Power Sensors NRV-Z

For RF and microwave power measurements

- Thermal sensors and diode sensors for high-precision power measurements
- Compatible with NRVS, NRVD, URV35 and URV55 basic units
- Frequency range DC to 40 GHz
- Power range 100 pW to 30 W
- Standards: GSM900/1800/1900, DECT, IS-95 CDMA, W-CDMA, NADC, PDC, DAB, DVB, etc
- Absolute calibration, simply plug in and measure
- Calibration data memory for sensor-specific parameters
- High long-term stability
- Excellent temperature response

ROHDE & SCHWARZ

With its large variety of power sensors Rohde&Schwarz is able to provide the right tool for power measurements with NRVS, NRVD, URV35 and URV55 basic units.

15 different types of power sensors in all cover the frequency range from DC to 40 GHz and the power range from 100 pW (–70 dBm) to 30 W (+45 dBm). In addition to thermal sensors, which are ideal as a high-precision reference for any waveform, diode sensors with a dynamic range of more than 80 dB are available.

The peak power sensors of the NRV-Z31/-Z32/-Z33 series allow power measurements on TDMA mobile phones to different digital standards as well as measurement of the peak power of pulsed or modulated signals.

Plug in and measure

With the individually calibrated sensors of the NRV-Z series plugged into the basic unit, a fully calibrated power meter is immediately ready for measurements – without need for entering calibration factors and without adjustment to a 50 MHz reference: this means a great benefit in the routine research and development work and an error source less when changing the sensor. These assets are brought about by the calibration data memory first introduced by Rohde&Schwarz which contains all the relevant physical parameters of the sensors, and the excellent long-term stability of the Rohde&Schwarz power sensors. Rohde&Schwarz is worldwide the only manufacturer to provide absolute calibration for its power sensors.

The right sensor for every application

Terminating power sensors are used for power measurements on a large variety of sources. The requirements placed on the sensor regarding frequency and power range, measurement accuracy and speed may therefore differ a great deal.
Four classes of power sensors allow optimum adaptation to the specific measurement task:

- Thermal power sensors NRV-Z51/-Z52/-Z53/-Z54/-Z55
- High-sensitivity diode sensors NRV-Z1/-Z3/-Z4/-Z6/-Z15
- Medium-sensitivity diode sensors NRV-Z2/-Z5
- Peak power sensors NRV-Z31/-Z32/-Z33

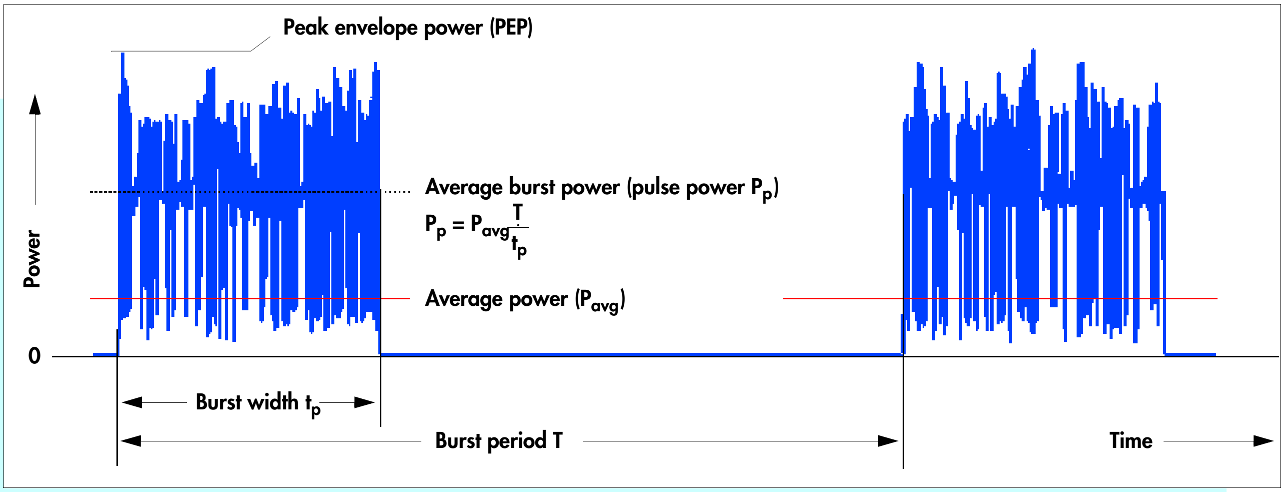
Thermal power sensors

The thermal power sensors of the **NRV-Z51** to **-Z55** series satisfy the most stringent demands placed on measurement accuracy and matching. They cover the power range from 1 µW (–30 dBm) to 30 W (45 dBm) and the frequency range from DC to 40 GHz.

These sensors are capable of measuring – without any degradation of the measurement accuracy – the power of CW signals as well as the average power of modulated or distorted signals by RMS weighting of all spectral components within the specified frequency range. Therefore, thermal sensors are the first choice for power measurements at the output of power amplifiers and on carrier signals with modulated envelope. Needless to say that the linearity of the sensor is independent of frequency, ambient temperature and waveform, and with 0.5% or 0.02 dB its contribution to the measurement uncertainty of sensors NRV-Z51/-Z52/-Z55 is negligible.

High-sensitivity diode sensors

The high-sensitivity power sensors **NRV-Z1/-Z3/-Z4/-Z6/-Z15** based on zero-bias Schottky diodes open up the power range below 1 µW down to the physical limit of 100 pW (–70 dBm). In this range, strictly speaking from –70 dBm to –20 dBm, their behaviour is much the same as that of thermal sensors, ie precise measurement of the average power of modulated signals, RMS weighting of harmonics and



Definition of the main power parameters using the transmitter signal of a NADC mobile station as an example. The average burst power can be displayed on the NRVS, NRVD and URV55 basic units after entering the duty cycle t_p/T. Required is a sensor that is able to precisely measure the average power P_{avg}, ie a thermal sensor or a diode sensor operated in the square-law region.

linearity independent of temperature and frequency.

All high-sensitivity sensors from Rohde&Schwarz are calibrated to allow precise power measurements also outside the square-law region up to a power of 20 mW (+13 dBm). The high signal-to-noise ratio of the sensor output signal in this region makes for very short measurement times. It should however be noted that the response of high-sensitivity sensors outside the square-law region differs from that of thermal sensors so that only spectrally pure signals with unmodulated envelope (CW, FM, φM, FSK, GMSK) can be measured. Regarding the display linearity, greater measurement uncertainties than with thermal sensors are to be expected in this region due to frequency and temperature effects.

Medium-sensitivity diode sensors

The medium-sensitivity sensors **NRV-Z2** and **NRV-Z5** based on diode sensors with 20 dB attenuator pad close the gap between the thermal and the high-sensitivity sensors in applications where in the power range between –20 dBm and 0 dBm both high measurement speed and the thermal sensor characteristics are required at a time.

Given a continuous load capability of 2 W, this type of sensor is extremely robust.

Peak power sensors

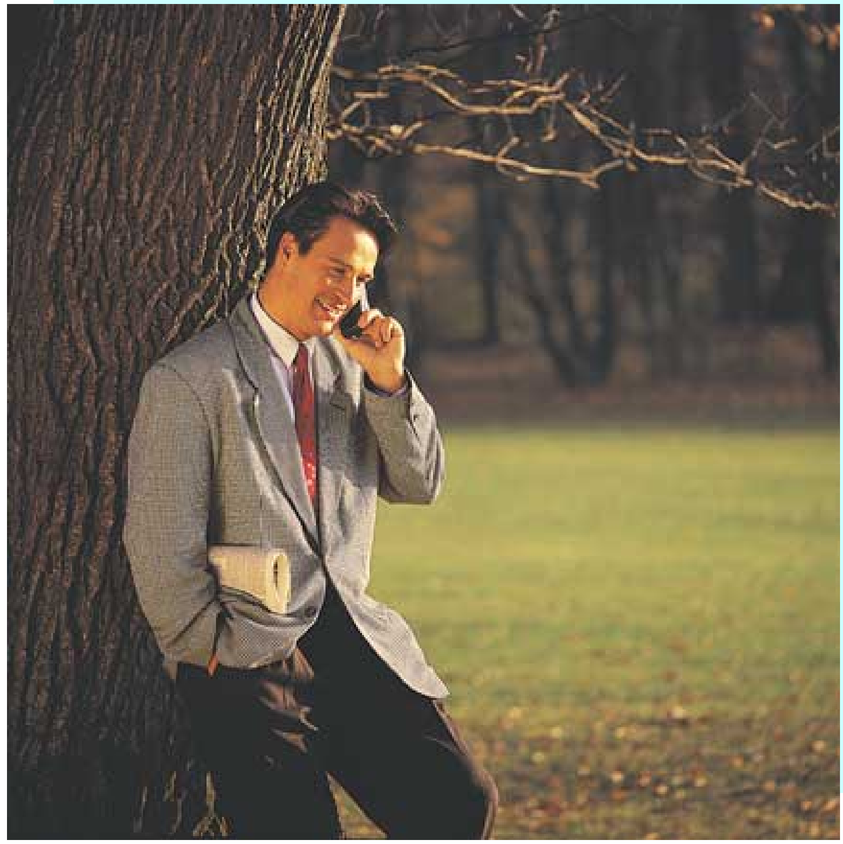
The peak power sensors **NRV-Z31/-Z32/-Z33** take a special place among diode sensors. They enable measurement of the peak envelope power (PEP) of modulated signals during signal peaks of 2 µs to 100 ms duration. They thus open up a large variety of applications, from the measurement of pulsed transmit power of TDMA mobile phones through special measurement tasks in applied physics to the measurement of sync pulse power of terrestrial TV transmitters. Peak power sensors from Rohde&Schwarz are available for the frequency range 30 MHz to 6 GHz in the power classes 20 mW (NRV-Z31), 2 W (NRV-Z32) and 20 W (NRV-Z33), the latter for direct power measurement at output stages.

