

R&S® SLG

Satellite Load Generator

Multichannel digital satellite TV modulator



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Satellite Load Generator

At a glance

The R&S®SLG satellite load generator is a multi-channel signal generator for digital satellite TV. It is the world's first integrated instrument to simulate TV satellite bands with full channel load. The R&S®SLG generates satellite TV signals using different standards and parameters and combines them in any desired manner. Users can simulate any conceivable uplink and downlink configurations in the lab.

The R&S®SLG has a frequency range from 250 MHz to 3225 MHz, covering all satellite IF frequency bands used worldwide. The R&S®SLG can simultaneously generate up to 32 digital satellite TV transponder signals in line with the DVB-S/S2, DVB-S2X, ISDB-S/S3 and turbo standards or, alternatively, one signal in line with DVB-S2 wideband. Up to 16 transponders can transmit MPEG transport streams; the other transponders carry PRBS data. The transport streams are fed into the instrument via IP or ASI inputs. The R&S®SLG uses its integrated transport stream generator to play short transport stream files. Each channel can contain an ARB waveform or a CW carrier instead of a TV signal.

The R&S®SLG is primarily suited for performing RF tests on satellite TV components. Its interfaces, which are commonly used in consumer electronics and professional satellite electronics, make the generator ideal for testing tuners and set-top boxes as well as upconverters, amplifiers and satellite payloads. Because it can simultaneously generate multiple channels with high symbol rates, the R&S®SLG is also well suited for performing stress tests on systems that process large data quantities, such as transcoders, conditional access middleware and military surveillance data processing systems.

The R&S®SLG can be fully remote controlled, making it ideal for integration into automatic test systems. All this functionality has been packed into a compact 19" 1 HU housing. Previously a rack full of modulators was needed to generate as many satellite TV signals as the R&S®SLG does.

Key facts

- Satellite IF range from 250 MHz to 3225 MHz
- Up to 32 simultaneous transponder signals
- Independent setting of symbol rate, FEC, level and frequency
- DVB-S/S2, DVB-S2X, DVB-S2 wideband, ISDB-S/S3 and turbo modulation standards
- Signal quality of 40 dB MER (typ.)



R&S®SLG Satellite Load Generator Benefits and key features

Versatile signal source for testing satellite receivers

- ▮ Maximum precision and flexibility thanks to multichannel digital signal generation
- ▮ Simulation of real-world receive conditions with white noise and phase noise
- ▮ Control and communications via DiSEqC™
- ▮ Multichannel ARB and CW generator

▷ [page 4](#)

Simulation of satellite TV bands with full channel load

- ▮ Simulation of real-world satellite configurations in the lab
- ▮ Realtime video transmission at high data rates
- ▮ Support of latest standards and technologies: DVB-S2/S2X wideband and channel bonding and ISDB-S3

▷ [page 6](#)

Signal generator system for the entire satellite IF range

- ▮ Compact instrument instead of many individual modulators
- ▮ Expandable master/slave configuration

▷ [page 8](#)

