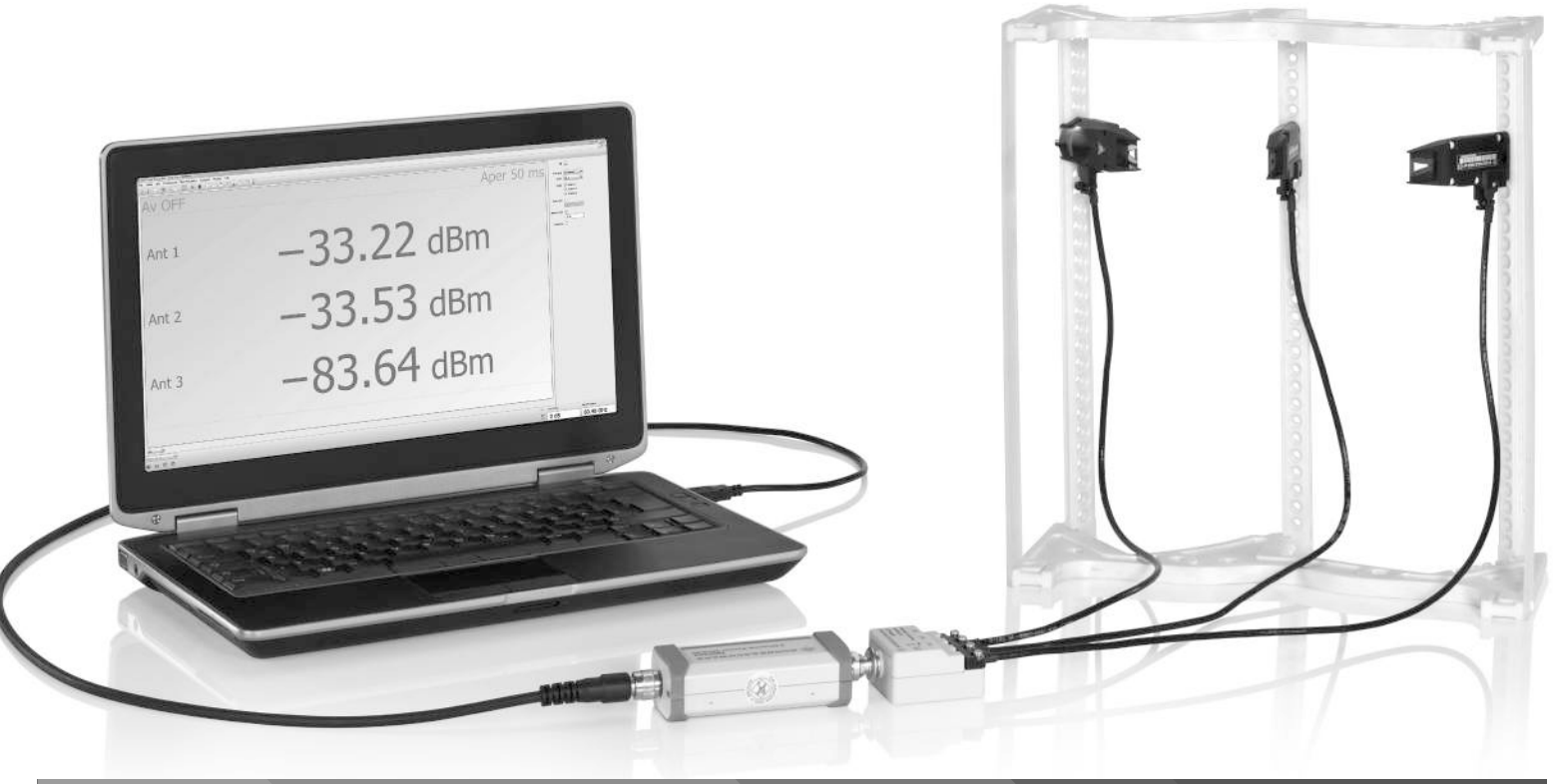
R&S®NRPM
OVER-THE-AIR (OTA) POWER MEASUREMENT SOLUTION

3 year warranty

Specifications



Data Sheet
https://mod-e.ru/

ROHDE&SCHWARZ
Make ideas real

CONTENTS

Definitions **3**

R&S®NRPM3(N) three-channel sensor module **4**

R&S®NRPM-A90/-A90D antenna modules **6**

Antenna characteristics of the R&S®NRPM-A90 (meas.) 10

Antenna characteristics of the R&S®NRPM-A90D (meas.) 11

Technical drawings of the R&S®NRPM-A90 12

Technical drawings of the R&S®NRPM-A90D 13

Accessories for R&S®NRPM OTA power sensors **14**

R&S®NRP-ZKU USB interface cables 14

R&S®NRP-ZK6 six-pole interface cables 14

R&S®NRPM-ZKD3 interface cable 14

R&S®NRPM-Z3 interface module 14

R&S®NRPM-ZD3 filtered cable feedthrough 15

General data **16**

R&S®NRPM3(N), R&S®NRPM-ZKD3, R&S®NRP-ZKU and R&S®NRP-ZK6 16

R&S®NRPM-A90/-A90D, R&S®NRPM-ZD3 and R&S®NRPM-Z3 16

Ordering information **17**

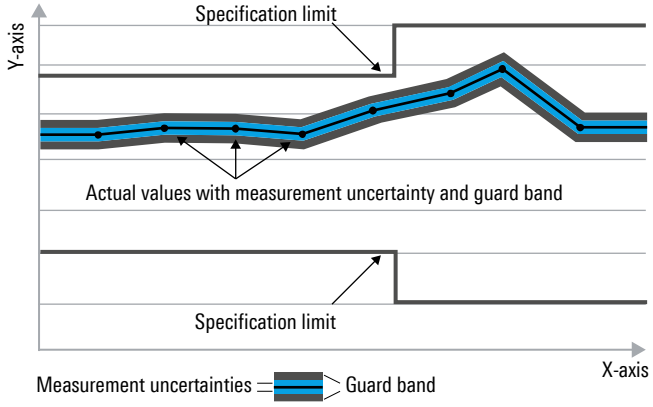
Endnotes **18**

Definitions

General
Product data applies under the following conditions:

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

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



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

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

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

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

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

Device settings and GUI parameters are 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.