DC to 40 GHz / 100 pW to 30 W GSM900/1800/1900,

Various models within a power class allow the handling of versatile waveforms:

– **Model 02** (of NRV-Z31) and **Model 05** (of NRV-Z32) are designed for general-purpose applications and are suitable for measuring the power of RF bursts from 2 µs width and at repetition rates from
10/s (NRV-Z31/model 02) and
25/s (NRV-Z32/model 05).

– **Model 03** (high-speed model of NRV-Z31/-Z33) can be used at repetition rates from 100/s and due to its higher measurement speed it is ideal for system applications and measurement of the sync pulse power of negatively modulated TV signals in line with the relevant standards for terrestrial television (NTSC, CCIR, British and OIRT). The picture content has no effect on the measurement result, while the effect of the sound carrier can be compensated using tabulated correction factors.



– **Models 04** of all peak power sensors are tailored to the requirements of TDMA radio networks and enable measurement of the transmit power of TDMA mobile stations to GSM and DECT standards.

The following table serves as a guide in choosing the suitable sensor for digital modulation:

Modulation	Time structure	Application	Suitable sensor	Measured parameter	Dynamic range
GMSK, GFSK, 4FSK (unmodulated envelope)	continuous	GSM, DECT base stations; same power in all timeslots	all sensors, without any restrictions	P_{avg}	50 to 80 dB
	one timeslot active, frame length <10 ms	GSM, DECT mobile stations	NRV-Z31/-Z32/-Z33 model 04	P_p (PEP) [1)]	43 dB
QPSK, OQPSK	continuous	IS-95 CDMA, W-CDMA base stations	NRV-Z51 to -Z55	P_{avg}	50 dB
OFDM	continuous	DVB-T / DAB transmitters	NRV-Z51 to -Z55	P_{avg}	50 dB
π/4DQPSK, 8 PSK, 16QAM, 64QAM symbol rate: any	continuous	NADC, PDC, PHS, TETRA base stations; same power in all timeslots	NRV-Z51 to -Z55	P_{avg}	50 dB
π/4DQPSK, 8 PSK, 16QAM, 64QAM symbol rate <25 kS/s	continuous	NADC, PDC TETRA base stations; same power in all timeslots	NRV-Z31/-Z32/-Z33 model 02/03/05	PEP	43 dB
	one timeslot active, frame length ≤40 ms	NADC, PDC mobile stations	NRV-Z32, model 05	PEP	43 dB
			NRV-Z51	P_p	40 dB

Footnotes see end of data sheet

DECT, IS-95, CDMA, WCDMA, NADC, PDC, DAB, DVB …

The right sensor for digital modulation

There are two main features of digitally modulated signals that have to be considered in power measurements:

- The pulsed envelope power to CDMA, DAB and DVB standards and all standards prescribing the modulation modes PSK, QAM and π/4DQPSK (e.g. NADC, PDC, PHS and TFTS) requires a differentiation between average power and peak power.
  All thermal power sensors can be used without any restrictions for average power measurements. Diode sensors may be used provided they are operated inside the square-law region. The peak power sensors of the NRV-Z31/-Z32/-Z33 series (models 02, 03 and 05) are suitable for measuring the peak value at symbol rates of up to 25 kS/s.

- In the case of transmission standards using TDMA structure, like GSM, DECT, NADC, PDC or PHS, the data stream for a channel is compressed to fit into one of several timeslots, so that the power measurement has to be carried out in a certain time interval. In the case of one active timeslot in the transmit signal (mobile station), the peak power sensors of the NRV-Z31/-Z32/-Z33 series can be used, with models 02, 03 and 05 being suitable for measuring the peak power and model 04 for measuring the average transmit power (GSM and DECT only).

Precision calibration

A power sensor can only be as precise as the measuring instruments used for its calibration. Therefore, the calibration standards used by Rohde&Schwarz are directly traceable to the standards of the German Standards Laboratory.

All data gained in calibration as well as the essential physical characteristics of the sensor, eg temperature effect, are stored in a data memory integrated in the sensor and can be read by the basic unit and considered in the measurements.

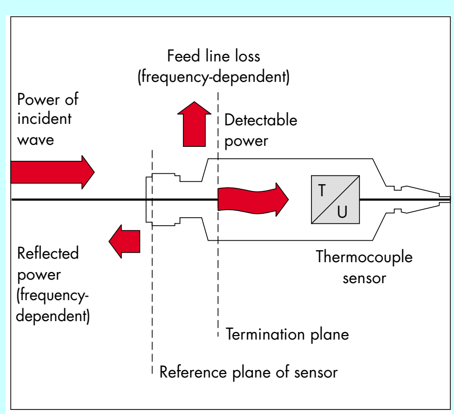
Since all Rohde&Schwarz power sensors feature absolute calibration, measurements can be started immediately after plugging the sensor into the basic unit without prior calibration to a 1 mW reference source. To activate the frequency-dependent calibration factors all the user needs to do is to enter the test frequency on the basic unit.

Calibration of the NRV-Z sensors is directly traceable to the standards of the German Standards Laboratory.

Power sensors are calibrated to the power of the incident wave.

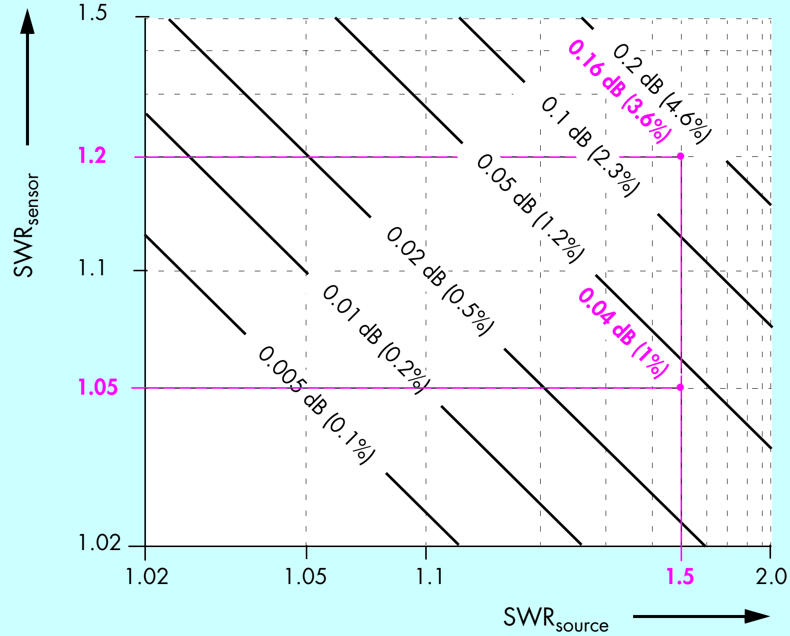
This ensures that with a matched source the available source power into 50 Ω (or 75 Ω) is measured.

With a mismatched source the power of the incident wave will differ from the available power according to the mismatch uncertainty.



Measurement accuracy and matching

The accuracy of power measurements is determined by diverse parameters, such as the measurement uncertainty in calibration, linearity or ambient temperature: parameters whose effect can directly be specified. In contrast, the effect of a mismatched power sensor can only be estimated if the source matching is known. Mismatch of source and sensor causes the device under test – the source – to supply a somewhat higher or lower power than for an exactly matched output. As shown in the graph on the right, the resulting measurement error can be several times greater than the measurement errors caused by all other parameters. Power sensors from Rohde & Schwarz therefore feature excellent matching to ensure optimum measurement accuracy even under conditions of strong reflections.



Maximum measurement error due to mismatch for source power available into 50 Ω (75 Ω). Values stated in dB and in % of power in W.

Example shown:
Power measurement on a source with SWR of 1.5.
A sensor with excellent matching with 1.05 SWR (eg NRV-Z5) generates a measurement error of as little as 0.04 dB (1%), while a SWR of 1.2 would result in a measurement error four times greater.