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R&S *SLG*

Versatile signal source for testing satellite receivers

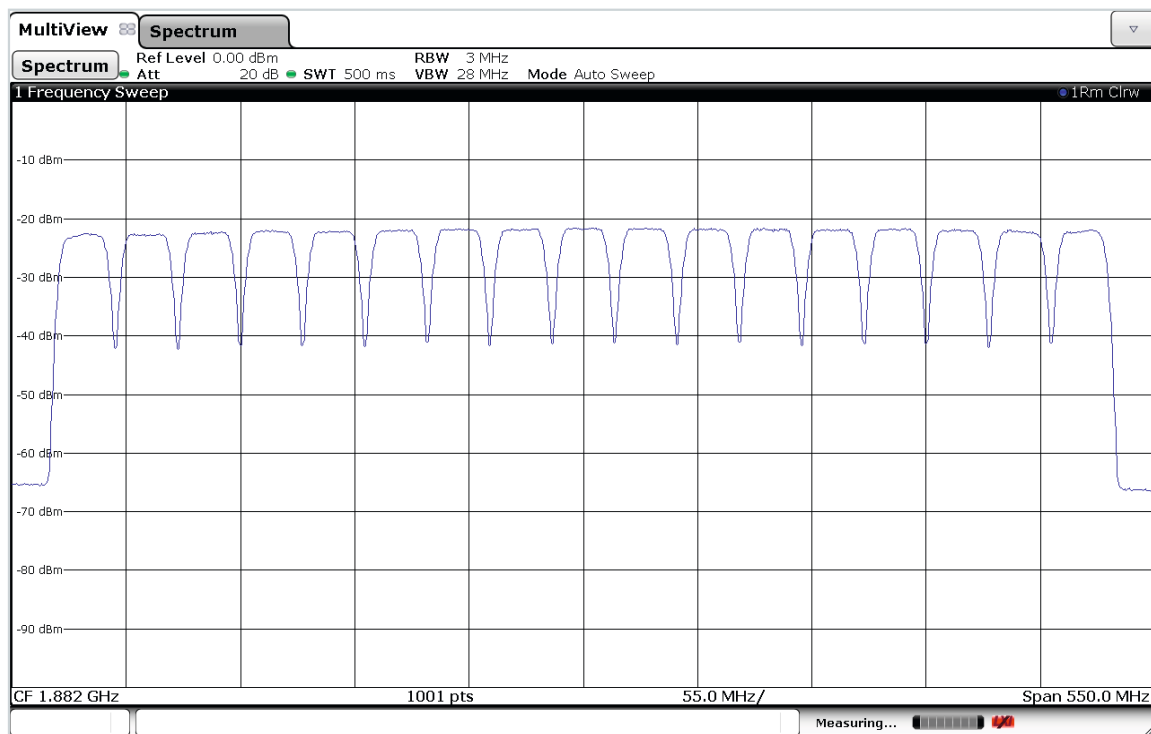
Maximum precision and flexibility thanks to multichannel digital signal generation

In a 500 MHz frequency subrange, the R&S®SLG generates up to 32 satellite TV transponder signals in line with the DVB-S/S2, ISDB-S/S3 and turbo standards. FPGA-based signal processing ensures high signal quality, with a MER of 40 dB (typ.) and a flat frequency response of $< \pm 1.5$ dB across the entire 500 MHz modulation bandwidth. This makes the R&S®SLG perfect for measuring intermodulation and adjacent channel suppression in satellite TV bands with full channel load.

Simulation of real-world receive conditions with white noise and phase noise

In practice, satellite reception is impaired primarily by atmospheric and cosmic background noise and the phase noise of the low-noise block converter (LNB). The R&S®SLG simulates these noises using two independent noise sources. White noise can be added over the entire 500 MHz modulation bandwidth. The noise power can be precisely set over a wide range. The R&S®SLG can also degrade the phase noise of all active transponders using a defined characteristic. The user specifies the phase noise mask using multiple reference points with up to 10 MHz carrier offset.

Spectrum: band with full channel load.



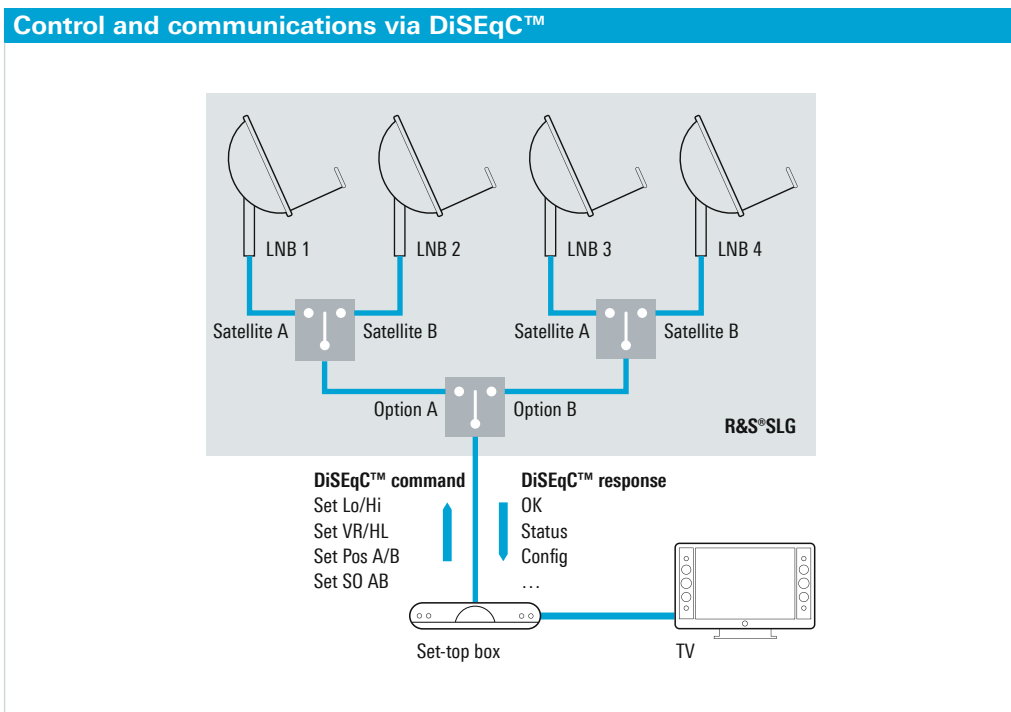
Control and communications via DiSEqC™ 1)