R&S®NRPM3(N) three-channel sensor module

Sensor type		sensor module for R&S®NRP OTA antenna modules
Measurand [1]		power of incident electromagnetic wave towards the antenna module
Number of measurement channels		3 parallel channels
Measurement functions	stationary and recurring waveforms and single events	continuous average
		trace
		list mode
Continuous average function	measurand	mean power over recurring acquisition interval
	aperture	10 µs to 2.0 s (default: 20 ms)
	window function	uniform or von Hann [2]
	duty cycle correction [3]	0.001 % to 100.0 %
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 100000
	resolution	≥ 0.5 µs (sample period)
List mode Av: averaging number	measurand	mean power over recurring acquisition interval, frequency can be stored in a list and triggered by burst detection (min. burst length 10 µs) or an external trigger
	maximum number of frequencies	10000
	initial delay after trigger	120 µs to 1 s
	periode of recurring measurements	2 × (aperture + 100 µs) × Av+ t_d t_d = 3.25 µs
Averaging filter	supported measurement functions	all
	averaging number	1 to 65535
	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
Frequency response correction	function	takes the frequency response of the antenna module into account
	parameter	center frequency of test signal
	residual uncertainty	see specification of calibration uncertainty and uncertainty for absolute and relative power measurements

Measurement times [4] Av: averaging number	continuous average	2 × (aperture + 100 µs) × Av + t_z t_z = 2 ms (typ.)
Zeroing (duration)		5.3 s

Acquisition	sample rate (continuous)	2 Msps
Triggering	internal	
	threshold level range and accuracy	see R&S®NRP OTA antenna module
	threshold level hysteresis	0 dB to 10 dB
	dropout [5]	0 s to 10 s
	external	EXTernal[1]: R&S®NRP-Z5
		EXTernal2: coaxial trigger I/0
	slope (external, internal)	pos./neg.
	delay (for list mode delay see list mode)	–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

Analog interface	mechanical	16-pin female push-pull connector
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 in line with the specification
	remote control protocols	supports USB test and measurement device class (USBTMC)
	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®NRPM3N	mechanical	RJ-45 jack
	power supply	power over Ethernet (PoE) class 3 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®NRPM3	48 mm × 30 mm × 115 mm (1.89 in × 1.18 in × 4.53 in)
	R&S®NRPM3N	73 mm × 26 mm × 123 mm (2.87 in × 1.02 in × 4.84 in)
Weight	R&S®NRPM3	< 0.20 kg (0.44 lb)
	R&S®NRPM3N	< 0.35 kg (0.77 lb)

R&S®NRPM-A90/-A90D antenna modules

All power levels represent equivalent isotropic received power levels P_{ISO} as defined in endnote 1.
The R&S®NRPM-A90 single-polarized antenna module contains one linear polarized antenna.
The R&S®NRPM-A90D dual-polarized antenna module contains two linear polarized antennas, which are perpendicular to each other.
Unless otherwise stated, the specifications are valid for the individual antennas of the R&S®NRPM-A90D.

Frequency range		18 GHz to 90 GHz

Power measurement range		continuous average	trace [6]
	18 GHz to 24 GHz	–69 dBm to –19 dBm	–56 dBm to –19 dBm
	> 24 GHz to 35 GHz	–70 dBm to –20 dBm	–57 dBm to –20 dBm
	> 35 GHz to 50 GHz	–73 dBm to –23 dBm	–60 dBm to –23 dBm
	> 50 GHz to 57 GHz	–74 dBm to –24 dBm	–61 dBm to –24 dBm
	> 57 GHz to 71 GHz	–76 dBm to –26 dBm	–63 dBm to –26 dBm
	> 71 GHz to 81 GHz	–76 dBm to –26 dBm	–63 dBm to –26 dBm
	> 81 GHz to 90 GHz	–73 dBm to –23 dBm	–60 dBm to –23 dBm

Maximum power		average power	peak envelope power for max. 10 µs
	18 GHz to 24 GHz	+15 dBm	+19 dBm
	> 24 GHz to 35 GHz	+14 dBm	+18 dBm
	> 35 GHz to 50 GHz	+11 dBm	+15 dBm
	> 50 GHz to 57 GHz	+10 dBm	+14 dBm
	> 57 GHz to 71 GHz	+8 dBm	+12 dBm
	> 71 GHz to 81 GHz	+8 dBm	+12 dBm
	> 81 GHz to 90 GHz	+11 dBm	+15 dBm

Zero offset		after external zeroing [7]
	18 GHz to 24 GHz	< 21 pW
	> 24 GHz to 35 GHz	< 17 pW
	> 35 GHz to 50 GHz	< 9 pW
	> 50 GHz to 57 GHz	< 7 pW
	> 57 GHz to 71 GHz	< 5 pW
	> 71 GHz to 81 GHz	< 5 pW
	> 81 GHz to 90 GHz	< 9 pW

Zero drift [8]	18 GHz to 24 GHz	< 15 pW
	> 24 GHz to 35 GHz	< 12 pW
	> 35 GHz to 50 GHz	< 6 pW
	> 50 GHz to 57 GHz	< 5 pW
	> 57 GHz to 71 GHz	< 3 pW
	> 71 GHz to 81 GHz	< 3 pW
	> 81 GHz to 90 GHz	< 6 pW

Measurement noise [9]	18 GHz to 24 GHz	< 15 pW
	> 24 GHz to 35 GHz	< 12 pW
	> 35 GHz to 50 GHz	< 6 pW
	> 50 GHz to 57 GHz	< 5 pW
	> 57 GHz to 71 GHz	< 3 pW
	> 71 GHz to 81 GHz	< 3 pW
	> 81 GHz to 90 GHz	< 6 pW

Dynamic response	video bandwidth	> 220 kHz (> 300 kHz)	( ): > +15 °C
	rise/fall time 10 %/90 %	< 2.2 µs (< 1.6 µs)	

Trigger threshold level	18 GHz to 24 GHz	–42 dBm to –19 dBm
	> 24 GHz to 35 GHz	–43 dBm to –20 dBm
	> 35 GHz to 50 GHz	–46 dBm to –23 dBm
	> 50 GHz to 57 GHz	–47 dBm to –24 dBm
	> 57 GHz to 71 GHz	–49 dBm to –26 dBm
	> 71 GHz to 81 GHz	–49 dBm to –26 dBm
	> 81 GHz to 90 GHz	–46 dBm to –23 dBm
Trigger threshold level accuracy		identical to uncertainty for absolute power measurements

Far-field distance [10]	18 GHz to 24 GHz	< 52 mm
	> 24 GHz to 35 GHz	< 76 mm
	> 35 GHz to 50 GHz	< 110 mm
	> 50 GHz to 57 GHz	< 125 mm
	> 57 GHz to 71 GHz	< 155 mm
	> 71 GHz to 81 GHz	< 175 mm
	> 81 GHz to 90 GHz	< 195 mm

Phase center [11]		distance	uncertainty (k = 2)
	18 GHz to 90 GHz	12.0 mm	*8.0 mm*

Radar cross section (meas.) [12]	R&S®	NRPM-A90 co-polarization	NRPM-A90 cross-polarization	NRPM-A90D
	18 GHz to 24 GHz	< –33 dBsm	< –27 dBsm	< –24 dBsm
	> 24 GHz to 35 GHz	< –34 dBsm	< –31 dBsm	< –30 dBsm
	> 35 GHz to 50 GHz	< –34 dBsm	< –31 dBsm	< –30 dBsm
	> 50 GHz to 57 GHz	< –34 dBsm	< –29 dBsm	< –27 dBsm
	> 57 GHz to 71 GHz	< –34 dBsm	< –29 dBsm	< –27 dBsm
	> 71 GHz to 81 GHz	< –32 dBsm	< –28 dBsm	< –26 dBsm
	> 81 GHz to 90 GHz	< –28 dBsm	< –25 dBsm	< –24 dBsm

Cross-polarization discrimination (typ.)		R&S®NRPM-A90	R&S®NRPM-A90D
	18 GHz to 50 GHz	< –28 dB	< –24 dB
	> 50 GHz to 57 GHz	< –25 dB	< –24 dB
	> 57 GHz to 71 GHz	< –18 dB	< –16 dB
	> 71 GHz to 81 GHz	< –13 dB	< –13 dB
	> 81 GHz to 90 GHz	< –10 dB	< –10 dB