The basic units

All power sensors can be used with the following basic units from Rohde & Schwarz:

NRVD
- Modern dual-channel power meter
- Menu-guided operation
- IEC/IEEE-bus interface (SCPI)
- Ideal for relative measurements in two test channels (attenuation, reflection)
- Large variety of measurement functions
- Result readout in all standard units
- Many extras like 1 mW test generator, indication of measurement uncertainty etc

NRVS
- Cost-effective, single-channel power meter
- Manual operation like NRVD
- Many measurement functions
- Result readout in all standard units
- Analog output fitted as standard
- IEC/IEEE-bus interface (syntax-compatible with NRV/URV5)

NRVD

NRVS

URV 35

- Compact voltmeter and power meter for use in service, test shop and lab
- Unique combination of analog and digital display in form of moving-coil meter plus LCD with backlighting
- Many measurement functions
- Result readout in all standard units
- Choice of battery or AC supply operation
- RS-232-C interface

URV 55

Cost-effective single-channel voltmeter; similar to NRVS.

URV 35

URV 55

Sensors for voltage and level measurements

Probes and insertion units (data sheet PD 756.9816) open up further applications of the power meters:

RF Probe URV5-Z7

- For practically no-load measurements in non-coaxial RF circuits; frequency range 20 kHz to 1 GHz
- Comprehensive accessories, including adapters for 50 Ω and 75 Ω connectors

Insertion Units URV5-Z2/-Z4

- For level measurement between source and load in coaxial 50 Ω and 75 Ω systems. With an optimally matched load, power measurements from –60 to +53 dBm are possible even without directional coupler
- Frequency range 9 kHz to 3 GHz

DC Probe URV5-Z1

For low-load DC measurements in RF circuits from 1 mV to 400 V.

URV5-Z2/-Z4

Calibration Kit NRVC

Calibration Kit NRVC is used for fast, program-controlled calibration of Rohde&Schwarz Power Sensors NRV-Z up to 18 GHz as well as of Voltage Sensors URV5-Z. It is a valuable tool for calibration labs and all those who use a great number of these sensors and wish to perform on-site calibration. The measurement uncertainties are in line with data sheet specifications and comparable to those of a factory calibration.

Main features

- Traceable power calibration from DC to 18 GHz
- Measurement level from –30 dBm (1 μW) to +20 dBm (100 mW), depending on sensor
- High long-term stability of thermal power standard through DC voltage reference
- Traceable linearity calibration from –30 dBm to +33 dBm at 50 MHz
- Complete calibration of a sensor in approx. 15 minutes
- Easy operation thanks to Windows™ user interface
- Programming of data memories of NRV sensors using computed correction data
- Standard-conformal documentation of measurement results

Calibration Kit NRVC

Specifications

Model connector, impedance	Frequency range	Power meas. range, max. power	Max. SWR (reflection coefficient)	Zero offset [2]	Display noise [3]	Linearity uncertainty	Power coefficient
High-sensitivity diode sensors (RMS weighting up to 10 µW; NRV-Z3 up to 6 µW)							
NRV-Z4 N connector, 50 Ω	100 kHz to 6 GHz	100 pW to 20 mW 100 mW (AVG) 100 mW (PK)	0.1 to 100 MHz 1.05 (0.024) >0.1 to 2 GHz 1.10 (0.048) >2 to 4 GHz 1.2 0 (0.09) >4 to 6 GHz 1.35 (0.15)	±50 pW	20 pW	0.03 dB (0.7%) [4]	0
NRV-Z1 N connector, 50 Ω	10 MHz to 18 GHz	200 pW to 20 mW 100 mW (AVG) 100 mW (PK)	0.01 to 1 GHz 1.06 (0.03) >1 to 2 GHz 1.13 (0.06) >2 to 4 GHz 1.27 (0.12) >4 to 18 GHz 1.41 (0.17)	±100 pW	40 pW	0.03 dB (0.7%) [4]	0
NRV-Z6 PC-3.5 connec- tor, 50 Ω	50 MHz to 26.5 GHz	400 pW to 20 mW 100 mW (AVG) 100 mW (PK)	0.05 to 0.1 GHz 1.30 (0.13) >0.1 to 18 GHz 1.20 (0.09) >18 to 26.5 GHz 1.40 (0.165)	±200 pW	80 pW	0.04 dB (1%) [4]	0
NRV-Z15 K connector [5] (2.92 mm), 50 Ω	50 MHz to 40 GHz	400 pW to 20 mW 100 mW (AVG) 100 mW (PK)	0.05 to 4 GHz 1.15 (0.070) >4 to 40 GHz 1.37 (0.157)	±200 pW	80 pW	0.04 dB (1%) [4]	0
NRV-Z3 N connector, 75 Ω	1 MHz to 2.5 GHz	100 pW to 13 mW 70 mW (AVG) 70 mW (PK)	1 MHz to 1 GHz 1.11 (0.05) >1to 2.5 GHz 1.20 (0.09)	±40 pW	16 pW	0.03 dB (0.7%) [4]	0
Medium-sensitivity diode sensors (RMS weighting up to 1 mW)							
NRV-Z5 N connector, 50 Ω	100 kHz to 6 GHz	10 nW to 500 mW 2 W (AVG) 10 W (PK)	100 kHz to 4 GHz 1.05 (0.024) >4 to 6 GHz 1.10 (0.048)	±5 nW	2 nW	0.03 dB (0.7%) [4]	0
NRV-Z2 N connector, 50 Ω	10 MHz to 18 GHz	20 nW to 500 mW 2 W (AVG) 10 W (PK)	0.01 to 4 GHz 1.05 (0.024) >4 to 8 GHz 1.10 (0.048) >8 to 12.4 GHz 1.15 (0.07) >12.4 to 18 GHz 1.20 (0.09)	±10 nW	4 nW	0.03 dB (0.7%) [4]	0
Thermal power sensors (RMS weighting in complete power measurement range)							
NRV-Z51 N connector, 50 Ω	DC to 18 GHz	1 µW to 100 mW 300 mW (AVG) 10 W (PK, 1 µs)	DC to 2 GHz 1.10 (0.048) >2 to 12.4 GHz 1.15 (0.07) >12.4 to 18 GHz 1.20 (0.09)	±60 nW	22 nW	0.02 dB (0.5%)	0
NRV-Z52 PC-3.5 connec- tor, 50 Ω	DC to 26.5 GHz	1 µW to 100 mW 300 mW (AVG) 10 W (PK, 1 µs)	DC to 2 GHz 1.10 (0.048) >2 to 12.4 GHz 1.15 (0.07) >12.4 to 18 GHz 1.20 (0.09) >18 to 26.5 GHz 1.25 (0.11)	±60 nW	22 nW	0.02 dB (0.5%)	0
NRV-Z55 K connector [5] (2.92 mm), 50 Ω	DC to 40 GHz	1 µW to 100 mW 300 mW (AVG) 10 W (PK, 1 µs)	DC to 2 GHz 1.10 (0.048) >2 to 12.4 GHz 1.15 (0.07) >12.4 to 18 GHz 1.20 (0.09) >18 to 26.5 GHz 1.25 (0.11) >26.5 to 40 GHz 1.30 (0.13)	±60 nW	22 nW	0.02 dB (0.5%)	0
NRV-Z53 N connector, 50 Ω	DC to 18 GHz	100 µW to 10 W 18 W (AVG) 1 kW (PK, 1 µs) (see diagram page 10)	DC to 2 GHz 1.11 (0.052) >2 to 8 GHz 1.22 (0.099) >8 to 12.4 GHz 1.27 (0.119) >12.4 to 18 GHz 1.37 (0.157)	±6 µW	2.2 µW	0.03 dB (0.7%)	0.011 dB/W (0.25%/W)
NRV-Z54 N connector, 50 Ω	DC to 18 GHz	300 µW to 30 W [6] 36 W (AVG) 1 kW (PK, 3 µs) (see diagram page 10)	DC to 2 GHz 1.11 (0.052) >2 to 8 GHz 1.22 (0.099) >8 to 12.4 GHz 1.27 (0.119) >12.4 to 18 GHz 1.37 (0.157)	±20 µW	7 µW	0.03 dB (0.7%)	0.007 dB/W (0.15%/W)
Peak power sensors							
NRV-Z31 N connector, 50 Ω	30 MHz to 6 GHz [7]	1 µW to 20 mW 100 mW (AVG) 100 mW (PK)	0.03 to 0.1 GHz 1.05 (0.024) >0.1 to 2 GHz 1.10 (0.048) >2 to 4 GHz 1.20 (0.09) >4 to 6 GHz 1.35 (0.15)	±30 nW	3 nW	included in calibration uncertainty	0
NRV-Z32 N connector, 50 Ω	30 MHz to 6 GHz [7]	100 µW to 2 W (**model 04**), 100 µW to 4 W [8] (**model 05**); 1 W (AVG) 4 W (PK, 10 ms) 8 W (PK, 1 ms)	0.03 to 4 GHz 1.11 (0.052) >4 to 6 GHz 1.22 (0.099)	±3 µW (**model 04**) ±4 µW (**model 05**)	0.3 µW (**model 04**) 0.4 µW (**model 05**)	included in calibration uncertainty	0.044 dB/W (1.0%/W)
NRV-Z33 N connector, 50 Ω	30 MHz to 6 GHz [7]	1 mW to 20 W 18 W (AVG) 80 W (PK) (see diagram page 10)	0.03 to 2.4 GHz 1.11 (0.052) >2.4 to 6 GHz 1.22 (0.099)	±30 µW	3 µW	included in calibration uncertainty	0.015 dB/W (0.35%/W)

Footnotes see end of data sheet

Calibration uncertainties in dB (bold type) and in % of power reading

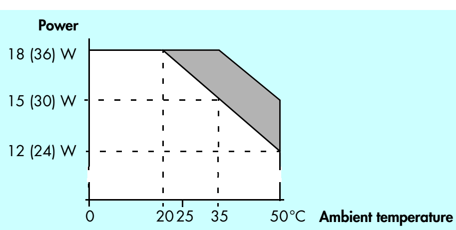
The calibration uncertainties in dB were calculated from the values in percent and rounded to two decimal places so that different values in percent may give one and the same value in dB.

