- DAkkS-accredited and PTB-traceable power sensor calibration
- Five modular R&S®NRPC calibration kits
- Short measurement times for high throughput
- Calibration up to 67 GHz for various power sensors
- Superior to thermistor based standards available on the market

xx: Model number depending on internal architecture and application.

SPECIAL APPLICATION SENSORS

Over-the-air (OTA) power sensor modules

R&S®NRPM-A90(D)

- For 5G, WLAN IEEE 802.11ad, IEEE 802.11ay and automotive radar
- Frequency range up to 90 GHz
- Dynamic range up to 57 dB
- USB interface

Frequency selective power sensor

R&S®NRQ6

- A milestone in power measurements
- Frequency range up to 6 GHz
- Dynamic range up to 150 dB
- 50 000 readings/s in continuous average mode
- LAN interface

TVAC-compliant diode power sensor

R&S®NRP33SN-V

- Specially designed for use in thermal vacuum (TVAC) chambers
- Frequency range up to 33 GHz
- Dynamic range up to 93 dB
- 50 000 readings/s in continuous average mode
- Qualified to withstand temperature fluctuations
- LAN interface

Power reflection meters

R&S®NRT-Zxx/R&S®FSH-Zxx

- Forward and reverse power measurements under operating conditions
- Frequency range up to 4 GHz
- Dynamic range up to 45 dB
- 26 dB minimum directivity

Power sensor modules

R&S®NRP-Z27/-Z37

- Level calibration of signal sources in conjunction with the R&S®FSMR measurement receiver
- Frequency range up to 26.5 GHz
- Dynamic range up to 50 dB
- USB interface

Level control sensors

R&S®NRP-Z28/-Z98

- Highly accurate signal level generation in conjunction with a signal generator
- Frequency range up to 18 GHz
- Dynamic range up to 87 dB
- Power feeding and monitoring at the same time
- USB interface

BASE UNITS

Power meter

R&S®NRX

- The new power meter generation with modern and intuitive user interface
- Expandable multichannel measurement feasibility [1)]
- High-resolution, graphical and numerical touch display
- Remote controllable via USB or LAN

[1)] R&S®NRX-K2/-K4 options available.

Reflection meter

R&S®NRT2

- Simultaneous display of forward and reverse power
- Frequency range up to 4 GHz [1)]
- Average power measurement range from 0.0007 W to 120 W [1)]
- Supports all directional sensor measurement modes

[1)] Sensor-dependent.

VERSATILE APPLICATIONS

Accurate measurement of TDMA based signals

The analysis of TDMA based signals encountered in GSM/EDGE and DECT is a standard power measurement application. The powerful R&S®NRPxxS/-Z2xx/-Z8x sensors are ideal for this task. 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 trace mode allows simultaneous analysis of multiple equidistant timeslots.

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

The power sensors also provide a fence function for the timeslot and time gate modes. The fence can be configured separately for each gate or globally for all timeslots, allowing users to keep track of the power during all 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 routine for the R&S®NRP power sensor family. This is true for accurately measuring average power, peak power or peak-to-average ratio in the time domain as well as quick statistical analysis for precisely determining 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.

Precise measurement is possible even for nonrepetitive pulse sequences with varying pulse power levels.

Using the sensor's buffered mode, 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 signals.

Component tests with high throughput

In component testing, the focus is on precisely determining the input/output power, gain and DUT input impedance matching. The R&S®NRP family provides an outstanding solution for this. Only one R&S®NRX base unit with up to four measurement channels is required for simultaneously evaluating sensor results. With the R&S®NRX base unit automatically calculating the power ratios, this makes it possible to correctly measure the power amplifier's input and output power and to accurately determine gain and input impedance matching.

Continuous monitoring of transmitter systems

Many applications must continuously monitor power and reflection for fast reaction times when an antenna is damaged. The necessary high-accuracy measuring instruments must not influence SWR and antenna feeder attenuation or generate any interfering signals. The R&S®NRT-Z14, R&S®NRT-Z43 and R&S®NRT-Z44 directional power sensors feature good matching, low insertion loss and excellent intermodulation characteristics. When a multicarrier signal is applied, the sum power is displayed – a feature rarely found in conventional directional power sensors. Since data is digitally transferred, the length of the connecting cable is not critical and the R&S®NRT-Z14, R&S®NRT-Z43 and R&S®NRT-Z44 directional power sensors can be installed where they measure most accurately – at the antenna feed point.