Dimensions (L × W × H)	R&S®NRPM-A90, without cable	75 mm × 49 mm × 25 mm (2.95 in × 1.93 in × 0.98 in)
	R&S®NRPM-A90D, without cable	81 mm × 62.5 mm × 49 mm (3.19 in × 2.46 in × 1.93 in)
Cable	length	
	model .02	550 mm (21.65 in)
	model .03	750 mm (29.53 in)
	model .04	1000 mm (39.37 in)
	model .05	1500 mm (59.06 in)
	connector durability	min. 30 mating cycles
Weight	R&S®NRPM-A90	26 g (0.06 lb)
	R&S®NRPM-A90D	56 g (0.12 lb)

Uncertainty for relative power measurements [13]	18 GHz to 24 GHz	levels ≤ –29 dBm	*0.05 dB*
		one level > –29 dBm	*0.09 dB*
	> 24 GHz to 35 GHz	levels ≤ –30 dBm	*0.05 dB*
		one level > –30 dBm	*0.09 dB*
	> 35 GHz to 50 GHz	levels ≤ –33 dBm	*0.05 dB*
		one level > –33 dBm	*0.09 dB*
	> 50 GHz to 57 GHz	levels ≤ –34 dBm	*0.05 dB*
		one level > –34 dBm	*0.09 dB*
	> 57 GHz to 71 GHz	levels ≤ –36 dBm	*0.05 dB*
		one level > –36 dBm	*0.09 dB*
	> 71 GHz to 81 GHz	levels ≤ –36 dBm	*0.05 dB*
		one level > –36 dBm	*0.09 dB*
	> 81 GHz to 90 GHz	levels ≤ –33 dBm	*0.05 dB*
		one level > –33 dBm	*0.09 dB*

R&S®NRPM-A90: Uncertainty for absolute power measurements [14]				(RH: relative humidity)
		+20 °C to +25 °C	+15 °C to +35 °C	+5 °C to +40 °C
	0 % to < 40 % RH	*0.68 dB*	*0.72 dB*	*0.77 dB*
	40 % to 60 % RH	*0.68 dB*	*0.71 dB*	*0.76 dB*
	> 60 % to 75 % RH	*0.69 dB*	*0.73 dB*	*0.78 dB*
18 GHz to 24 GHz	> 75 % to 95 % RH	*0.70 dB*	*0.75 dB*	*0.81 dB*
		+20 °C to +25 °C	+15 °C to +35 °C	+5 °C to +40 °C
	0 % to < 40 % RH	*0.50 dB*	*0.54 dB*	*0.61 dB*
	40 % to 60 % RH	*0.49 dB*	*0.53 dB*	*0.59 dB*
	> 60 % to 75 % RH	*0.51 dB*	*0.56 dB*	*0.62 dB*
> 24 GHz to 35 GHz	> 75 % to 95 % RH	*0.53 dB*	*0.58 dB*	*0.66 dB*
		+20 °C to +25 °C	+15 °C to +35 °C	+5 °C to +40 °C
	0 % to < 40 % RH	*0.51 dB*	*0.56 dB*	*0.62 dB*
	40 % to 60 % RH	*0.50 dB*	*0.54 dB*	*0.60 dB*
	> 60 % to 75 % RH	*0.53 dB*	*0.60 dB*	*0.72 dB*
> 35 GHz to 57 GHz	> 75 % to 95 % RH	*0.55 dB*	*0.64 dB*	*0.72 dB*
		+20 °C to +25 °C	+15 °C to +35 °C	+5 °C to +40 °C
	0 % to < 40 % RH	*0.58 dB*	*0.64 dB*	*0.68 dB*
	40 % to 60 % RH	*0.58 dB*	*0.61 dB*	*0.67 dB*
	> 60 % to 75 % RH	*0.61 dB*	*0.68 dB*	*0.75 dB*
> 57 GHz to 71 GHz	> 75 % to 95 % RH	*0.65 dB*	*0.73 dB*	*0.83 dB*
		+20 °C to +25 °C	+15 °C to +35 °C	+5 °C to +40 °C
	0 % to < 40 % RH	*0.63 dB*	*0.68 dB*	*0.71 dB*
	40 % to 60 % RH	*0.61 dB*	*0.64 dB*	*0.69 dB*
	> 60 % to 75 % RH	*0.67 dB*	*0.73 dB*	*0.79 dB*
> 71 GHz to 81 GHz	> 75 % to 95 % RH	*0.72 dB*	*0.81 dB*	*0.91 dB*
		+20 °C to +25 °C	+15 °C to +35 °C	+5 °C to +40 °C
	0 % to < 40 % RH	*0.72 dB*	*0.76 dB*	*0.79 dB*
	40 % to 60 % RH	*0.69 dB*	*0.72 dB*	*0.77 dB*
	> 60 % to 75 % RH	*0.75 dB*	*0.80 dB*	*0.86 dB*
> 81 GHz to 90 GHz	> 75 % to 95 % RH	*0.80 dB*	*0.87 dB*	*0.97 dB*

R&S®NRPM-A90D: Uncertainty for absolute power measurements at 1 m distance to the DUT [14, 15] (RH: relative humidity)				
		+20 °C to +25 °C	+15 °C to +35 °C	+5 °C to +40 °C
	0 % to < 40 % RH	*0.73 dB*	*0.76 dB*	*0.81 dB*
	40 % to 60 % RH	*0.73 dB*	*0.75 dB*	*0.80 dB*
	> 60 % to 75 % RH	*0.73 dB*	*0.77 dB*	*0.82 dB*
18 GHz to 24 GHz	> 75 % to 95 % RH	*0.74 dB*	*0.79 dB*	*0.85 dB*
		+20 °C to +25 °C	+15 °C to +35 °C	+5 °C to +40 °C
	0 % to < 40 % RH	*0.56 dB*	*0.60 dB*	*0.66 dB*
	40 % to 60 % RH	*0.55 dB*	*0.59 dB*	*0.64 dB*
	> 60 % to 75 % RH	*0.57 dB*	*0.61 dB*	*0.67 dB*
> 24 GHz to 35 GHz	> 75 % to 95 % RH	*0.59 dB*	*0.63 dB*	*0.71 dB*
		+20 °C to +25 °C	+15 °C to +35 °C	+5 °C to +40 °C
	0 % to < 40 % RH	*0.60 dB*	*0.64 dB*	*0.69 dB*
	40 % to 60 % RH	*0.59 dB*	*0.62 dB*	*0.68 dB*
	> 60 % to 75 % RH	*0.61 dB*	*0.68 dB*	*0.78 dB*
> 35 GHz to 57 GHz	> 75 % to 95 % RH	*0.63 dB*	*0.71 dB*	*0.78 dB*
		+20 °C to +25 °C	+15 °C to +35 °C	+5 °C to +40 °C
	0 % to < 40 % RH	*0.68 dB*	*0.73 dB*	*0.77 dB*
	40 % to 60 % RH	*0.68 dB*	*0.71 dB*	*0.76 dB*
	> 60 % to 75 % RH	*0.71 dB*	*0.77 dB*	*0.83 dB*
> 57 GHz to 71 GHz	> 75 % to 95 % RH	*0.74 dB*	*0.81 dB*	*0.90 dB*
		+20 °C to +25 °C	+15 °C to +35 °C	+5 °C to +40 °C
	0 % to < 40 % RH	*0.74 dB*	*0.78 dB*	*0.81 dB*
	40 % to 60 % RH	*0.72 dB*	*0.75 dB*	*0.79 dB*
	> 60 % to 75 % RH	*0.77 dB*	*0.82 dB*	*0.88 dB*
> 71 GHz to 81 GHz	> 75 % to 95 % RH	*0.82 dB*	*0.90 dB*	*0.99 dB*
		+20 °C to +25 °C	+15 °C to +35 °C	+5 °C to +40 °C
	0 % to < 40 % RH	*0.89 dB*	*0.93 dB*	*0.95 dB*
	40 % to 60 % RH	*0.87 dB*	*0.89 dB*	*0.93 dB*
	> 60 % to 75 % RH	*0.92 dB*	*0.96 dB*	*1.01 dB*
> 81 GHz to 90 GHz	> 75 % to 95 % RH	*0.96 dB*	*1.02 dB*	*1.10 dB*