Frequency in GHz	up to 0.03	>0.03 to 0.1	>0.1 to 1	>1 to 2	>2 to 4	>4 to 6	>6 to 8	>8 to 10	>10 to 12.4	>12.4 to 15	>15 to 16	>16 to 18	>18 to 20	>20 to 24	>24 to 26.5	>26.5 to 30	>30 to 35	>35 to 40
NRV- Z1	**0.07** 1.5	**0.07** 1.6	**0.07** 1.6	**0.07** 1.6	**0.08** 1.7	**0.08** 1.8	**0.09** 1.9	**0.10** 2.2	**0.10** 2.3	**0.11** 2.5	**0.14** 3.0	**0.15** 3.3						
NRV-Z2	**0.07** 1.4	**0.07** 1.5	**0.07** 1.5	**0.07** 1.5	**0.07** 1.6	**0.07** 1.6	**0.07** 1.6	**0.08** 1.8	**0.08** 1.8	**0.09** 2.1	**0.11** 2.4	**0.13** 2.8						
NRV-Z3	**0.06** 1.4	**0.06** 1.4	**0.07** 1.4	**0.07** 1.5	**0.07** 1.6	calibrated up to 2.5 GHz												
NRV-Z4	**0.05** 1.2	**0.06** 1.3	**0.06** 1.3	**0.06** 1.3	**0.06** 1.4	**0.07** 1.5												
NRV-Z5	**0.05** 1.1	**0.05** 1.2	**0.05** 1.2	**0.05** 1.2	**0.06** 1.3	**0.06** 1.3												
NRV-Z6		**0.06** 1.2	**0.06** 1.2	**0.06** 1.2	**0.06** 1.3	**0.06** 1.4	**0.07** 1.6	**0.08** 1.8	**0.08** 1.9	**0.10** 2.1	**0.11** 2.5	**0.13** 2.9	**0.09** 1.9	**0.09** 2.0	**0.09** 2.0			
NRV-Z15		**0.05** 1.1	**0.05** 1.2	**0.05** 1.2	**0.06** 1.3	**0.07** 1.6	**0.09** 2.0	**0.10** 2.2	**0.10** 2.3	**0.12** 2.7	**0.14** 3.1	**0.15** 3.4	**0.08** 1.8	**0.09** 2.0	**0.09** 2.0	**0.10** 2.2	**0.11** 2.4	**0.10** 2.2
NRV-Z31	**0.05** 1.2	**0.06** 1.2	**0.07** 1.6	**0.07** 1.6	**0.11** 2.4	**0.11** 2.5	0 to 10 mW											
	0.05 1.2	**0.06** 1.2	**0.07** 1.6	**0.07** 1.6	**0.15** 3.4	**0.16** 3.5	>10 mW to 20 mW											
NRV-Z32 (04)	**0.08** 1.7	**0.08** 1.7	**0.09** 2.0	**0.09** 2.0	**0.13** 2.9	**0.17** 3.8	0 to 1 W											
	0.08 1.7	**0.08** 1.7	**0.09** 2.0	**0.09** 2.0	**0.17** 3.7	**0.20** 4.5	>1 W to 2 W											
NRV-Z32 (05)	**0.08** 1.7	**0.08** 1.7	**0.09** 2.0	**0.09** 2.0	**0.13** 2.9	**0.17** 3.8	0 to 1 W											
	0.09 1.9	**0.09** 1.9	**0.10** 2.2	**0.10** 2.2	**0.25** 5.6	**0.28** 6.1	>1 to 4 W											
NRV-Z33	**0.08** 1.7	**0.08** 1.7	**0.09** 2.0	**0.09** 2.0	**0.14** 3.2	**0.17** 3.8	0 to 10 W											
	0.08 1.7	**0.08** 1.7	**0.09** 2.0	**0.09** 2.0	**0.18** 3.9	**0.20** 4.5	>10 W to 20 W											
NRV-Z51	9)	**0.05** 1.0 9)	**0.05** 1.0	**0.05** 1.1	**0.05** 1.2	**0.06** 1.2	**0.06** 1.4	**0.07** 1.6	**0.07** 1.6	**0.09** 1.9	**0.10** 2.3	**0.12** 2.7						
NRV-Z52	9)	**0.05** 1.1 9)	**0.06** 1.2	**0.06** 1.2	**0.06** 1.3	**0.06** 1.4	**0.07** 1.5	**0.08** 1.7	**0.08** 1.8	**0.10** 2.1	**0.11** 2.5	**0.13** 2.9	**0.08** 1.8	**0.09** 1.9	**0.09** 1.9			
NRV-Z53	9)	**0.07** 1.6 9)	**0.07** 1.6	**0.07** 1.6	**0.10** 2.2	**0.10** 2.2	**0.10** 2.3	**0.12** 2.7	**0.13** 2.8	**0.16** 3.6	**0.17** 3.8	**0.18** 4.1						
NRV-Z54	9)	**0.08** 1.7 9)	**0.08** 1.7	**0.08** 1.7	**0.10** 2.2	**0.10** 2.3	**0.11** 2.3	**0.12** 2.8	**0.13** 2.8	**0.16** 3.6	**0.17** 3.8	**0.18** 4.1						
NRV-Z55	9)	**0.05** 1.1 9)	**0.05** 1.2	**0.05** 1.2	**0.06** 1.3	**0.06** 1.4	**0.07** 1.5	**0.08** 1.7	**0.08** 1.8	**0.10** 2.1	**0.11** 2.5	**0.13** 2.9	**0.08** 1.7	**0.09** 1.9	**0.09** 1.9	**0.10** 2.2	**0.11** 2.4	**0.10** 2.1

Temperature effect (relative measurement error in dB (bold type) and in % of power reading)

T_{amb}	22°C to 24°C	18°C to 28°C		10°C to 40°C		0°C to 50°C	
		max.	typ.	max.	typ.	max.	typ.
NRV-Z1 to -Z5, -Z31	included in calibration uncertainty	**0.05** 1.0	**0.015** 0.3	**0.14** 3.0	**0.05** 1.0	**0.32** 7.0	**0.09** 2.0
NRV-Z6/-Z15		**0.03** 0.6	**0.005** 0.1	**0.09** 2.0	**0.02** 0.5	**0.18** 4.0	**0.05** 1.0
NRV-Z32		**0.06** 1.3	**0.02** 0.4	**0.16** 3.6	**0.06** 1.2	**0.37** 8.1	**0.10** 2.3
NRV-Z33		**0.06** 1.4	**0.02** 0.4	**0.19** 4.2	**0.06** 1.3	**0.41** 9.0	**0.11** 2.5
NRV-Z51/-Z52/-Z55		**0.02** 0.4	**0.005** 0.1	**0.06** 1.3	**0.02** 0.4	**0.09** 2.0	**0.02** 0.5
NRV-Z53/-Z54		**0.04** 0.8	**0.01** 0.2	**0.11** 2.5	**0.03** 0.7	**0.18** 4.0	**0.05** 1.0

Max. power as a function of ambient temperature for sensors NRV-Z33, NRV-Z53 and NRV-Z54. Values for NRV-Z54 in ( )



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

Supplementary data for Peak Power Sensors NRV-Z31/-Z32/-Z33

Waveform

Model	02	03	04	05
Min. burst width	2 µs	2 µs	200 µs	2 µs
Min. burst repetition rate [10)]	10 Hz	100 Hz	100 Hz	25 Hz
Min. duty cycle[11)]	5×10^{-4} (2×10^{-3})	10^{-3} (10^{-2})	2×10^{-2} (2×10^{-2})	5×10^{-4} (2×10^{-3})

Peak weighting error

NRV-Z32 (model 05)
Max. peak weighting errors in % of power reading for burst signals of TDMA mobile stations in line with GSM 900/1800/1900, PDC and NADC specifications:

Average burst power	GSM 900/1800/1900	NADC / PDC
10 mW to 2 W	**1.5** [1.5]	**5.5** [5.5]
1 mW to 10 mW	**1.5** [2.0]	**5.5** [6.5]
0.3 mW to 1 mW	**3.5** [4.5]	**6.5** [8]
0.1 mW to 0.3 mW	**8.0** [11]	**15** [20]

