Measurement, analysis and monitoring of RF signals

19" Remote Analyzer for remote controlled measurements and analysis of electrical signals ranging from 9 kHz up to 6 GHz

- **Application-oriented operating modes with bandwidths up to 32 MHz**
  - Spectrum Analysis mode with Wideband FFT and Channel Monitoring
  - Multi-Channel Power mode for rapid evaluation of up to 500 freely selectable channels
  - Level Meter with true RMS and PEAK detectors
  - Scope with I/Q Data
- **Ethernet for easy integration into the test environment and for remote control**
- **Extremely high speed measurement with sweep rates of up to 12 GHz/s**
- **Excellent frequency resolution of up to 600,000 frequency points per sweep**
- **Analog demodulation**
- **Digital audio streaming over Ethernet**
- **Low power consumption <20 W**
- **Fan-less design for silent, continuous operation**
- **Compact and space saving, 1.75" (1U) high**

INTRODUCTION

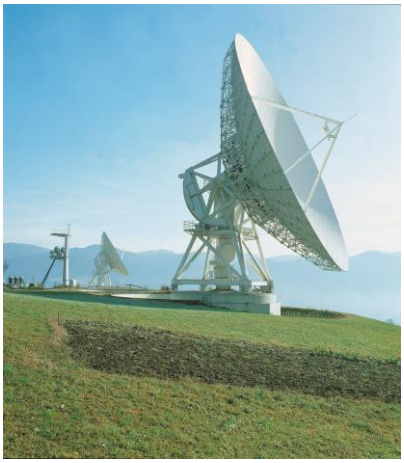
The digital design of the NRA Analyzers is based on a smart combination of the super heterodyne principle with leading-edge FFT analysis and trigger functions. It captures pulsed and random signals and is ideal for short- and long-term observation of all types of RF signals. The NRA RX models are cost effective analyzers with receiver characteristics, designed for radio monitoring.

The NRA Series

The compact size and wide range of remote operation facilities make integration for monitoring & surveillance applications both fast and straightforward. Wherever you are, you can obtain information from the NRA by accessing it from a PC, as long as Ethernet connectivity is provided. The measurement data are also available in binary format to optimize the speed of communication. Ready-made software solutions can be used for standard applications. The “Antenna Control” option enables direct use of Narda antennas and cables. The antenna factors and cable data are detected and taken into account automatically, so that the device delivers precise results in units of field strength, which makes light work of integration into a measuring system.

NRA – Front view

NRA – Rear view



Two NRA RX models with receiver characteristics

NRA-3000 RX (9 kHz to 3 GHz) and
NRA-6000 RX (9 kHz to 6 GHz)

It is vital that standards and technical parameters are met in view of the ever increasing use of wireless technologies and the limited natural resource of the frequency spectrum. The NRA RX models are specially designed for this task, being ideal for radio monitoring. Example applications include:

- Radio surveillance and monitoring
- Demodulation and decoding
- Spectrum occupancy measurements
- Coverage measurements
- Signal analysis and classification
- Detection of illegal transmitters
- SIGINT (COMINT and ELINT)

The ideal entry level remote analyzer

NRA-2500

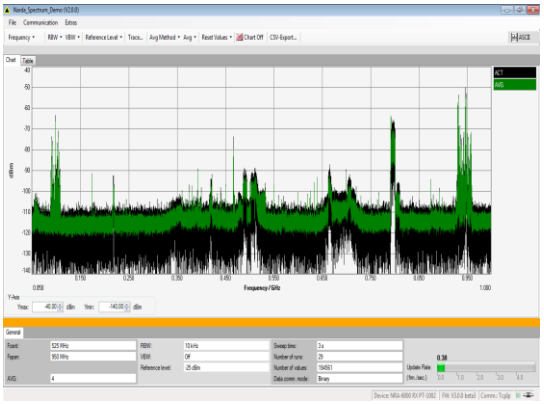
- Signal analysis from 5 MHz to 2.5 GHz
- Ideal analyzer for satellite pointing and tracking, antenna peaking, and carrier monitoring

OPERATING MODES

The main operating mode of the NRA provides powerful spectrum analysis. Other operating modes are available as options, so the device can be optimally configured for specific measurement tasks. The recorded signals are preprocessed in all operating modes, thus reducing the quantity of data and relieving the load on the network. It is also possible to add features at any time, so the NRA is a future-proof, versatile measurement solution for a diversity of applications.