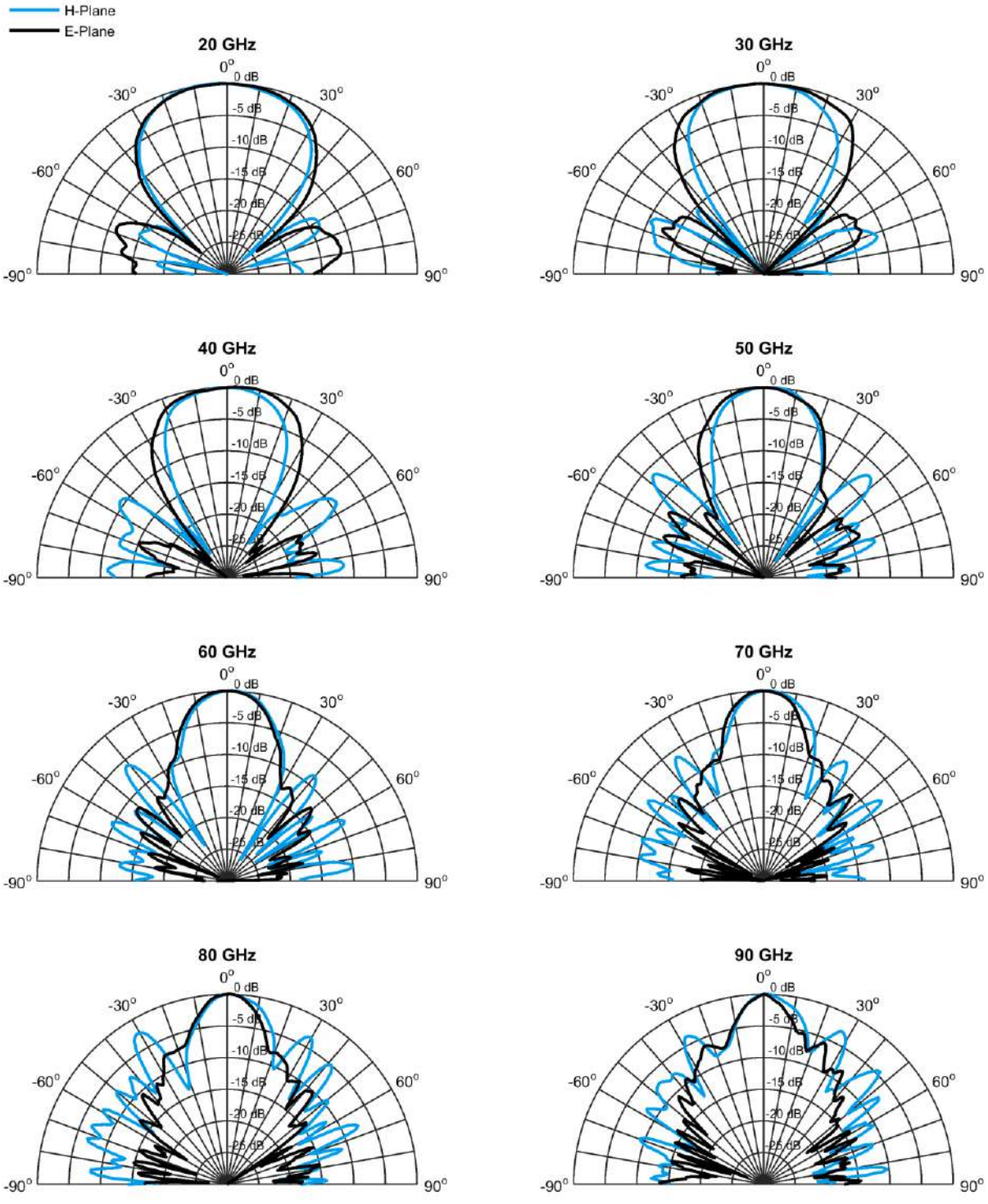
Note: For a distance of 1 m between R&S®NRPM-A90D and DUT use the uncertainties of the table above. For other distances, also the values of the following table are required to calculate the total uncertainty for absolute power measurements in a quadratic manner.

R&S®NRPM-A90D: Additional uncertainty for absolute power measurements depending on the distance to the DUT [15]								
Distance / Frequency	200 mm	300 mm	400 mm	500 mm	700 mm	1 m	2 m	> 2 m
18 GHz to 24 GHz	*0.48 dB*	*0.22 dB*	*0.12 dB*	*0.06 dB*	*0.02 dB*	*0.00 dB*	*0.03 dB*	*0.05 dB*
> 24 GHz to 35 GHz	*0.60 dB*	*0.34 dB*	*0.21 dB*	*0.14 dB*	*0.06 dB*	*0.00 dB*	*0.07 dB*	*0.12 dB*
> 35 GHz to 57 GHz	*0.70 dB*	*0.37 dB*	*0.23 dB*	*0.15 dB*	*0.06 dB*	*0.00 dB*	*0.07 dB*	*0.13 dB*
> 57 GHz to 71 GHz	*1.26 dB*	*0.56 dB*	*0.30 dB*	*0.18 dB*	*0.07 dB*	*0.00 dB*	*0.08 dB*	*0.16 dB*
> 71 GHz to 81 GHz	–	*0.70 dB*	*0.39 dB*	*0.24 dB*	*0.10 dB*	*0.00 dB*	*0.11 dB*	*0.22 dB*
> 81 GHz to 90 GHz	–	–	*0.67 dB*	*0.41 dB*	*0.16 dB*	*0.00 dB*	*0.19 dB*	*0.36 dB*

Example: For an OTA power measurement with the R&S®NRPM-A90D at 28 GHz, an ambient temperature of +29 °C, a relative humidity of 70 % at a distance of 0.5 m the total uncertainty for absolute power measurements is calculated as:

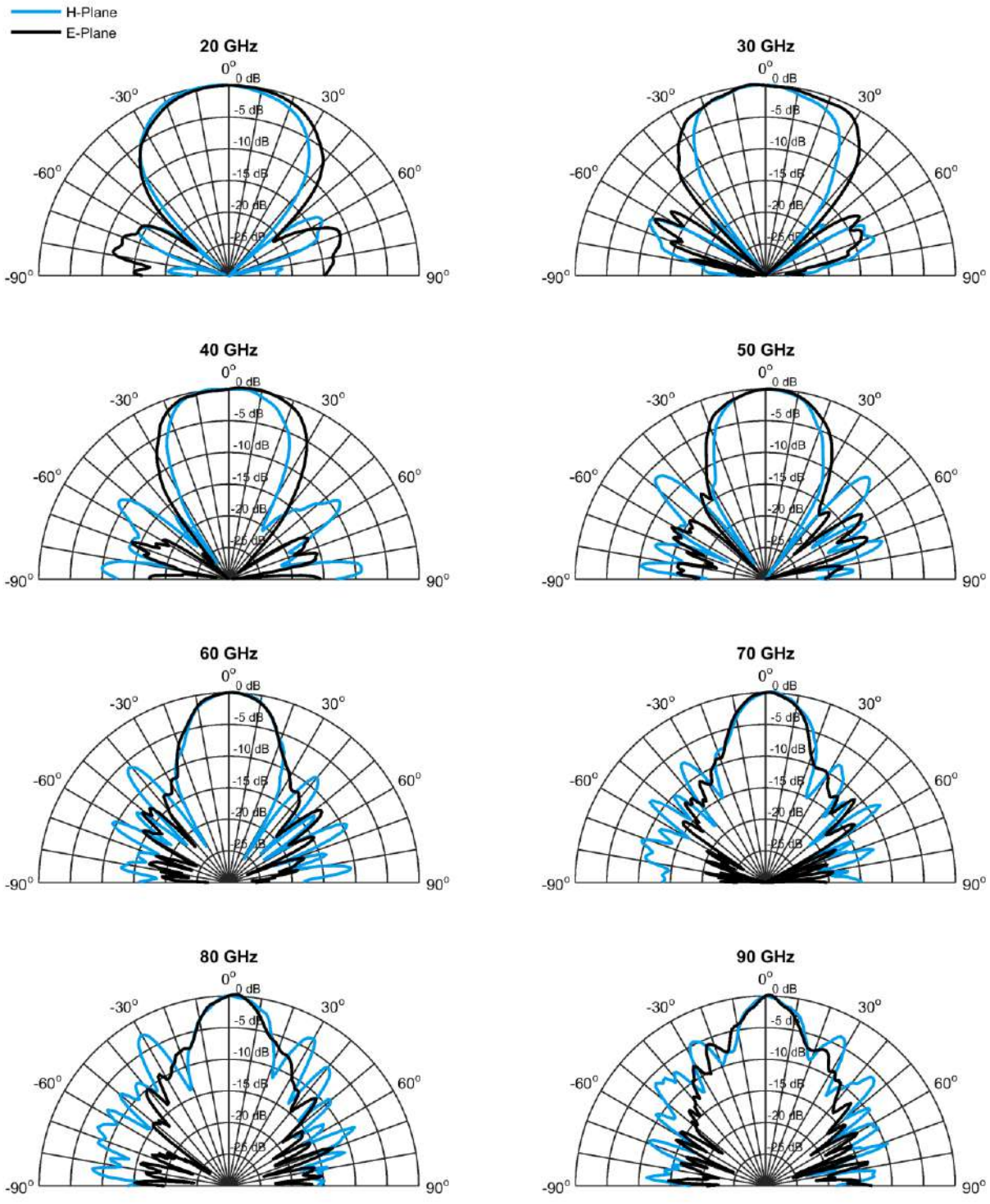
$U_{abs} = \sqrt{0.61^2 + 0.14^2\ dB}\ = 0.63\ dB.$

Antenna characteristics of the R&S®NRPM-A90 (meas.)



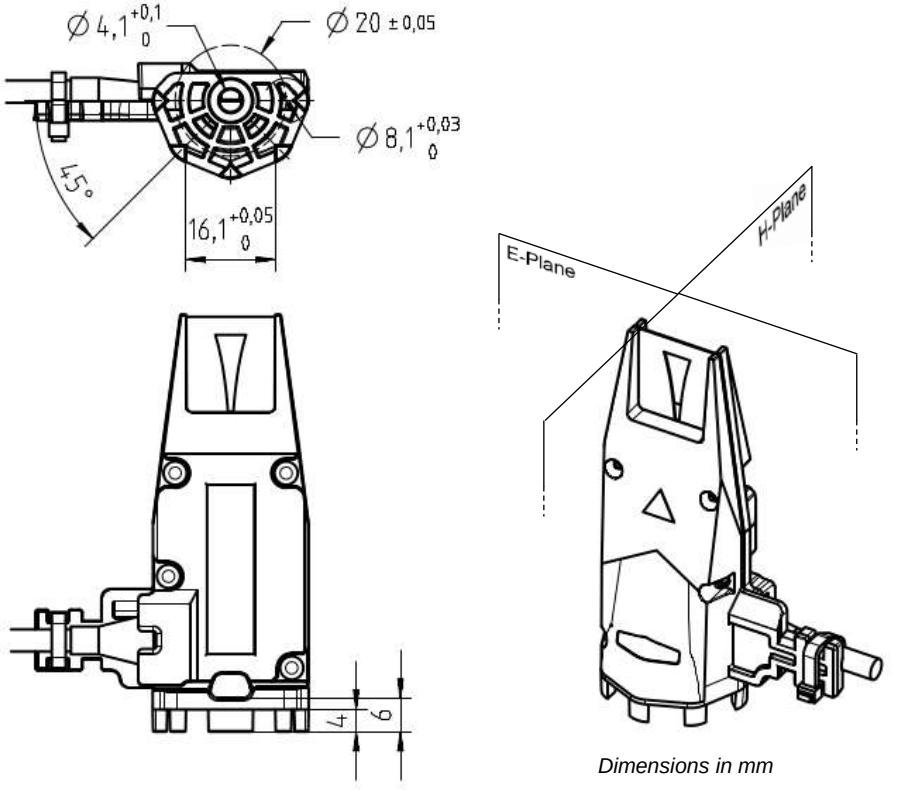
The definition of E plane and H plane is shown in the technical drawings of the R&S®NRPM-A90 on page 12.

Antenna characteristics of the R&S®NRPM-A90D (meas.)



Antenna characteristics for antenna 1 and antenna 2 are almost identical. The definition of E plane and H plane of the individual antennas 1 and 2 is shown in the technical drawings of the R&S®NRPM-A90 on page 12.