POWER SENSOR OVERVIEW

		Level range	Frequency range	Connector type
		–70 dBm … +40 dBm	DC … 100 GHz	
Three-path diode power sensors	R&S®NRP8S(N)	–70 dBm … +23 dBm	10 MHz … 8 GHz	N (m)
	R&S®NRP18S(N)	–70 dBm … +23 dBm	10 MHz … 18 GHz	N (m)
	R&S®NRP33S(N)	–70 dBm … +23 dBm	10 MHz … 33 GHz	3.5 mm (m)
	R&S®NRP40S(N)	–70 dBm … +20 dBm	50 MHz … 40 GHz	2.92 mm (m)
	R&S®NRP50S(N)	–70 dBm … +20 dBm	50 MHz … 50 GHz	2.4 mm (m)
	R&S®NRP67S(N)	–70 dBm … +20 dBm	50 MHz … 67 GHz	1.85 mm (m)
	R&S®NRP18S-10	–60 dBm … +33 dBm	10 MHz … 18 GHz	N (m)
	R&S®NRP18S-20	–50 dBm … +42 dBm	10 MHz … 18 GHz	N (m)
	R&S®NRP18S-25	–45 dBm … +45 dBm	10 MHz … 18 GHz	N (m)
TVAC-compliant three-path diode power sensor	R&S®NRP33SN-V	–70 dBm … +23 dBm	10 MHz … 33 GHz	3.5 mm (m)
Thermal power sensors	R&S®NRP18T(N)	–35 dBm … +20 dBm	DC … 18 GHz	N (m)
	R&S®NRP33T(N)	–35 dBm … +20 dBm	DC … 33 GHz	3.5 mm (m)
	R&S®NRP40T(N)	–35 dBm … +20 dBm	DC … 40 GHz	2.92 mm (m)
	R&S®NRP50T(N)	–35 dBm … +20 dBm	DC … 50 GHz	2.4 mm (m)
	R&S®NRP67T(N)	–35 dBm … +20 dBm	DC … 67 GHz	1.85 mm (m)
	R&S®NRP90T(N)	–35 dBm … +20 dBm	DC … 90 GHz	1.35 mm (m)
	R&S®NRP110T	–35 dBm … +20 dBm	DC … 110 GHz	1 mm (m)
Thermal waveguide power sensors	R&S®NRP75TWG	–35 dBm … +20 dBm	50 GHz … 75 GHz	WR15
	R&S®NRP90TWG	–35 dBm … +20 dBm	60 GHz … 90 GHz	WR12
	R&S®NRP110TWG	–35 dBm … +20 dBm	75 GHz … 110 GHz	WR10
EMC average power sensors	R&S®NRP6A(N)	–70 dBm … +23 dBm	8 kHz … 6 GHz	N (m)
	R&S®NRP18A(N)	–70 dBm … +23 dBm	8 kHz … 18 GHz	N (m)
Wideband power sensors	R&S®NRP-Z81	–60 dBm … +20 dBm	50 MHz … 18 GHz	N (m)
	R&S®NRP-Z85	–60 dBm … +20 dBm	50 MHz … 40 GHz	2.92 mm (m)
	R&S®NRP-Z86, model .40	–60 dBm … +20 dBm	50 MHz … 40 GHz	2.4 mm (m)
	R&S®NRP-Z86, model .44	–60 dBm … +20 dBm	50 MHz … 44 GHz	2.4 mm (m)
Two-path diode power sensors	R&S®NRP-Z211	–60 dBm … +20 dBm	10 MHz … 8 GHz	N (m)
	R&S®NRP-Z221	–60 dBm … +20 dBm	10 MHz … 18 GHz	N (m)
Power sensor modules	R&S®NRP-Z27	–24 dBm … +26 dBm	DC … 18 GHz	N (m)
	R&S®NRP-Z37	–24 dBm … +26 dBm	DC … 26.5 GHz	3.5 mm (m)
Level control sensors	R&S®NRP-Z28	–67 dBm … +20 dBm	10 MHz … 18 GHz	N (m)
	R&S®NRP-Z98	–67 dBm … +20 dBm	9 kHz … 6 GHz	N (m)
Frequency selective power sensor	R&S®NRQ6	–130 dBm … +20 dBm	50 MHz … 6 GHz	N (m)
Over-the-air (OTA) three-channel power sensor module	R&S®NRPM-A90 (D)	–76 dBm … –19 dBm	18 GHz … 90 GHz	OTA

PRECISE AND ACCURATE

Direct link to Germany's national metrology institute

The DC reference circuit and the verification sensor ensure the power standard stability vital to generating reproducible and precise measurements. Tools used to calibrate power sensors need to combine stability with high absolute accuracy. Such high absolute accuracy means keeping traceability to Germany's national metrology institute (PTB) as direct as possible.