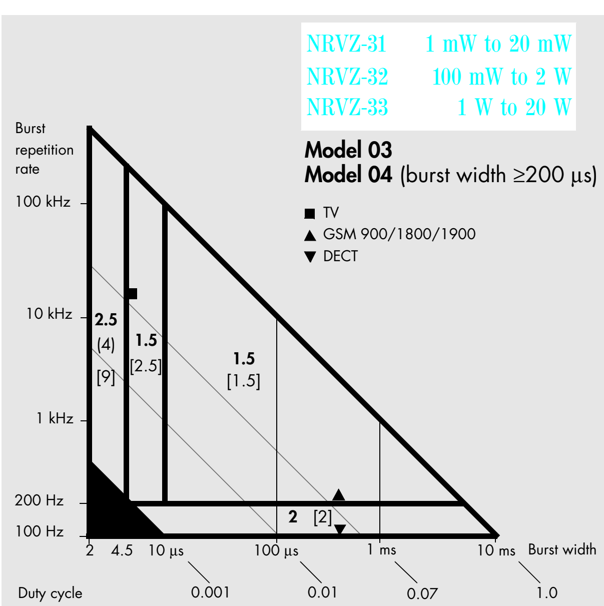
Values without brackets (bold type) T_{amb} = 18°C to 28°C
Values in [ ] 0°C to 50°C
For conversion into dB see table on the right.
For other waveforms the diagrams shown for NRV-Z31 model 02 apply approximately, with burst repetition rates of 10 Hz and 50 Hz corresponding to burst repetition rates of 25 Hz and 125 Hz of NRV-Z32.

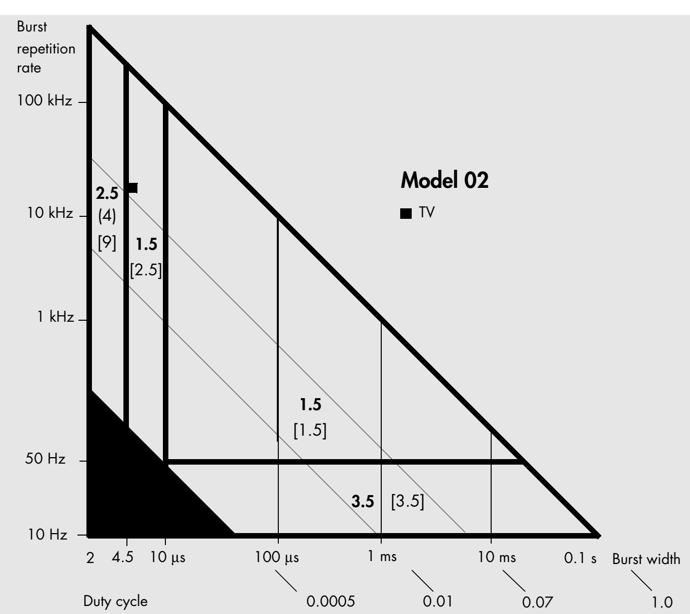
NRV-Z31/-Z32 (model 04)/-Z33
The maximum measurement errors specified in the following diagrams for burst signals with corresponding width and repetition rate compared to a CW signal of same power hold true for all peak power sensors (except NRV-Z32 model 05 – see above).

Numeric values: maximum error in % of power reading.
– without brackets (bold type): T_{amb} = 18°C to 28°C
– in ( ): 10°C to 40°C
– in [ ]: 0°C to 50°C
– black areas: not specified
For conversion into dB see table on the right
Where no value is specified for the temperature range 10°C to 40°C, the correct value is obtained by forming the average from the values specified for 18°C to 28°C and 0°C to 50°C.

Conversion of measurement error in % of power reading into dB:

%	dB
±1.5	–0.066/+0.065
±2	–0.088/+0.086
±2.5	–0.110/+0.107
±3	–0.132/+0.128
±3.5	–0.155/+0.149
±4	–0.177/+0.170
±5	–0.223/+0.212
±6	–0.269/+0.253
±7	–0.315/+0.294
±8	–0.362/+0.334
±9	–0.410/+0.374
±10	–0.458/+0.414
±11	–0.506/+0.453
±12	–0.555/+0.492
±13	–0.605/+0.531
±14	–0.655/+0.569
±15	–0.706/+0.607
±16	–0.757/+0.645
±18	–0.862/+0.719
±20	–0.969/+0.792



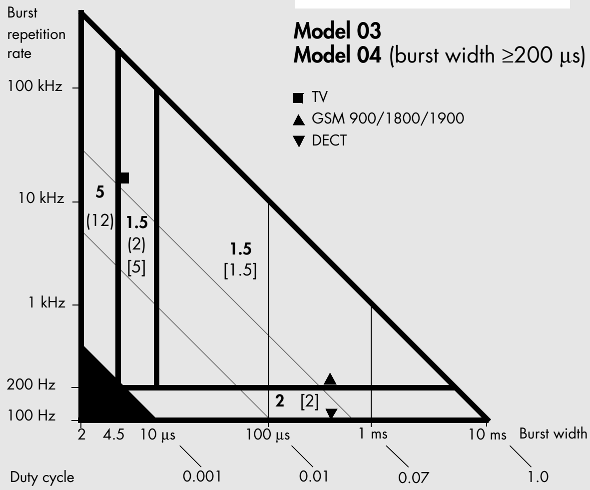


Footnotes see end of data sheet

NRVZ-31 100 µW to 1 mW
NRVZ-32 10 mW to 100 mW
NRVZ-33 100 mW to 1 W

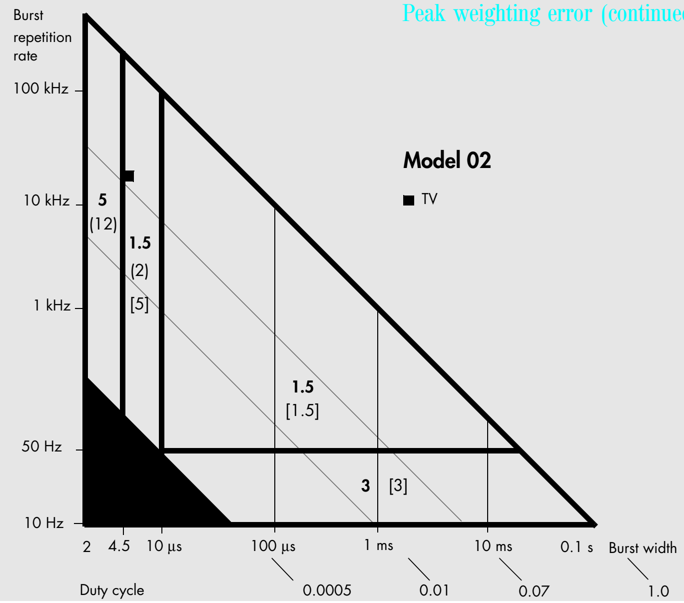
Model 03
Model 04 (burst width ≥200 µs)

■ TV
▲ GSM 900/1800/1900
▼ DECT



Model 02

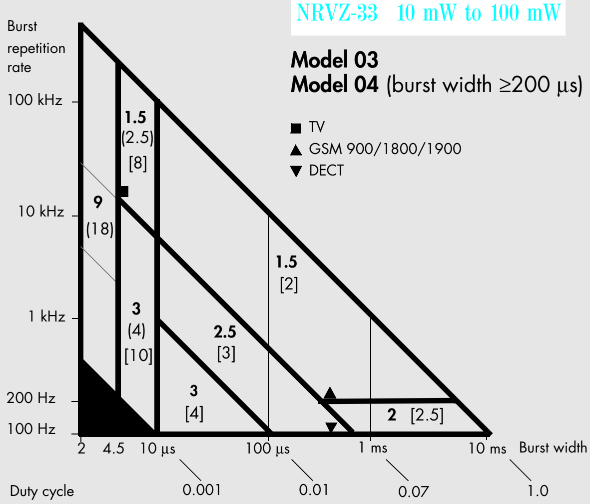
■ TV



NRVZ-31 10 µW to 100 µW
NRVZ-32 1 mW to 10 mW
NRVZ-33 10 mW to 100 mW

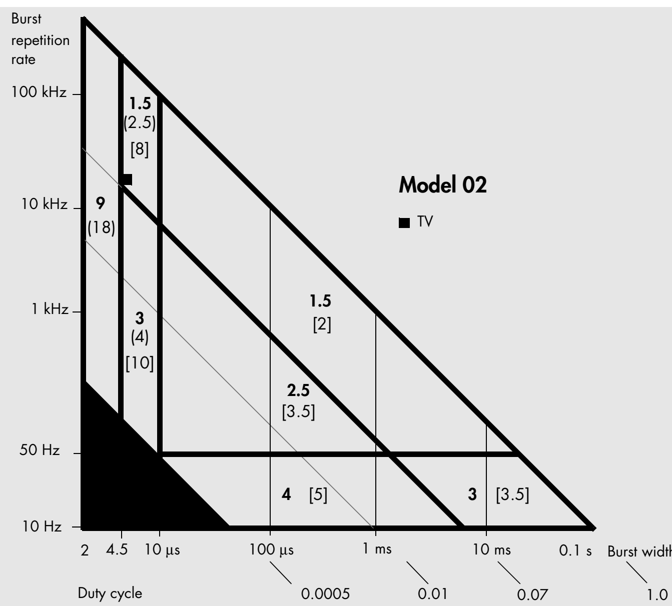
Model 03
Model 04 (burst width ≥200 µs)