From the satellite tuner's perspective, the R&S®SLG simulates the satellite receiver system. This system includes up to four LNBs, each with polarization and highband/lowband switchover. The satellite tuner controls the system in line with the DiSEqC™ protocol. The R&S®SLG is also controlled via DiSEqC™. It accepts commands and answers them, responding in a way predefined by the user. For example, the generator simulates the switchover from horizontal to vertical polarization by loading a saved configuration file containing the settings of the vertically polarized transponders. This R&S®SLG functionality simplifies test sequence automation and allows the satellite tuner's DiSEqC™ functionality to be tested.

Multichannel ARB and CW generator

The R&S®SLG modulates satellite TV signals as well as arbitrary waveform signals. Up to four I/Q waveform files can be simultaneously played and each assigned to one or more RF channels. This makes it possible, for example, to simulate narrowband satellite communications signals or interfering signals scattered across the satellite IF. If modulation is switched off, the R&S®SLG generates CW signals.

¹⁾ DiSEqC™ is a trademark of Eutelsat.

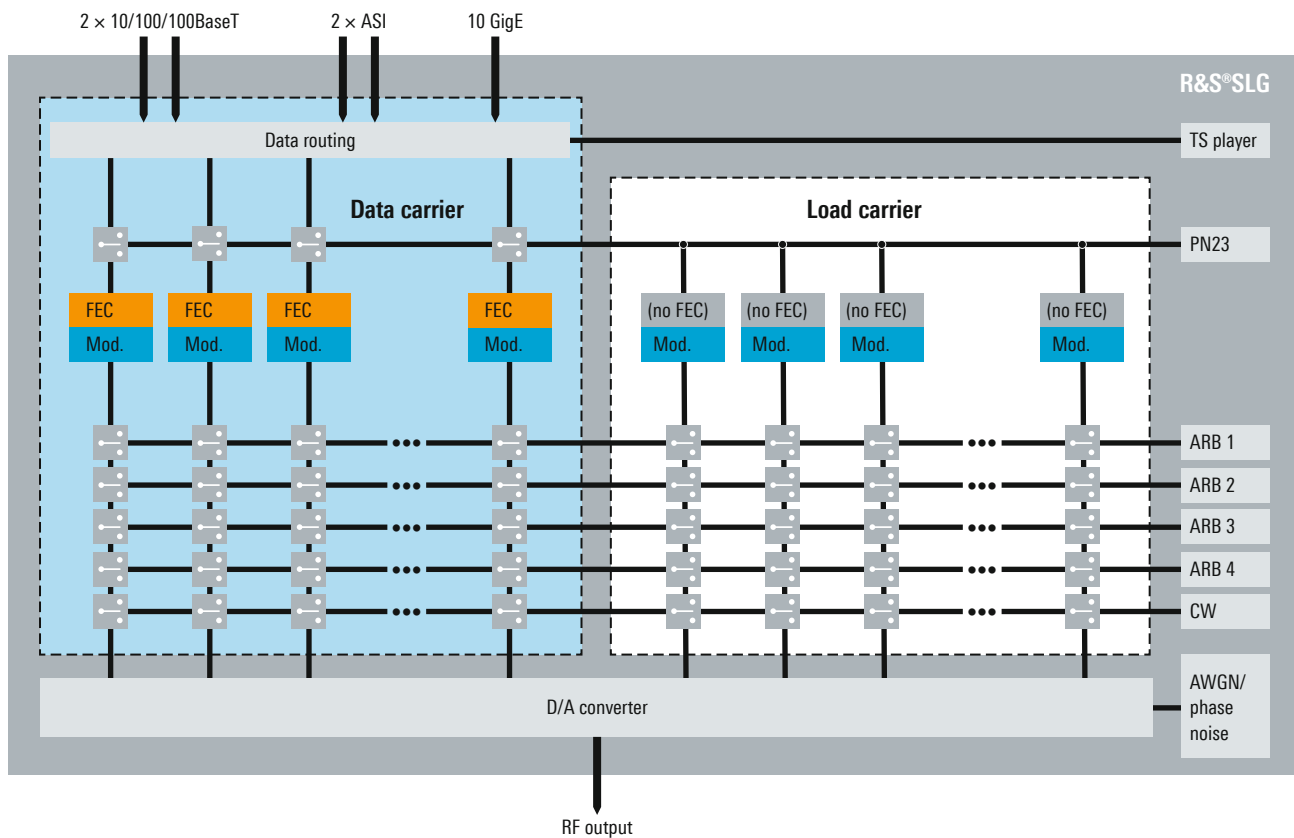


Simulation of satellite TV bands with full channel load

Simulation of real-world satellite configurations in the lab

The R&S®SLG generates signals of up to 32 satellite transponders simultaneously. Symbol rate, constellation, FEC, level and center frequency can be defined by the user for each signal. The DVB-S, DVB-S2, DVB-S2X and DVB-SNG standards, or the ISDB-S and ISDB-S3 standards, can be combined as desired, enabling the R&S®SLG to simulate any conceivable configuration of satellite TV bands. Any scenario entered can be saved and reloaded as required. This makes it possible to reproduce specific satellite configurations at various sites around the world – an invaluable advantage for globally networked R&D teams.