SPECTRUM ANALYSIS

Spectrum Analysis mode covers a wide frequency range from 9 kHz to 6 GHz, depending on the version chosen, and features finely adjustable resolution bandwidths from 10 Hz to 20 MHz. The input attenuator is adjustable in 1 dB steps to give optimum matching to the measurement signal. The analyzers provide spectrums containing up to 600,000 frequency points. Additionally, the detector can be used to match the frequency points to a fixed number e.g. 4096. This provides a rapid overview of the entire RF spectrum or a very detailed analysis of specific sections.

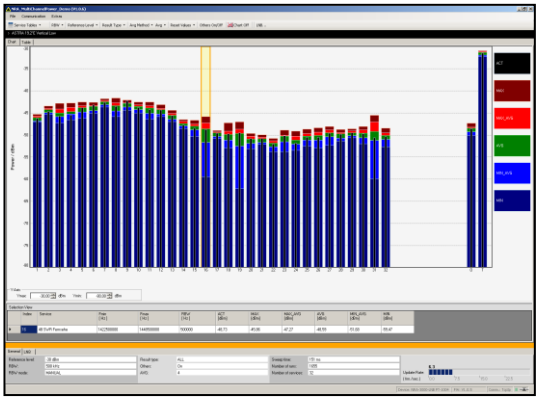


Overview of the Frequency Spectrum (Bildschirm der NRA Spectrum Demo Software)

MULTI CHANNEL POWER (Option)

MCP mode is perfect for obtaining a rapid overview of specified frequency bands or channels. Service tables can be defined containing up to 500 freely selectable channels each with a dedicated channel bandwidth CBW and service name. Simultaneous representation of maximum (Max), average (Avg) and minimum (Min) values allows immediate distinction between permanent and sporadic signals.

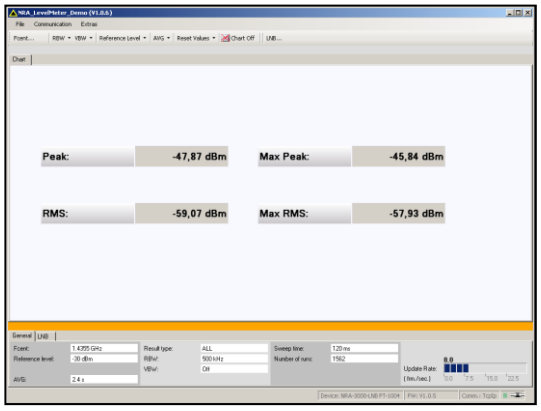
This mode can be used for violation detection in spectrum monitoring, for example. You can define entire frequency bands as “channels”. You will then see immediately when signals occur in these bands.



Multi-channel view (Bar graph or Table) (Screen NRA MCP Demo Software)

LEVEL METER (Option)

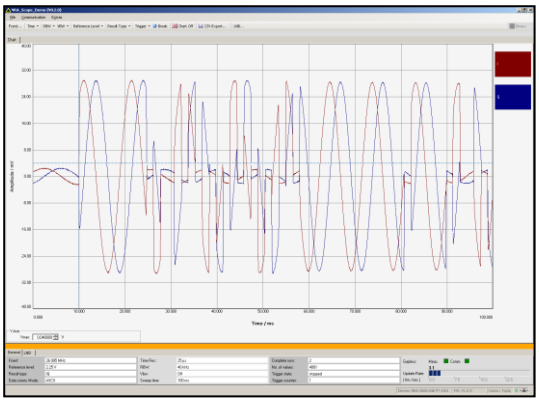
Level Meter mode allows selective measurements at a defined frequency (Fcent) e.g. for monitoring a specific channel (Zero-Span operation). The channel bandwidth (CBW) can be set in the range of 100 Hz to 32 MHz. The steep filter characteristics provide precise separation from adjacent channels. Peak detector values (for short pulsed) and RMS detector values (for fluctuating signals) are displayed simultaneously. Level Meter mode provides gapless and interruption-free measurements. It is also possible to demodulate analog modulated signals such as FM, AM, CW, LSB and USB and listen in to them by using headphones.