■ TV
▲ GSM 900/1800/1900
▼ DECT



Model 02

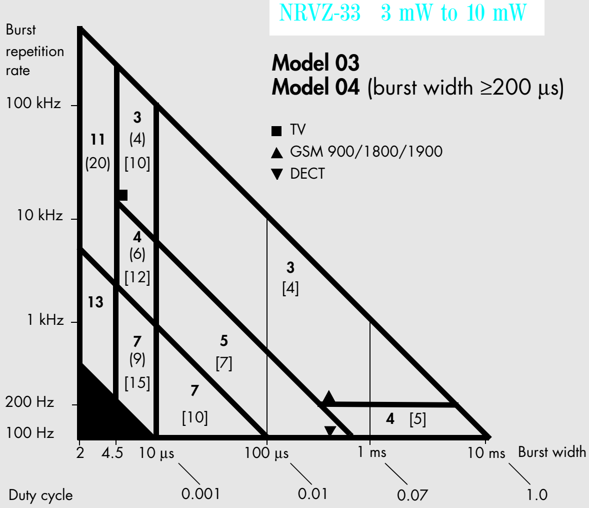
■ TV



NRVZ-31 3 µW to 10 µW
NRVZ-32 300 µW to 1 mW
NRVZ-33 3 mW to 10 mW

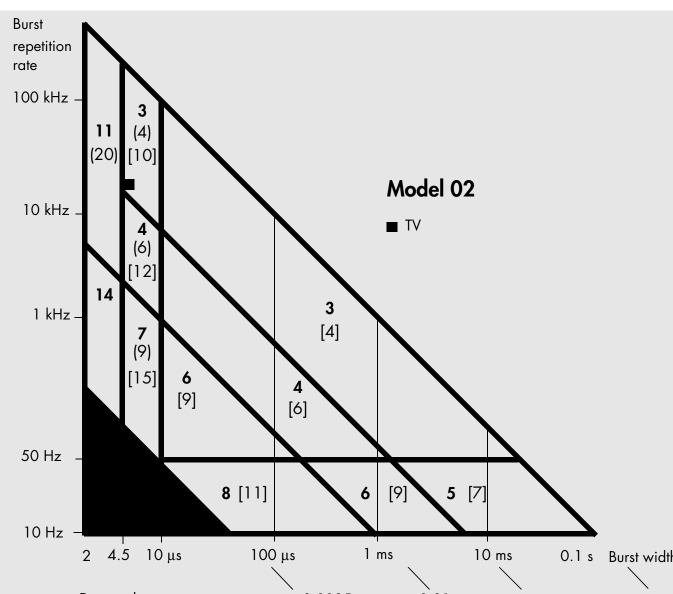
Model 03
Model 04 (burst width ≥200 µs)

■ TV
▲ GSM 900/1800/1900
▼ DECT

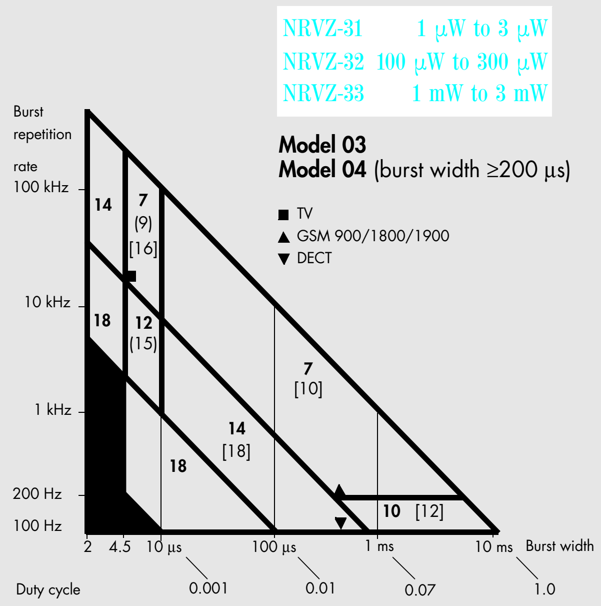


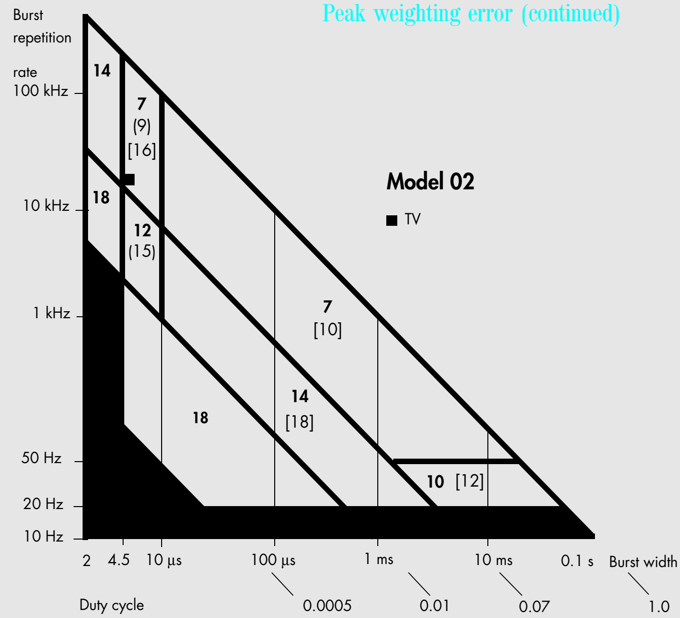
Model 02

■ TV



Peak weighting error (continued)





General data

Environmental conditions	
Temperature ranges	meet DIN IEC 68-2-1/68-2-2
Operating	0 °C to +50 °C
Storage	–40 °C to +70 °C
Permissible humidity	max. 80%, without condensation
Vibration, sinusoidal	5 Hz to 55 Hz, max. 2 g; 55 Hz to 150 Hz, 0.5 g cont. (meets DIN IEC 68-2-6, IEC 1010-1 and MIL-T-28800 D class 5)
Vibration, random	10 Hz to 500 Hz, acceleration 1.9 g (rms) (meets DIN IEC 68-2-36)
Shock	40 g shock spectrum (meets MIL-STD-810 D, DIN IEC 68-2-27)
EMC	meets EN 50081-1 and 50082-1, EMC directive of EU (89/336/EEC), EMC law of the Federal Republic of Germany and MIL-STD-461 C (RE 02, CE 03, RS 03, CS 02)
Safety	meets EN 61010-1
Dimensions and weight	
NRV-Z1 to -Z15/-Z31 NRV-Z51/-Z52/-Z55	120 mm × 37 mm × 31 mm; 0.35 kg
NRV-Z51, model 04	156 mm × 37 mm × 31 mm; 0.35 kg
NRV-Z32	190 mm × 37 mm × 31 mm; 0.42 kg
NRV-Z33, NRV-Z53	240 mm × 54 mm × 60 mm; 0.53 kg
NRV-Z54	298 mm × 54 mm × 60 mm; 0.68 kg
Length of connecting cable	1.3 m / 5 m (other lengths on request)

*) For use at RF connectors with high temperature difference to the environment of the power sensor, eg at the output of power attenuators.

Ordering information

High-Sensitivity Diode Sensors		
20 mW, 50 Ω, 18 GHz	NRV-Z1	0828.3018.02
with 5 m cable	NRV-Z1	0828.3018.03
13 mW, 75 Ω, 2.5 GHz	NRV-Z3	0828.3418.02
with 5 m cable	NRV-Z3	0828.3418.03
20 mW, 50 Ω, 6 GHz	NRV-Z4	0828.3618.02
with 5 m cable	NRV-Z4	0828.3618.03
20 mW, 50 Ω, 26.5 GHz	NRV-Z6	0828.5010.02
20 mW, 50 Ω, 40 GHz	NRV-Z15	1081.2305.02
Medium-Sensitivity Diode Sensors		
500 mW, 50 Ω, 18 GHz	NRV-Z2	0828.3218.02
with 5 m cable	NRV-Z2	0828.3218.03
500 mW, 50 Ω, 6 GHz	NRV-Z5	0828.3818.02
with 5 m cable	NRV-Z5	0828.3818.03
Thermal Power Sensors		
100 mW, 50 Ω, 18 GHz	NRV-Z51	0857.9004.02
with 3 m cable, thermally insulated*)	NRV-Z51	0857.9004.04
100 mW, 50 Ω, 26.5 GHz	NRV-Z52	0857.9204.02
10 W, 50 Ω, 18 GHz	NRV-Z53	0858.0500.02
30 W, 50 Ω, 18 GHz	NRV-Z54	0858.0800.02
100 mW, 50 Ω, 40 GHz	NRV-Z55	1081.2005.02
Peak Power Sensors		
20 mW, 50 Ω, 6 GHz	NRV-Z31	
– Standard model	– Model 02	0857.9604.02
– High-speed model	– Model 03	0857.9604.03
– TDMA model	– Model 04	0857.9604.04
2 W, 50 Ω, 6 GHz	NRV-Z32	
– TDMA model	– Model 04	1031.6807.04
– Universal model	– Model 05	1031.6807.05
20 W, 50 Ω, 6 GHz	NRV-Z33	
– High-speed model	– Model 03	1031.6507.03
– TDMA model	– Model 04	1031.6507.04
Calibration Kit		
Calibration Kit for Power Sensors 1 µW to 100 mW; DC to 18 GHz	NRVC	1109.0500.02
Verification Set for NRVC	NRVC-B1	1109.1007.02
Accessory Set for Linearity Measurements	NRVC-B2	1109.1207.02

Definitions

Measurement uncertainty

Parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand. Regarding calibrations and data sheet specifications Rohde & Schwarz conforms to the relevant international guidelines[15] recommending the specification of an expanded uncertainty with a coverage factor k=2. With normally distributed measurement errors it can be assumed that the limits thus defined will be adhered to in 95% of all cases.