Signal flow



Realtime video transmission at high data rates

A pseudo random binary sequence (PRBS) as content suffices to test a receiver's RF characteristics. However, the R&S®SLG can fill up to 16 transponders with video and audio content. With 16 transponders, symbol rates up to 30 Msymbol/s are possible; with eight transponders, up to 72 Msymbol/s; and with just one transponder, even 416 Msymbol/s. Transport streams can be fed into the instrument via an IP or ASI interface. The large number of signals and the high data rates delivered by the R&S®SLG make it an ideal signal source for stress tests on transcoders as well as on software and data processing systems.

Support of latest standards and technologies: DVB-S2/S2X wideband and channel bonding and ISDB-S3

The R&S®SLG already supports the latest satellite transmission standards such as DVB-S2X and ISDB-S3. In a special operating mode, eight transponders with up to 72 Msymbol/s can be generated. In addition, the R&S®SLG supports a single-carrier mode for the DVB-S2/S2X wideband standard. This mode generates a transponder with a bandwidth of up to 500 MHz. The DVB-S2X channel bonding functionality allows the allocation of a single logical high data rate channel to three different transponders. Here, the R&S®SLG is capable of handling up to four channel bonding scenarios simultaneously.

ISDB-S3 is defined in the ARIB-STD-B44v2 standard with an additional 9/10 code rate and 33.7561 Msample/s symbol rate. These modifications are based on the requirements for higher data rates on 8k transmissions. As a result, the satellite IF band was enhanced. The R&S®SLG generates such ISDB-S3 signals across the entire Japanese satellite IF band up to 3225 MHz.

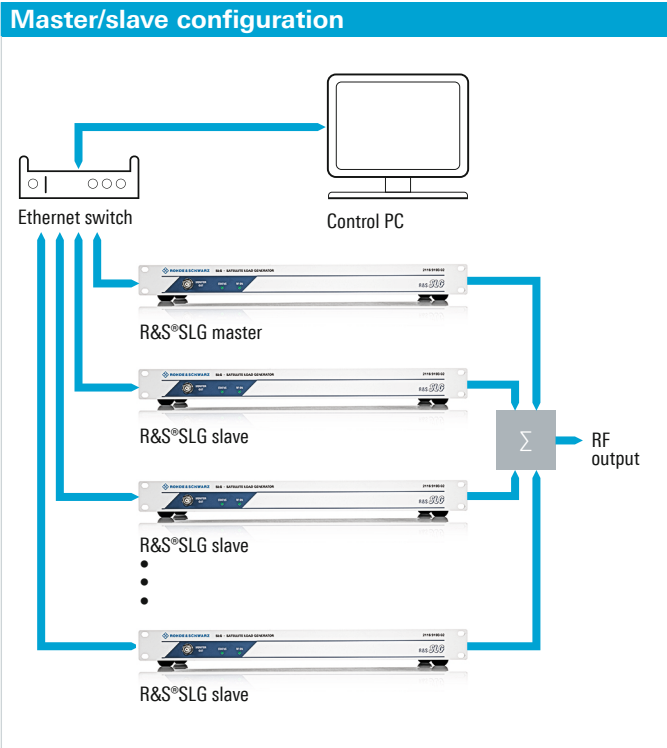
Signal generator system for the entire satellite IF range