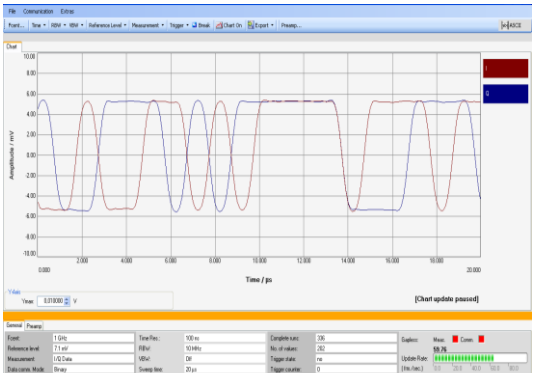
True RMS analysis by selecting Fcent and RBW (Screen NRA Level Meter Demo Software)

SCOPE and IQ DATA (Option)

Scope mode (zero span operation) provides an oscilloscopic time domain analysis. Almost all signal details can be made visible in this mode to allow rapid classification. The minimum resolution time of 32 ns even allows analysis of high-speed data transmissions or pulsed signals such as radar. A top sweep time of 24 hours allows full-day power monitoring of a single carrier. Extensive trigger functions allow for triggering and subsequent monitoring of burst signals including a pre-trigger view.
RF signals can be completely described by I/Q data. The I/Q demodulated data of the NRA allows the user to restore the signal for post-processing or deep analysis. Gapless data streaming is provided for bandwidths up to 400 kHz. Bandwidths up to 32 MHz can be transmitted block by block.



Scope view for detailed analysis versus time (Screen NRA Scope Demo Software)



IQ-Data-View for detailed analysis of digital modulated signals (Screen NRA Scope Demo Software)

Driver software for radio monitoring solutions

The following companies cooperate with Narda:

-**INRADIOS** Remote Signal Analysis Software
-**RadioInspector** Software for radio spectrum monitoring
-**Krypto 500** Signal demodulation and decoding
-**Skylink** Remote Spectrum Analyzer Monitor System
-**Dataminer** MONITORING AND REMOTE REAL-TIME
-**Hiltron** DSNG Monitor&Control Software HMCS
-**TesAmerica** Tes Monitor
-**SAT Corporation** Monics Satellite Carrier Monitoring System
-Others are planned for the future

DEFINITIONS AND CONDITIONS

Conditions
Unless otherwise noted, specifications apply after 30 minutes warm-up time within the specified environmental conditions. The product is within the recommended calibration cycle.

Specifications with limits
These describe product performance for the given parameter covered by warranty. Specifications with limits (marked as <, ≤, >, ≥, ±, max., min.) apply under the given conditions for the product and are tested during production taking measurement uncertainty into account.

Specifications without limits
These describe product performance for the given parameter covered by warranty. Specifications without limits represent values with negligible deviations which are ensured by design (e.g. dimensions or resolution of a setting parameter).

Typical values (typ.)
These characterize product performance for the given parameter that is not covered by warranty. When stated as a range or as a limit (marked as <, ≤, >, ≥, ±, max., min.), they represent the performance met by approximately 80 % of the instruments. Otherwise, they represent the mean value. The measurement uncertainty is not taken into account.

Nominal values (nom.)
These characterize expected product performance for the given parameter that is not covered by warranty. Nominal values are verified during product development but are not tested during production.

Uncertainties
These characterize an interval for a given measurand estimated to have a level of confidence of approximately 95 percent. Uncertainty is stated as the standard uncertainty multiplied by the coverage factor k=2 based on the normal distribution. The evaluation has been carried out in accordance with the rules of the "Guide of the Expression of Uncertainty in Measurement" (GUM).