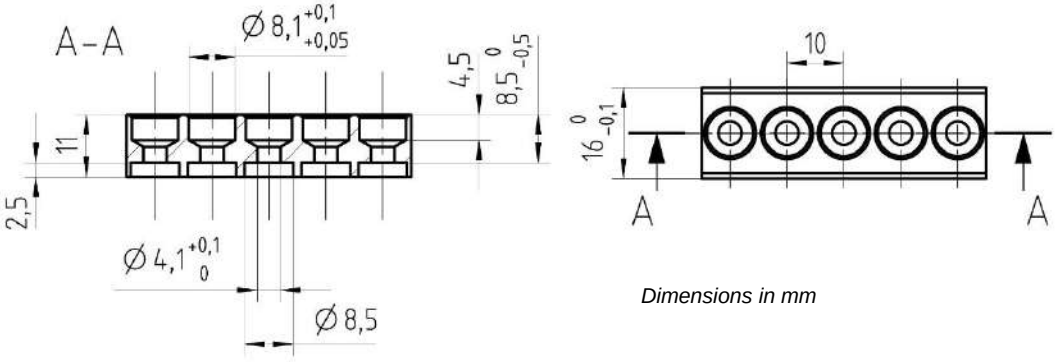
Technical drawings of the R&S®NRPM-A90



Dimensions in mm

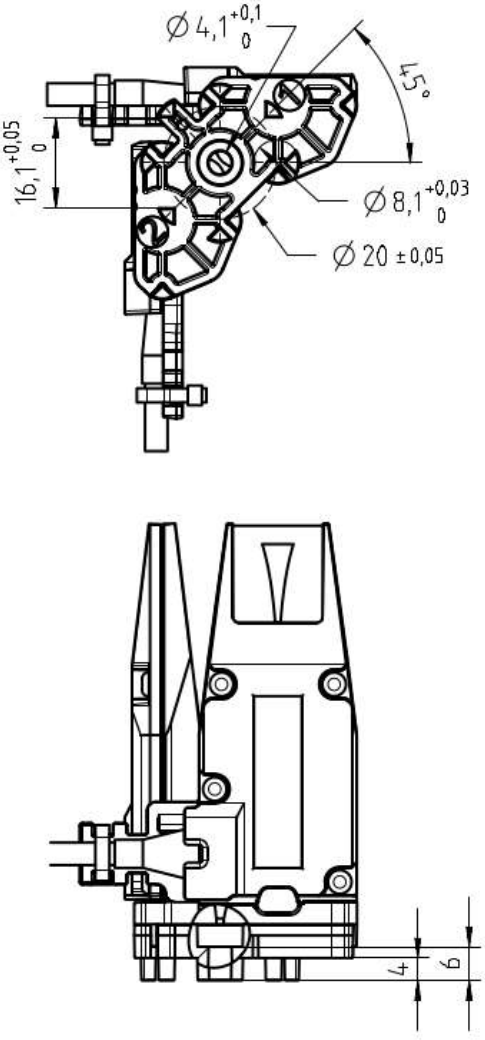
Rail for mounting the R&S®NRPM-A90 with an expanding rivet

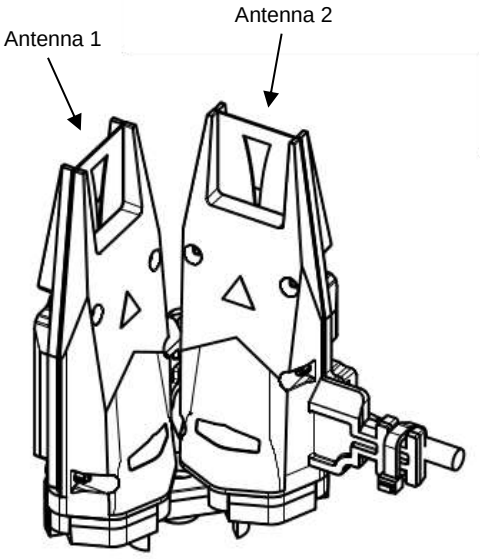
Recommended rivet: Essentra Components, SR-4120B or SR-4120W (1 rivet SR-4120W per antenna module is enclosed)



Dimensions in mm

Technical drawings of the R&S®NRPM-A90D

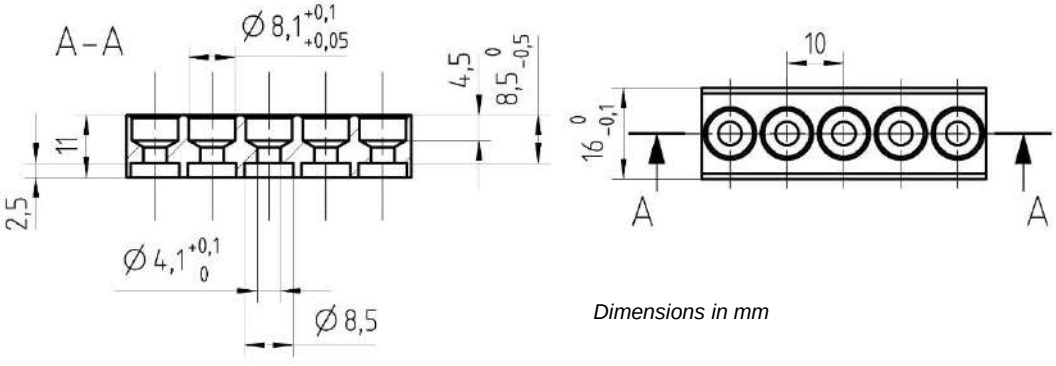




Dimensions in mm

Rail for mounting the R&S®NRPM-A90D with an expanding rivet

Recommended rivet: Essentra Components, SR-4120B or SR-4120W (1 rivet SR-4120W per antenna module is enclosed)



Dimensions in mm

Accessories for R&S®NRPM OTA power sensors

R&S®NRP-ZKU USB interface cables

The R&S®NRP-ZKU interface cables are used to connect the R&S®NRPM3(N) sensor module 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 or commercially available M12 extension cables. Using such extension cables can affect the reliability of the high-speed data transfer.

R&S®NRP-ZK6 six-pole interface cables

The R&S®NRP-ZK6 interface cables are used to connect the R&S®NRPM3(N) sensor module to an R&S®NRP-Z5 sensor hub.

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 or commercially available M12 extension cables. Using such extension or adapter cables can affect the reliability of the high-speed data transfer.

R&S®NRPM-ZKD3 interface cable

The R&S®NRPM-ZKD3 interface cable is used to connect an R&S®NRPM3(N) sensor module to an R&S®NRPM-ZD3 feedthrough module.

Connectors	sensor side	16-pin male push-pull connector
	side of feedthrough module	15-pin male D-Sub connector
Length	1425.8770.02	0.75 m
	1436.2984.02	0.71 m

The R&S®NRPM-ZKD3 interface cable must not be combined with commercially available D-Sub extension cables.

R&S®NRPM-Z3 interface module

The R&S®NRPM-Z3 interface module is directly connected to the R&S®NRPM3(N) three-channel sensor module and hosts up to three antenna module cables.