Compact instrument instead of many individual modulators

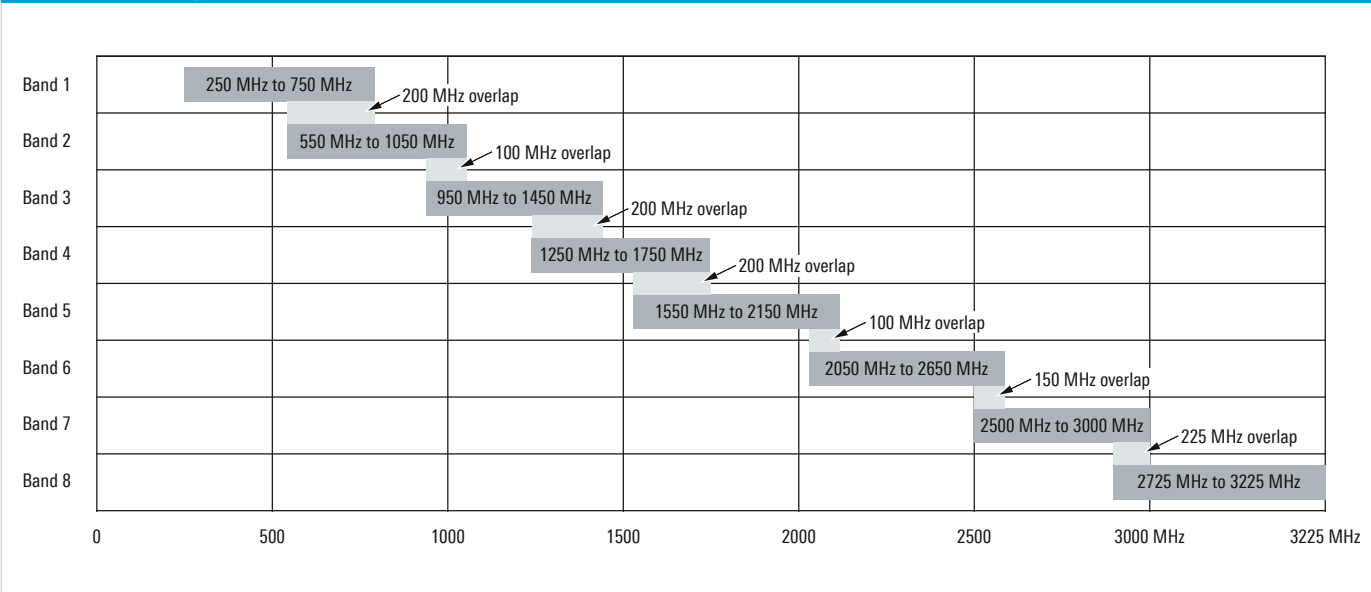
In development labs for receivers, often a central signal generator system generates the test signals and distributes them to the individual test setups. Up to now, generating a large number of test signals required a large number of modulators. Such setups are complicated to configure and calibrate, take up a lot of space and consume much power. The R&S®SLG considerably simplifies this application. Featuring a 19" housing of only one height unit, it is extremely compact and very easy to operate via its graphical user interface or by remote control. Since no coupling network is needed, the accompanying loss and frequency response are eliminated. The power consumption of the R&S®SLG is only a fraction of that of conventional systems with multiple modulators.

Expandable master/slave configuration

The R&S®SLG uses a 500 MHz subband of the entire satellite IF range. For a larger frequency range, one R&S®SLG can be used as a master with one or more secondary R&S®SLG satellite load generators as slaves. The slaves have the same functional range as the master but must be connected to the master. Users control the entire system via the master's interfaces. A slave can be upgraded to a full-fledged R&S®SLG by means of a software license. Using the R&S®SLG in a master/slave configuration, users can fill precisely the frequency ranges they want with signals. Users still maintain the instrument's full flexibility for future applications in other configurations, protecting their investment.