Calibration uncertainty

Expanded (k=2) uncertainty attributed to the calibration factors in the data memory of a sensor and hence smallest measurement uncertainty that can be attained for absolute power measurements under reference conditions[16]. The data sheet specifications for NRV sensors[17] are based on the measurement uncertainty in calibration plus an additional uncertainty for aging and wear and tear.

Mismatch uncertainty

Measurement uncertainty contribution that has additionally to be taken into account with a mismatched source, if the value measured by the power meter is to be used to determine the source power available with a matched load.

Linearity

Measure of a power meter's capability to express an increase/reduction of the measured power in a corresponding change of the reading. Linearity is affected by negative influences in the calibration of the sensor (linearity uncertainty), zero offset, display noise and influence of the basic unit (upon change of the measurement range). With diode sensors operated outside the square-law region the following parameters may additionally influence the linearity: frequency-dependent linearity errors, temperature effect, harmonics.

Linearity uncertainty

Smallest expanded (k=2) uncertainty that can be attained for relative power measurements under reference conditions[18] relative to the sensor-specific reference power. The magnitude of the linearity uncertainty is mainly determined by the calibration method.

Frequency-dependent linearity error

Linearity errors outside the square-law region caused by the voltage-dependent junction capacitance of a diode detector and noticeable from about ¼ of the upper frequency limit. Rohde&Schwarz specifies the error relative to the sensor-specific reference power.

Power coefficient

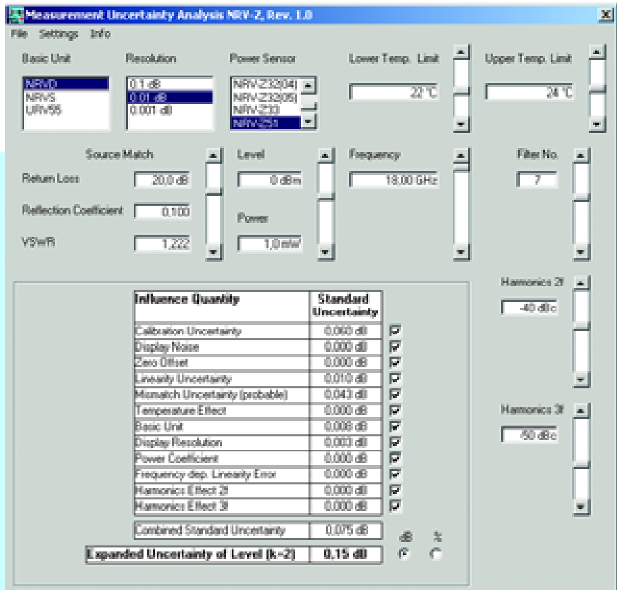
Measure of the sensitivity of a high-power sensor to the self-heating of the attenuator pad at the input. Multiplication by the average power of the test signal yields the maximum variation of the attenuation value that causes a variation of the reading by the same amount. As a function of the variation speed of the measured quantity, this behaviour may cause linearity errors. The thermal time constants of the attenuator pads used lie in the range of seconds.

Zero offset

Error in the measurement result caused by the power meter in the form of a systematic, absolute measurement error independent of the magnitude of the measured power. Zero offsets can very easily be recognized if the reading is other than zero with no power applied. The relative measurement uncertainty caused by zero offsets is inversely proportional to the measured power.

Footnotes see end of data sheet

Definitions (continued)



User interface of measurement uncertainty analysis program

Display noise

Statistical component superimposed on the reading whose absolute magnitude is independent of the measured power. Therefore the relative measurement uncertainty caused by display noise is inversely proportional to the measured power.

Peak weighting error

Measurement error of a peak power sensor in case of a pulsed but otherwise unmodulated RF signal with squarewave envelope (burst) compared to a CW signal of same power.

Harmonics effect

Harmonics may adversely affect the measurement accuracy of diode sensors, and compared to a thermal sensor the reading is increased or decreased depending on the phase position relative to the fundamental. Thermal sensors always measure the power of the total signal and therefore exclusively provide RMS weighting of the harmonics – provided these are within the specified frequency range. For details on the behaviour of diode sensors please refer to the Rohde&Schwarz brochure on Voltage and Power Measurements (PD0757.0835). As a rule of thumb it can be assumed that the harmonics effect for power ratings below 1 µW (–30 dBm) with high-sensitivity sensors and 100 µW (–10 dBm) with medium-sensitivity sensors is negligible. Harmonics below –60 dBc can be considered to be noncritical irrespective of the power measured.

Temperature effect

Effect of the ambient temperature on the accuracy of the sensor. Rohde&Schwarz specifies the residual relative measurement error after internal correction of the temperature response of the sensor, i.e. the maximum value and a typical value corresponding approximately to one standard deviation. The specifications apply without any restrictions to thermal sensors and to diode sensors operated inside the square-law region, whereas for diode sensors outside the square-law region they refer exclusively to CW signals.

Influence of basic unit

Rohde&Schwarz specifies the maximum measurement error caused by the basic unit in absolute power measurements at different ambient temperatures.

Calculation of total measurement uncertainty

The calculation or at least estimation of the measurement uncertainty should be part of every power measurement. Therefore, Rohde&Schwarz offers the Measurement Uncertainty Analysis Program NRV-Z*), a tool that allows fast calculation of the measurement uncertainty without any basic knowledge being required. For manual calculation, the individual influencing parameters should also be combined statistically, as described on page 14, for example. The influencing parameters to be taken into account are listed in the table below.

Type of sensor ⇨	Thermal sensor or diode sensor inside square-law region		Diode sensor outside square-law region + CW signal		Peak power sensor	
Type of measurement ⇨	absolute	relative [20]	absolute	relative [20]	absolute	relative [20]
Influencing parameter						
Mismatch uncertainty	●	○ [19]	●	○ [19]	●	○ [19]
Calibration uncertainty	●		●		●	●
Linearity uncertainty	●	●	●	●		
Frequency-dependent linearity error			●	●		
Power coefficient	○ [12]	○ [12]			○ [12]	○ [12]
Harmonics effect	○ [13]	○ [13]	●	●	●	●
Temperature effect	●		●	●	●	●
Zero offset	●	●			●	●
Display noise	●	●			●	●
Basic unit	●	○ [14]	●	○ [14]	●	○ [14]
Peak weighting error					●	●

The table below shows an example of the measurement uncertainty being manually calculated for an absolute power measurement with Thermal Power Sensor NRV-Z51 at 1.9 GHz / –10 dBm:

	Specification		Standard uncertainty
Influencing parameter	**Value**	**Weighting / distribution**	u_i
Mismatch uncertainty (SWR_{source} = 1.2)	0.038 dB	1.4 σ/u	0.027 dB
Calibration uncertainty	0.050 dB	2 σ/normal	0.025 dB
Linearity uncertainty	0.020 dB	2 σ/normal	0.010 dB
Temperature effect (18°C to 28°C)	0.005 dB	1 σ	0.005 dB
Zero offset	60 nW	2 σ/normal	0.001 dB
Display noise (filter 7)	4 x 22 nW	2 σ/normal	0.002 dB
Basic unit NRVS	0.017 dB	1.7 σ/square	0.010 dB
			Expanded uncertainty $(2 \times \sqrt{\Sigma u_i^2})$ **= 0.080 dB (1.8%)**

*) Application Note 1GP43, can be downloaded from the R&S Homepage, under Products & More, Application Notes.

Footnotes

1) With GSM and DECT the envelope is unmodulated so that the determination of the average burst power can be reduced to a measurement of the peak power (PEP).

2) Within 1 h after zero adjustment with a probability of 95%, permissible temperature variation 1°C, after 2 h warmup of basic unit with sensor.
NRV-Z53 and NRV-Z54: after measurement of high-power signals, larger zero offsets may temporarily occur (up to 0.5 mW for NRV-Z53, 2 mW for NRV-Z54 after application of rated power).