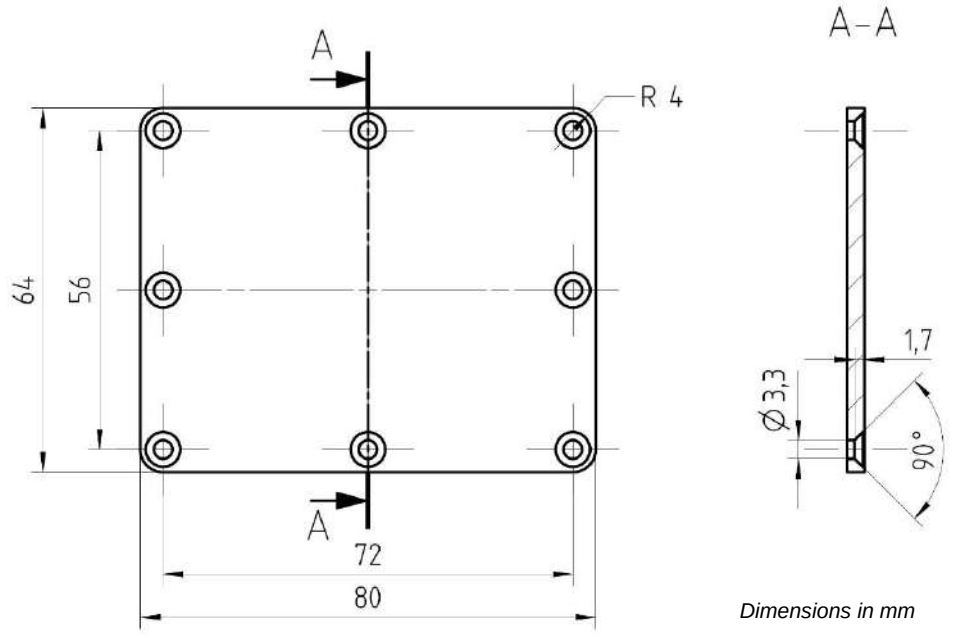
Connectors	sensor module interface	16-pin male push-pull connector
	antenna interface	3 × 10-pin antenna cable connectors
Dimensions (W × H × L)		68 mm × 48 mm × 26.5 mm (2.68 in × 1.89 in × 1.04 in)
Weight		105 g (0.23 lb)

R&S®NRPM-ZD3 filtered cable feedthrough

The R&S®NRPM-ZD3 feedthrough module is used in combination with anechoic chambers to feed the antenna signals from inside to outside the chamber. It combines the signals from up to three antenna module cables to one R&S®NRPM3(N) sensor module.

Connectors	outside	15-pin female D-Sub connector
	inside	3 × 10-pin antenna cable connectors
Dimensions (W × H × L)	feedthrough module with cover	80 mm × 64 mm × 40 mm (3.15 in × 2.52 in × 1.58 in)
Weight	feedthrough module with cover	112 g (0.25 lb)

Drilling template for the R&S®NRPM-ZD3



Dimensions in mm

General data

R&S®NRPM3(N), R&S®NRPM-ZKD3, R&S®NRP-ZKU and R&S®NRP-ZK6

Environmental conditions		
Temperature [16]	operating temperature range	0 °C to +50 °C
	permissible temperature range	–10 °C to +55 °C
	storage temperature range	–40 °C to +85 °C
Damp heat		+25 °C/+55 °C, 95 % rel. humidity, cyclic, with restrictions: noncondensing, in line with EN 60068-2-30
Air pressure	operating	795 hPa (2000 m) to 1060 hPa
	transport	566 hPa (4500 m) to 1060 hPa
Mechanical resistance		
Vibration	sinusoidal	5 Hz to 55 Hz, 0.15 mm amplitude const., 1.8 g at 55 Hz, 55 Hz to 150 Hz, 0.5 g const., 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
Product conformity		
Electromagnetic compatibility	EU: in line with EMC Directive 2004/108/EC	applied harmonized standards: EN 61326-1 (industrial environment), EN 61326-2-1, EN 55011 (class B),
Calibration interval	recommended for highest accuracy	2 years

R&S®NRPM-A90/-A90D, R&S®NRPM-ZD3 and R&S®NRPM-Z3

Environmental conditions		
Temperature	operating temperature range	+5 °C to +40 °C
	permissible temperature range	0 °C to +50 °C
	storage temperature range	–20 °C to +75 °C
Damp heat		+25 °C/+40 °C, 95 % rel. humidity, cyclic, with restrictions: noncondensing, in line with EN 60068-2-30
Air pressure	operating	795 hPa (2000 m) to 1060 hPa
	transport	566 hPa (4500 m) to 1060 hPa
Mechanical resistance		
Vibration	sinusoidal	5 Hz to 55 Hz, 0.15 mm amplitude const., 1.8 g at 55 Hz, 55 Hz to 150 Hz, 0.5 g const., in line with EN 60068-2-6
	random	8 Hz to 500 Hz, 1.2 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
Product conformity		
Electromagnetic compatibility [17]	EU: in line with EMC Directive 2004/108/EC	applied harmonized standards: EN 61326-1 (industrial environment), EN 61326-2-1, EN 55011 (class B),
Calibration interval	R&S®NRPM-A90/-A90D recommended for highest accuracy	1 year

Ordering information

Designation	Type	Order No.
Three-channel sensor module, for R&S®NRPM-A90/-A90D antenna modules	R&S®NRPM3	1425.8563.02
Three-channel sensor module, LAN version for R&S®NRPM-A90/-A90D antenna modules	R&S®NRPM3N	1425.8592.02
Single-polarized antenna module, 18 GHz to 90 GHz, cable length: 550 mm	R&S®NRPM-A90	1426.7760.02
Single-polarized antenna module, 18 GHz to 90 GHz, cable length: 750 mm	R&S®NRPM-A90	1426.7760.03
Single-polarized antenna module, 18 GHz to 90 GHz, cable length: 1000 mm	R&S®NRPM-A90	1426.7760.04
Single-polarized antenna module, 18 GHz to 90 GHz, cable length: 1500 mm	R&S®NRPM-A90	1426.7760.05
Dual-polarized antenna module, 18 GHz to 90 GHz, cable length: 550 mm	R&S®NRPM-A90D	1426.7777.02
Dual-polarized antenna module, 18 GHz to 90 GHz, cable length: 750 mm	R&S®NRPM-A90D	1426.7777.03
Dual-polarized antenna module, 18 GHz to 90 GHz, cable length: 1000 mm	R&S®NRPM-A90D	1426.7777.04
Dual-polarized antenna module, 18 GHz to 90 GHz, cable length: 1500 mm	R&S®NRPM-A90D	1426.7777.05
Accessories		
Filtered cable feedthrough, for anechoic chamber (e.g. R&S®TS7124 shielded RF test box)	R&S®NRPM-ZD3	1425.8786.02
Interface cable, connecting R&S®NRPM-ZD3 filtered cable feedthrough with R&S®NRPM3(N) sensor module	R&S®NRPM-ZKD3	1436.2984.02
Interface module, for operation without anechoic chamber	R&S®NRPM-Z3	1426.7602.02
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
Six-pole interface cable, length: 1.50 m	R&S®NRP-ZK6	1419.0664.02
Six-pole interface cable, length: 3.00 m	R&S®NRP-ZK6	1419.0664.03
Six-pole interface cable, length: 5.00 m	R&S®NRP-ZK6	1419.0664.04
Trigger cable to synchronize two R&S®NRPM3(N) sensor modules, connectors SMB to SMB, length: 0.75 m	R&S®NRPM-ZKT	1425.8857.02
Sensor hub	R&S®NRP-Z5	1146.7740.02

Designation	Type	Order No.
Documentation		
Documentation of calibration values	R&S®DCV-2	0240.2193.06
Printout of DCV (in combination with DCV only)	R&S®DCV-ZP	1173.6506.02

Warranty		
R&S®NRPM3(N), R&S®NRPM-A90, R&S®NRPM-A90D		3 years
All other items [18]		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 [19]. Necessary calibration and adjustments carried out during repairs are also covered.