Frequency range and subbands



Specifications in brief

Specifications in brief		
RF parameters		
Frequency range		250 MHz to 3225 MHz
Frequency bands	one band settable out of 8 bands	band 1 to band 8
Number of channels	in one 500 MHz band	max. 32
Frequency response	in one 500 MHz band	$\leq \pm 1.25$ dB
Level	per carrier	≥ -14.5 dBm
	overall	≥ -3 dBm
Level setting range	per carrier	0 dB to -30 dB
	step size	0.1 dB
Modulations		
Satellite TV standards		DVB-S/DSNG, DVB-S2, DVB-S2X, ISDB-S/S3
	channel bonding	DVB-S2X
Symbol rate	for 32 carriers	0.1 Msymbol/s to 30 Msymbol/s
	for 8 carriers	5 Msymbol/s to 72 Msymbol/s
	for 1 carrier	45 Msymbol/s to 416 Msymbol/s
MER in bands 3, 4 and 5	for 32 carriers with 30 Msymbol/s	46 dB (typ.) with equalizer, 40 dB (typ.) without equalizer
	for 8 carriers with 72 Msymbol/s	46 dB (typ.) with equalizer, 36.5 dB (typ.) without equalizer
	for 1 carrier with 416 Msymbol/s	40 dB (typ.) with equalizer, 30.5 dB (typ.) without equalizer
AWGN and phase noise		
AWGN bandwidth	1 dB drop	510 MHz
Noise power	in 500 MHz bandwidth	-45 dBm to $+5$ dBm
Phase noise	for each active carrier	user-defined up to 10 MHz offset from carrier
Arbitrary waveform generator		
Memory space	total	400 Mbyte
Number of files played simultaneously		max. 4
File size		≤ 256 Mbyte/(number of played files)
Aggregate sample rate	sum of all played files	≤ 288 Msample/s
Interfaces		
RF outputs	primary	50 Ω SMA
	secondary	75 Ω F; DiSEqC™ version 2.1, level 2.2
Monitor outputs	RF, ASI	2 \times BNC
Transport stream inputs	ASI	2 \times 75 Ω BNC
	IP	2 \times 10/100/1000BaseT, RJ-45, 1 \times SFP+
Control interface	Ethernet	10/100BaseT, RJ-45
	format	web browser interface, SCPI, SNMP
General data		
Operating temperature range		0°C to $+45$ °C
Dimensions	W \times H \times D	482.6 mm \times 279.4 mm \times 44.5 mm (19 in \times 11 in \times 1.75 in)
Weight		3.2 kg (7.05 lb)

Ordering information

Designation	Type	Order No.
Base unit (including power cord and manual)		
Satellite Load Generator	R&S®SLG	2116.9193.02
Satellite Load Generator (slave configuration)	R&S®SLG	2116.9193.03
Software options		
Master Upgrade for R&S®SLG Slave Unit	R&S®SLG-K100	2116.9341.02
Turbo Code Modulation ¹⁾	R&S®SLG-K200	2118.7298.02
DVB-S2X MODCOD (Master)	R&S®SLG-K210	2118.7717.02
DVB-S2X Channel Bonding (Master)	R&S®SLG-K211	2118.7769.02
DVB-S2X MODCOD (Slave)	R&S®SLG-K220	2118.7775.02
DVB-S2X Channel Bonding (Slave)	R&S®SLG-K221	2118.7781.02
Extended Frequency Range Band 8	R&S®SLG-K3018	2118.7946.02

¹⁾ The turbo code is a proprietary technology of the EchoStar Corporation. The R&S®SLG-K200 option may only be sold to EchoStar licensees and only with the express permission of EchoStar.

Warranty		
Base unit		3 years
All other items		1 year
Options		
Extended Warranty, one year	R&S®WE1	Please contact your local Rohde & Schwarz sales office.
Extended Warranty, two years	R&S®WE2	
Extended Warranty with Calibration Coverage, one year	R&S®CW1	
Extended Warranty with Calibration Coverage, two years	R&S®CW2	

From pre-sale to service. At your doorstep.

The Rohde&Schwarz network in over 70 countries ensures optimum on-site support by highly qualified experts. User risks are reduced to a minimum at all stages of the project:

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



Service that adds value

- | Worldwide
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- | Uncompromising quality
- | Long-term dependability

About Rohde & Schwarz

The Rohde & Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, monitoring and network testing. Founded more than 80 years ago, the independent company which is headquartered in Munich, Germany, has an extensive sales and service network with locations in more than 70 countries.

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

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R&S® is a registered trademark of Rohde & Schwarz GmbH & Co. KG

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