SPECIFICATIONS

Narda Rack Mount Analyzer		NRA-2500	NRA-3000 RX	NRA-6000 RX
Frequency range		5 MHz to 2.5 GHz	9 kHz (5 MHz) to 3 GHz	9 kHz to 6 GHz
Modes		Spectrum Analysis Multi Channel Power (option) Level Meter (option)	Spectrum Analysis Multi Channel Power (option) Level Meter (option) Scope and I/Q (option)	
RF DATA [a]				
Frequency	Resolution bandwidth (RBW)	See specifications for each mode		
	Phase noise (SSB)	fc: 57.5 MHz / 2.1405 GHz / 4.5005 GHz df = 10 kHz: ≤ -121 dBc/Hz / ≤ -92 dBc/Hz / ≤ -97 dBc/Hz df =100kHz: ≤ -126 dBc/Hz / ≤ -100 dBc/Hz / ≤ -100 dBc/Hz		
	Reference frequency	Initial deviation: < 1 ppm Aging: < 1 ppm/year, < 5 ppm over 15 years Thermal drift: < 1.5 ppm (-10 °C to +50 °C)		
Amplitude	Display Range	From Displayed Average Noise Level (DANL) to 0 dBm	From Displayed Average Noise Level (DANL) to +20 dBm	
	Reference level (RL) (in 1 dB steps)	-30 dBm to 0 dBm	-30 dBm to +20 dBm	
	RF Input attenuation (coupled with RL)	0 to 30 dB in steps of 1 dB	0 to 50 dB in steps of 1 dB	
	Expanded level measurement uncertainty	≤ 1.5 dB (15 °C to 30 °C) ≤ 2.3 dB (-10 °C to 50 °C)	≤ 1.2 dB (15 °C to 30 °C) ≤ 2.0 dB (-10 °C to 50 °C)	
	Display Average Noise Level (DANL) for RL = -30 dBm (input attenuation = 0 dB)	< -140 dBm/Hz (noise figure < 34 dB)	f ≤ 50 MHz: < -160 dBm/Hz (noise figure < 14 dB) f ≤ 2 GHz: < -156 dBm/Hz (noise figure < 18 dB) f ≤ 3 GHz: < -155 dBm/Hz (noise figure < 19 dB)	f ≤ 4 GHz: < -155 dBm/Hz (noise figure < 19 dB) f ≤ 6 GHz: < -150 dBm/Hz (noise figure < 24 dB)
	3rd order intermodulation (IP3)	f ≤ 50 MHz: < -76 dBc for two single tones with a level of 6 dB below RL, spaced by 1 MHz or more, IP3 ≥ +22 dBm (@ RL = -10 dBm) f > 50 MHz: < -60 dBc for two single tones with a level of 6 dB below RL, spaced by 1 MHz or more, IP3 ≥ +14 dBm (@ RL = -10 dBm)		
	Spurious responses (input related) [b), c)]	< -50 dBc or RL -50 dB	< -60 dBc or RL -60 dB	
	Spurious responses (residual) (for RL = -30 dBm, ATT = 0 dB)	< -80 dBm	< -90 dBm	
RF input	Type	N-Connector, 50 Ω, female		
	Maximum RF power level	+27 dBm (destruction limit)		
	Maximum DC voltage	±50 V		
	Return loss (typ.) RL ≥ -28 dBm (input attenuation ≥ 2 dB)	> 10 dB	> 12 dB	> 12 dB for f ≤ 4.5 GHz > 10 dB for f > 4.5 GHz
10 MHz Reference Input		Technical parameter: Z = 600 Ohm; U = 0.1 Vpp to 3 Vpp, max 10 V_{DC}		

a) RF data apply in the temperature range of 20 °C to 26 °C and a relative humidity between 25 % and 75 %. Valid only for remote control using the Ethernet (100 BaseTx) interface.
b) Carrier offset of ≥ 100 kHz
c) Whichever is worse

SPECTRUM		NRA-2500	NRA-3000 RX	NRA-6000 RX
Measurement principle		High resolution spectrum analysis with up to approx. 600,000 samples per sweep		
Reference Level setting (RL)		Set individually from a list or use the “RL Search” function for determining the optimum Reference Level; Range is specified under RF Data		
Resolution bandwidth (RBW) [a]		1 kHz to 1 MHz (1-2-3-5 steps), -3 dB nom.	10 Hz to 20 MHz (1-2-3-5 steps), -3 dB nom.	
Filter	Type	Gaussian		
	Shape factor (-60 dB/ -3 dB)	<3.8 (typ.)		
Video bandwidth (VBW)		0.2 Hz to 2 MHz (1-2-3-5 steps) or off VBW range = RBW/10 … RBW/1000		
Detection	High resolution spectrum	Root mean square value (RMS). The effective integration time is T ≈ 0.32 / VBW The number of bins per sweep is up to approx. 600,000 (≈ 2 * Span/RBW)		
	Fixed resolution spectrum	+Peak, -Peak and RMS detectors can be selected for data compression of each selected result trace. The number of bins per sweep can be set to a fix value in the range of: 21 to 27,517		
Sweep time (typ.), inclusive communication over Ethernet 100baseTx [b]	50 MHz Span	ASCII: < 21 ms (@ RBW = 0.5 MHz, 201 bins) BINARY: < 17 ms (@ RBW = 0.5 MHz, 201 bins)		
	1 GHz Span	ASCII: < 119 ms (@ RBW = 1 MHz, 2001 bins) BINARY: < 88 ms (@ RBW = 1 MHz, 2001 bins)		
	6 GHz Span	NA	NA	ASCII: < 875 ms BINARY: < 500 ms (@ RBW = 0.5 MHz, 24001 bins) ASCII: < 11 s BINARY: < 6.5 s (@ RBW = 20 kHz, 614401 bins)
Traces		ACT: Reads out the actual measured spectrum AVG: RMS averaging over a selectable number of spectra (4 to 256) or a selectable time period of 1 to 30 minutes MAX: Maximum hold function MAX_AVG: Maximum hold function after averaging MIN: Minimum hold function MIN_ AVG: Minimum hold function after averaging		