Extended warranty with calibration coverage (CW1 and CW2)
Enhance your extended warranty by adding calibration coverage at a package price. This package ensures that your Rohde & Schwarz product is regularly calibrated, inspected and maintained during the term of the contract. It includes all repairs [19] 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 [19] and accredited calibration at the recommended intervals as well as any accredited calibration carried out during repairs or option upgrades.

Endnotes

[1] The power of the incident electromagnetic wave towards the antenna module can be measured in various quantities:

a) Equivalent isotropically received power P_{ISO} in W or dBm (default): Equivalent detected power of an isotropic antenna with an ideal power detector at the phase center location of the R&S®NRPM antenna module assuming radiation only from boresight direction.

b) Power at the internal RF detector in W or dBm: The measurement result without including antenna gain and frequency dependent calibration factors.

c) Power density S in W/m², calculated as $S = \frac{4\pi}{\lambda^2} \cdot P_{ISO}$.

d) Electric field strength E_{eff} in V/m, calculated as $E_{eff} = \sqrt{S \cdot Z_0}$ with $Z_0 = 376.73\ \Omega$.

e) Magnetic field strength H_{eff} in A/m, calculated as $H_{eff} = \sqrt{S/Z_0}$ with $Z_0 = 376.73\ \Omega$.

The equivalent isotropically radiated power (EIRP) of the transmitter (DUT) can be calculated as $EIRP = P_{ISO} \cdot \left(\frac{4\,\pi\,d}{\lambda}\right)^2$, where d denotes the distance between the phase centers of the transmitter and the R&S®NRPM-A90/-A90D and λ denotes the wavelength.

[2] 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.

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

[4] 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.

[5] 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.

[6] With a resolution of 256 pixel.

[7] 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).

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

[9] 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.

[10] The far-field distance is calculated according to the equation $\frac{2\,D^2}{\lambda}$, where D is the largest lateral dimension of the receiving antenna and λ is the wavelength. The minimum distance between transmitter and the R&S®NRPM-A90/-A90D is defined as $\frac{2\,(D_1+D_2)^2}{\lambda}$, where D_1 is the largest lateral dimension of the transmitter and D_2 is the largest lateral dimension of the receiving antenna.

[11] The phase center of the R&S®NRPM-A90/-A90D is defined from the front end towards the interior of the antenna module. The corresponding measurement uncertainty depends on the distance to the transmitter and can be calculated as $20\ dB \cdot \lg\left(1 + \frac{U_{ph}}{d}\right)$ where U_{ph} denotes the uncertainty of the phase center and d denotes the distance between the phase centers of the transmitter and the R&S®NRPM-A90/-A90D.
Example: Uncertainty contribution of the phase center at a distance of $0.5\ m$: $20\ dB \cdot \lg\left(1 + \frac{0.008\ m}{0.5\ m}\right) = 0.138\ dB$.
This uncertainty contribution is relevant for calculating the uncertainty of the EIRP of the DUT according to the formula in footnote 1. As a rule of thumb, the contribution of the R&S®NRPM-A90/-A90D phase center can be neglected for distances larger than $1\ m$. The phase center uncertainty contribution of the transmitter can be calculated in the same way.

[12] Radar cross sections (RCS) of both the R&S®NRPM-A90/-A90D and the transmitter are required in order to calculate the uncertainty contribution caused by multi-reflections: $6.14\ dB \cdot \frac{\sqrt{\sigma_{A90} \cdot \sigma_{Tx}}}{4\pi\ d^2}$, where σ_{A90} denotes the RCS of the R&S®NRPM-A90/-A90D, σ_{Tx} denotes the RCS of the transmitter and d denotes the distance between the phase centers of the transmitter and the R&S®NRPM-A90/-A90D. In most cases, especially for large distances, this contribution can be neglected.

[13] Expanded uncertainty (k = 2) for relative power measurements on CW signals of the same frequency. Specifications include linearity and temperature effect. Zero offset, zero drift and measurement noise must additionally be taken into account when measuring low powers.

[14] Expanded uncertainty (k = 2) for absolute power measurements on CW signals in the far-field range with a maximum alignment error of ±2° in azimuth and elevation relative to the reference boresight of the R&S®NRPM-A90/-A90D. Specifications include calibration uncertainty, linearity, temperature and humidity effect. Contributions from zero offset, zero drift, measurement noise as well as radar cross section must additionally be taken into account. These contributions must be added quadratically to the expanded uncertainty (k = 2) for absolute power measurements.
Polarization of transmitter and receiving antenna are assumed to match better than ±5°. The error due to polarization mismatch can be calculated as $cos^2(\varphi)$ where φ denotes the angle the two antennas are rotated to each other.

Example: The uncertainty of a power measurement at P_{ISO} equals –56 dBm (2.5 nW) and 28 GHz at a distance of 0.5 m between transmitter and antenna module is to be determined for an R&S®NRPM-A90. The ambient temperature is +29 °C, rel. humidity is 70 %, and the averaging number is set to 4 in the continuous average mode with an aperture time of 20 ms.
In the following the individual uncertainty contributions are calculated.

Contribution of zero offset: $10\ dB \cdot \lg\left(1 + \frac{17\ pW}{2.5\ nW}\right) = 0.029\ dB$

Contribution of zero drift: $10\ dB \cdot \lg\left(1 + \frac{12\ pW}{2.5\ nW}\right) = 0.021\ dB$

Contribution of noise (see footnote 9): $P_{Noise} = 12\ pW \cdot \sqrt{\frac{10.24\ s}{2 \cdot 0.02\ s \cdot 4}} = 96\ pW$

$10\ dB \cdot \lg\left(1 + \frac{96\ pW}{2.5\ nW}\right) = 0.163\ dB$

Combined with the uncertainty of 0.56 dB for absolute power measurements under the given conditions, the total expanded uncertainty is

$$\sqrt{0.029^2 + 0.021^2 + 0.163^2 + 0.56^2}dB = 0.59\ dB$$

The contribution of the radar cross section has been neglected.

[15] The design of the R&S®NRPM-A90D shows a transversal offset of the individual antenna to the reference boresight. Therefore, the angle of the transmitter to the individual antenna depends on the distance between transmitter and antenna module. This leads to a contribution to the uncertainty of absolute power measurements depending on the distance between the transmitter and the R&S®NRPM-A90D which must be added quadratically. Not included in this specification are any changes of the antenna gain of the transmitter as a function of the distance between transmitter and antenna module.

[16] 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.

[17] Immunity tests have been performed with the R&S®NRPM-A90/-A90D antenna module mounted into an anechoic chamber using the R&S®NRPM-ZD3 filtered cable feedthrough. In case of a measurement setup with the R&S®NRPM-Z3 interface module the R&S®NRPM-A90/-A90D, the R&S®NRPM3(N) and the R&S®NRPM-Z3 have been arranged inside an anechoic environment.

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

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

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&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.

www.rohde-schwarz.com

Sustainable product design

- ► Environmental compatibility and eco-footprint
- ► Energy efficiency and low emissions
- ► Longevity and optimized total cost of ownership

Certified Quality Management
ISO 9001

Certified Environmental Management
ISO 14001

Rohde&Schwarz training

www.training.rohde-schwarz.com

Rohde&Schwarz customer support

www.rohde-schwarz.com/support

https://mod-e.ru/

5215.8806.22 05.00 PDP/PDW 1 en
5215880622