3) Noise specifications (2 standard deviations) refer to filter 11, temperature 18°C to 28°C. With the most sensitive measurement range selected on NRVS, NRVD and URV55, filter 11 is set automatically (autofilter mode, resolution HIGH). Noise values for other filter settings are obtained by multiplication with the factors given in the table below. The specified measurement times are typical values in remote-control mode:

Filter No. (NRVS, NRVD, URV55)		**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Noise multiplier		51	32	23	16	11.3	8	5.6	4	2.8	2	1.4	1.0	0.7
Meas. time (s)	NRV-Z1 to -Z6/-Z15	0.045	0.05	0.06	0.08	0.15	0.27	0.49	0.95	1.85	3.6	7.2	14.5	28.5
	NRV-Z31, model 02	1.04	1.04	1.05	1.07	1.13	1.24	1.44	1.84	2.7	4.3	7.5	14	27
	NRV-Z31, model 03/04	0.135	0.14	0.15	0.17	0.23	0.34	0.54	0.94	1.77	3.4	6.6	13	26
	NRV-Z32, model 04	0.135	0.14	0.15	0.17	0.23	0.34	0.54	0.94	1.77	3.4	6.6	13	26
	NRV-Z32, model 05	0.435	0.44	0.45	0.47	0.53	0.64	0.84	1.24	2.07	3.7	6.9	14	27
	NRV-Z33	0.135	0.14	0.15	0.17	0.23	0.34	0.54	0.94	1.77	3.4	6.6	13	26
	NRV-Z51 to -Z55	0.115	0.12	0.13	0.15	0.21	0.32	0.52	0.92	1.75	3.4	6.6	13	26

In autofilter mode the following settings are made as a function of measurement range and resolution:

			Filter No.						
Resolution	HIGH	0.001 dB	11	9	7	7	7	7	7
	MEDIUM	0.01 dB	9	7	3	3	3	3	3
	LOW	0.1 dB	7	3	0	0	0	0	0
Meas. range	NRV-Z1/-Z3/-Z4/-Z6/-Z15		10 nW	100 nW	1 µW	10 µW	100 µW	1 mW	20 mW
	NRV-Z2/-Z5		1 µW	10 µW	100 µW	1 mW	10 mW	100 mW	500 mW
	NRV-Z31		–	1 µW	10 µW	100 µW	1 mW	20 mW	–
	NRV-Z32		–	100 µW	1 mW	10 mW	100 mW	2 (4) W	–
	NRV-Z33		–	1 mW	10 mW	100 mW	1 W	20 W	–
	NRV-Z51/-Z52/-Z55		10 µW	100 µW	1 mW	10 mW	100 mW	–	–
	NRV-Z53		1 mW	10 mW	100 mW	1 W	10 W	–	–
	NRV-Z54		10 mW	100 mW	1 W	10 W	30 W	–	–

Footnotes (continued)

4) Further causes of linearity errors are described in the section "Definitions" under the keyword "Linearity".
The linearity errors specified in the table below are referred to the sensor-specific reference power. Since the errors are proportional to frequency and power, the specified maximum values can be expected to occur at the individual interval limits only.

Frequency-dependent linearity errors for diode sensors

			Frequency		
		10 MHz to 4 GHz	**4 GHz to 8 GHz**	**>8 GHz to 13 GHz**	**>13 GHz to 18 GHz**
NRV-Z1	–17 dBm to +3 dBm 20 µW to 2 mW	0	0 to +0.09 dB 0 to +2%	0 to +0.21 dB 0 to +5%	0 to +0.25 dB 0 to +6%
	> +3 dBm to +13 dBm > 2 mW to 20 mW	0	0 to +0.17 dB 0 to +4%	0 to +0.41 dB 0 to +10%	0 to +0.49 dB 0 to +12%
NRV-Z2	+3 dBm to +23 dBm 2 mW to 200 mW	0	0 to +0.09 dB 0 to +2%	0 to +0.21 dB 0 to +5%	0 to +0.25 dB 0 to +6%
	> +23 dBm to +27 dBm > 200 mW to 500 mW	0	0 to +0.15 dB 0 to +3.5%	0 to +0.33 dB 0 to +8%	0 to +0.41 dB 0 to +10%
		100 kHz to 1.5 GHz	**>1.5 GHz to 3 GHz**	**>3 GHz to 6 GHz**	
NRV-Z4	–17 dBm to +3 dBm 20 µW to 2 mW	0	0 to +0.09 dB 0 to +2%	0 to +0.25 dB 0 to +6%	
	> +3 dBm to +13 dBm > 2 mW to 20 mW	0	0 to +0.17 dB 0 to +4%	0 to +0.41 dB 0 to +10%	
NRV-Z5	+3 dBm to +23 dBm 2 mW to 200 mW	0	0 to +0.09 dB 0 to +2%	0 to +0.25 dB 0 to +6%	
	> +23 dBm to +27 dBm > 200 mW to 500 mW	0	0 to +0.15 dB 0 to +3.5%	0 to +0.33 dB 0 to +8%	
		0.05 GHz to 0.2 GHz	**>0.2 GHz to 4 GHz**	**>4 GHz to 14 GHz**	**>14 GHz to 26.5 GHz**
NRV-Z6	–17 dBm to +3 dBm 20 µW to 2 mW	–0.11 dB to +0.02 dB –2.5% to +0.5%	0	0 to +0.02 dB 0 to +0.5%	0 to +0.07 dB 0 to +1.5%
	> +3 dBm to +13 dBm > 2 mW to 20 mW	–0.2 dB to +0.07 dB –4.5% to +1.5%	0	0 to +0.07 dB 0 to +1.5%	0 to +0.19 dB 0 to +4.5%
		0.05 GHz to 0.2 GHz	**>0.2 GHz to 4 GHz**	**>4 GHz to 12.4 GHz**	**>12.4 GHz to 40 GHz**
NRV-Z15	–17 dBm to +3 dBm 20 µW to 2 mW	±0.01 dB ±0.2%	0	0 to +0.04 dB 0 to +1%	0 to +0.09 dB 0 to +2%
	> +3 dBm to +13 dBm > 2 mW to 20 mW	–0.02 dB to +0.01 dB –0.5% to +0.2%	0	0 to +0.09 dB 0 to +2%	0 to +0.33 dB 0 to +8%

5) K connector is a trademark of Anritsu Corp.

6) In the temperature range 35°C to 50°C only short-term or reduced load (see diagram page 10) permitted if there is no protection against inadvertent contacting.

7) The lower frequency limit is 10 MHz for ambient temperatures up to 28°C.

8) 4 W peak power corresponds to an average power of approx. 2.1 W of a mobile to NADC or PDC standard.

9) For frequencies below 50 MHz, no calibration factors are stored in the EPROM of the sensor.
Therefore, frequency-response correction should not be used in this range and a calibration uncertainty of 2% be assumed.

10) The burst repetition rate is the reciprocal value of the burst period T.

11) The values in parentheses should not be exceeded in remote-controlled operation. Otherwise it is not ensured that the first value measured after triggering is a settled reading. Repeat triggering until steady results are output or provide for an appropriate delay before triggering after power to be measured has been applied.

12) Sensors with attenuator pad only.

13) At upper limit of square-law region.

14) To be considered when measuring in different ranges.

15) ISO Guide to the Expression of Uncertainty in Measurement. International Organization for Standardization, Geneva, Switzerland, ISBN: 92-67-10188-9, 1995.
Radio Equipment and Systems (RES); Uncertainties in the measurement of mobile radio equipment characteristics. ETSI Technical Report ETR028, June 1997, 3rd Edition, European Telecommunications Standards Institute. Valbonne, France.

Footnotes (continued)

[16] Sensor temperature 22 °C to 24 °C, matched source, CW signal with sensor-specific reference power, >50 dB harmonic suppression for diode sensors.
Influence of basic unit neglected (eg after calibration).
The sensor-specific reference power is
1 µW to 10 µW for high-sensitivity diode sensors,
0.1 mW to 1 mW for medium-sensitivity diode sensors,
1 mW for NRV-Z51/-Z52/-Z55,
10 mW to 100 mW for NRV-Z53 and
10 mW to 300 mW for NRV-Z54.
For the peak power sensors NRV-Z31/-Z32/-Z33 the specified calibration uncertainties are valid in the total power range,
however with a harmonic suppression of 60 dB or more.

[17] Calculated for an average sensor of the relevant type. The uncertainties stated in the calibration report may slightly differ since they are determined taking into account the individual characteristics of the sensor and of the calibration system used. Usually the values are better than the data sheet specs; they may occasionally be somewhat poorer at specific frequency values.

[18] Thermal sensors and diode sensors operated inside the square-law region:
No restrictions on part of the sensor, only the influence of the basic unit and zero offset should be negligible (sufficient measurement power, basic unit calibrated, ambient temperature 15 °C to 35 °C).
Diode sensors operated outside the square-law region:
Sensor temperature 22 °C to 24 °C, CW signal with harmonics suppression >60 dB, frequency within the range without frequency-dependent linearity uncertainties, influence of basic unit and zero offset negligible (sufficient measurement power, basic unit calibrated).

[19] For power-dependent source matching.

[20] At constant test frequency.

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ISO 9001
DQS REG. NO 1954

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