MULTI - CHANNEL POWER (OPTION 3200/95.01)	
Measurement principle	Spectrum analysis, followed by Channel Power evaluation
Number of channels	1 to 500 channels can be defined in a channel list
Channel lists	Creation by remote commands or by PC configuration software (NRA Tools). User definable channel names (15 characters max.) can be assigned. <Others> summarizes results of all frequency gaps within the list of channels.
Channel bandwidth CBW (-3 dB nom.)	Individually selectable for each channel, from 40 Hz to 6 GHz
Roll-off factor	< 4 * RBW / CBW
Applied resolution bandwidth (RBW) (for filter specification see Spectrum Analysis)	AUTO: Each channel will be measured using a dedicated and automatically determined RBW setting. CBW / 4, (RBW ≤ 20 MHz) MANUAL: All channels will be measured using the same RBW. 10 Hz to 20 MHz (1-2-3-5 steps), (RBW ≤ CBW / 4) INDIVIDUAL: Each channel will be measured using a dedicated and manually defined RBW setting. Only available for <Others> = OFF
Detection	Root mean square value (RMS). The effective integration time is T ≈ 1 / RBW
Traces (separate result values for each channel)	ACT: Actual measured value AVG: RMS averaging over a selectable number of actual results (4 to 256) or a selectable time period of 1 to 30 minutes MAX: Maximum hold function MAX_AVG: Maximum hold function after averaging MIN: Minimum hold function MIN_ AVG: Minimum hold function after averaging

a) RBW list depends on selected Span
b) Values are valid for one single trace with NRA firmware V 3.0.0 and control software “Spectrum Demo V 2.0.0”

LEVEL METER (OPTION 3200/95.02)		
Measurement principle		Selective level measurement (zero span mode at a tunable fixed frequency)
Channel bandwidth CBW (-6 dB)		100 Hz to 32 MHz (in steps of 100, 125, 160, 200, 250, 320, 400, 500, 640, 800, 1000,…, 10 MHz, 13.333 MHz, 16 MHz, 20 MHz, 26.666 MHz, 32 MHz)
Filter	Type	Steep cut-off channel filter (app. raised cosine)
	Roll-off factor	0.16
Video bandwidth (VBW)		0.01 Hz to 32 MHz or off VBW range = CBW/1 … CBW/10000
Detector		Peak (hold time = 480 ms)
		RMS (average time selectable from 480 ms up to 30 min)
		Peak & RMS simultaneously
Result presentation		PEAK: Displays the actual peak value MAX_PEAK: Max hold function for peak values RMS: Displays the actual RMS value MAX_RMS: Max hold function for RMS values
SCOPE AND I/Q DATA (Option 3200/95.03) – not for NRA-2500		
Measurement principle		Selective level measurement (zero span mode at a tunable fixed frequency) with quadrature demodulation and high resolution time domain analysis
Channel bandwidth CBW (-6 dB nominal)		100 Hz to 32 MHz (in steps of 100, 125, 160, 200, 250, 320, 400, 500, 640, 800, 1000,…, 10 MHz, 13.333 MHz, 16 MHz, 20 MHz, 26.666 MHz, 32 MHz)
Filter	Type	Steep cut-off channel filter (app. raised cosine)
	Roll-off factor	0.16
Video bandwidth (VBW)		0.01 Hz to 32 MHz or off VBW range = CBW/1 … CBW/10000
Measurement	Scope, actual	ACT: Actual magnitude vs. time
	Scope, condensed	Detectors are used to condense the magnitude values vs. time MAX: Maximum value within the time resolution interval (corresponds to +Peak detector) AVG: Average value within the time resolution interval (corresponds to RMS detector) MIN: Minimum value within the time resolution interval (corresponds to -Peak detector)
	I/Q Data	The RF signal is represented by the components I and Q, resulting from the complex output signal of a base-band demodulation (I/Q demodulation). I: Real part (In-phase) Q: Imaginary part (Quadrature-phase) IQ: Real part and imaginary part
Data resolution	Scope, actual	250000 samples max., time resolution coupled to 1/CBW (31.25 ns to 10 ms)
	Scope, condensed	62500 samples max., observation time 4 µs to 24 h, time resolution interval ≥ 250 ns
	I/Q Data, block-wise	250000 samples max. for all CBW settings from 100 Hz to 32 MHz Time resolution coupled to 1/CBW (31.25 ns to 10 ms)
	I/Q Data, streaming	Gapless data streaming for CBW settings from 100 Hz to 400 kHz Time resolution coupled to 1/CBW (2.5 µs to 10 ms) Information content IQ: 32 bit for CBW ≥ 40 kHz 64 bit for CBW < 40 kHz Data rate = CBW · information content Example calculation 1: Data rate = 100 Hz · 64 bit = 6.4 kbit/s Example calculation 1: Data rate = 400 kHz · 32 bit = 12.8 Mbit/s
Triggering		Free run, single, multiple, manual start, time controlled Programmable trigger level, trigger slope and trigger delay