Rohde&Schwarz has installed metrological infrastructure at its production site to integrate the transfer standards needed for exchange with the PTB. Since these transfer standards are also included in national primary standards, they help ensure the highest possible accuracy. To minimize the influence of random errors in the upper levels of the calibration hierarchy, each frequency point is traced back to the primary standards via weighted averages of multiple transfer standards.

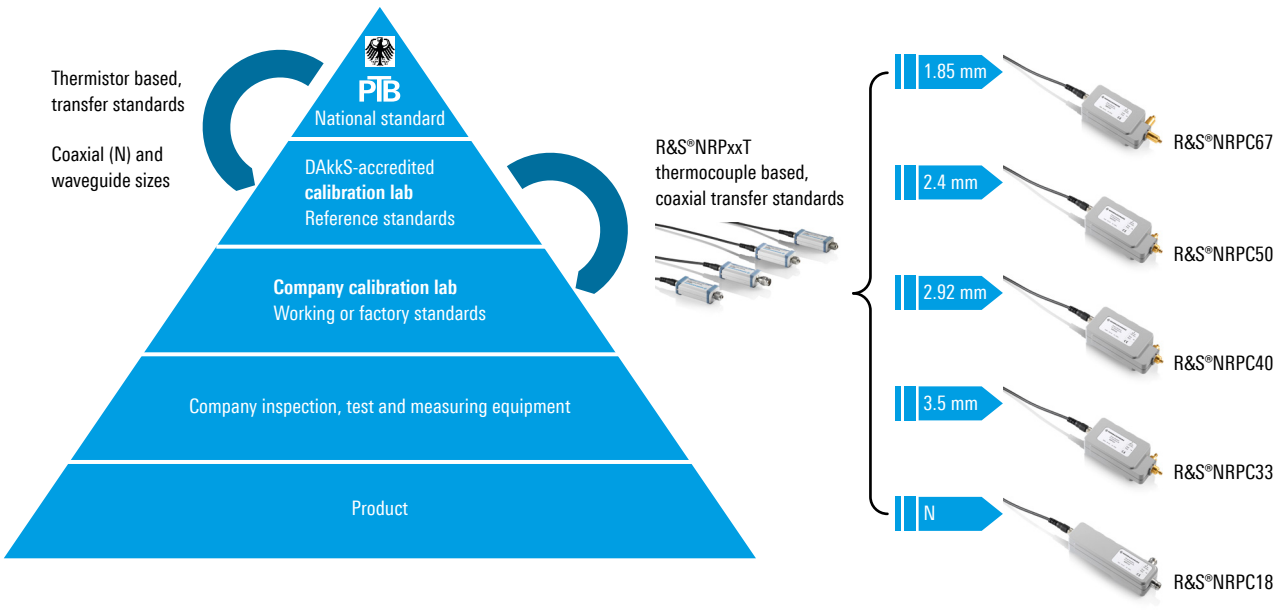
Dependable specifications

Verifying the accuracy of power standards is difficult, since the measurement uncertainty is similar to that of reference instruments. A reliable verification requires many comparisons using multiple reference instruments. This is why specifications do not state error limits but uncertainties for power standard results. Uncertainties are based on expected values calculated using fixed rules and indicate the distribution of measurement results. The calculation includes stochastic influences such as measurement noise or reproducibility of the plug connection, as well as systematic influences whose exact magnitude and sign are unknown. These include measurement errors that persist after correcting for known influences due to insufficient knowledge of their exact value.

Rohde&Schwarz exclusively specifies IEC/EN 60359 measurement uncertainty limits for the power sensors of the R&S®NRP/R&S®FSH families and the R&S®NRPC calibration kits. Measurement uncertainty limits designate the greatest possible measurement uncertainty when making calculations in line with the GUM [1] rules and under the assumption of the most unfavorable conditions. Measurement uncertainties in individual cases are usually much smaller.

[1] Guide to the Expression of Uncertainty in Measurement (ISO/BIPM guideline)

Calibration hierarchy for Rohde&Schwarz power sensors and standards



Service 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 and measurement, technology systems, and networks and 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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Rohde&Schwarz training

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