INTERFACE			
Remote access			ASCII based command sets, response in ASCII or fast Binary Mode (selectable)
Status information			System - LED (bicolored) and LAN (single-colored)
Interface	Front panel		USB mini B (USB 2.0) - for programming/debugging and updates
			Audio socket 3,5 mm - for listening to demodulated analog signals AM, FM, LSB, USB, CW in Level Meter mode demodulation bandwidth 100 Hz to 200 kHz (max. 16 kHz for LSB, USB). Squelch: -120 dB to -40 dB nominal, Off
	Back panel		Ethernet (100BaseT) - for measurement control
			Antenna Control - for controlling Narda antennas and cables
Web server			Web applications “NRA Web Terminal” and “NRA Live Display Viewer” based on Java Applets and HTML. For web terminal Java “Version 7 Update 79” or previous version required
Result units			Measurement results can be displayed in one of the following units: dBm, dBV, dBmV, dBuV
Digital audio streaming			Capability to stream demodulated signals over Ethernet. AM, FM, LSB, USB, CW. Demodulation bandwidth 100 Hz to 200 kHz (max. 16 kHz for LSB, USB)
GENERAL SPECIFICATIONS			
Compliance	Climatic	Storage	1K3 (IEC 60721-3) extended to -10 °C to +50 °C
		Transport	2K4 (IEC 60721-3)
		Operating	7K2 (IEC 60721-3) extended to -10 °C to +50 °C
	Mechanical	Storage	1M3 (IEC 60721-3)
		Transport	2M3 (IEC 60721-3)
		Operating	7M3 (IEC 60721-3)
	Ingress protection		IP 50
	EMC	European Union	Complies with EMC Directive 2014/30/EU (previously 2004/108/EC) and IEC/EN 61326-1: 2013
		Immunity	IEC/EN: 61000-4-2, 61000-4-3, 61000-4-4, 61000-4-5, 61000-4-6, 61000-4-11
		Emissions	IEC/EN: 61000-3-2, 61000-3-3, IEC/EN 55011 (CISPR 11) Class B
	Safety		Complies with European Low Voltage Directive 2014/35/EU (previously 2006/95/EC) and IEC/EN 61010-1: 2010
Environmental	Operating temperature		-10 °C to +50 °C
	Humidity		< 29 g/m³ (< 93 % RH at +30 °C), non-condensing
Dimensions (W x H x D)			Standard EIA Rack Unit (1RU): 482 mm x 45 mm x 362 mm (19" x 1,75" x 14,3")
Weight			< 5 kg (11lbs)
Status information			System - LED (bicolored) and LAN (single-colored)
Power supply			100 to 240 V (AC), 50/60Hz
Power consumption			< 20 W
Country of origin			Germany
Recommended calibration interval			24 months
Intended use			Indoor

ORDERING INFORMATION

NRA	Part number
NRA-2500 Remote Analyzer, 5 MHz – 2.5 GHz	**3201/201**
NRA-3000 RX Remote Analyzer, 9 kHz – 3 GHz	**3202/201**
NRA-6000 RX Remote Analyzer, 9 kHz – 6 GHz	**3203/201**
OPTIONS	
Option, Multi Channel Power	**3200/95.01**
Option, Level Meter	**3200/95.02**
Option, Scope and I/Q Data not for NRA-2500	**3200/95.03**
Option, Calibration Report	**3200/92.01**
Option, Antenna Control (available only with purchase of product)	**3200/91.01**

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