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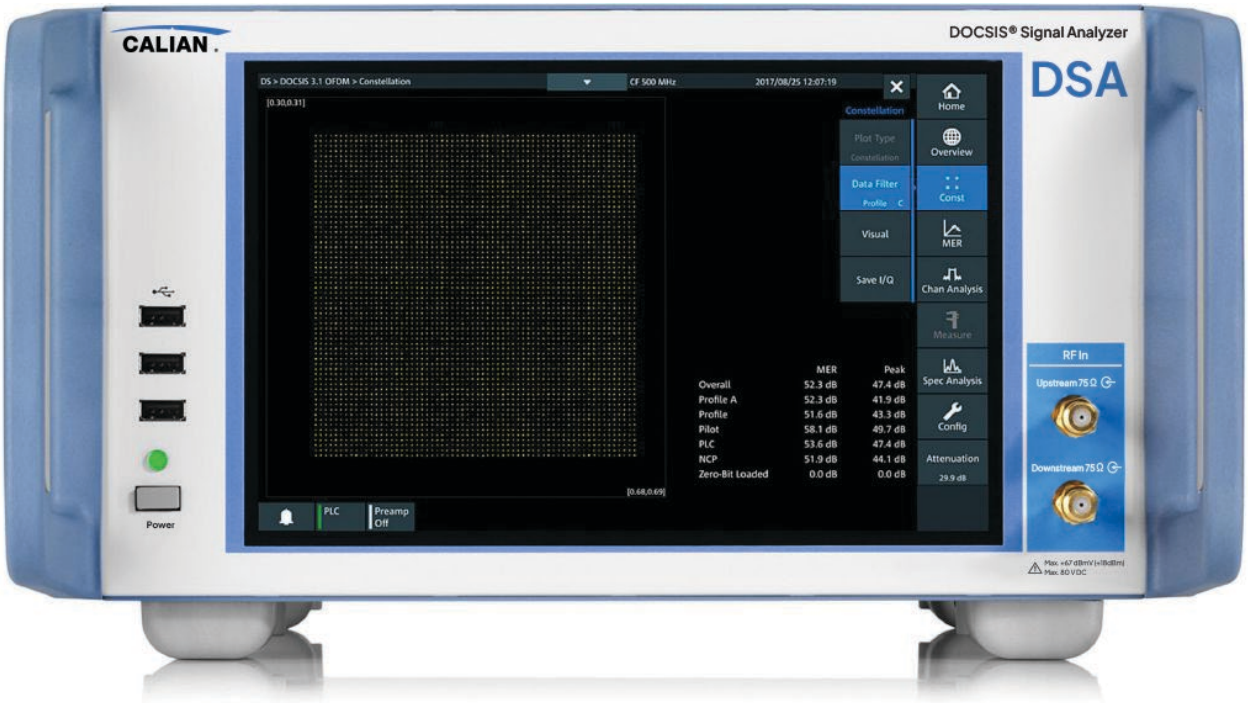
DOCSIS Signal Analyzer

Specifications



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Contents

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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.

Non-traceable specifications with limits (n. trc.)

Represent product performance that is specified and tested as described under “Specifications with limits” above. However, product performance in this case cannot be warranted due to the lack of measuring equipment traceable to national metrology standards. In this case, measurements are referenced to standards used in the Calian laboratories.

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 designated with the format “parameter: value”.

Non-traceable specifications with limits, typical data as well as nominal and measured values are not warranted by Calian.

In line with the 3GPP standard, chip rates are specified in million chips per second (Mcps), whereas bit rates and symbol rates are specified in billion bit per second (Gbps), million bit per second (Mbps), thousand bit 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.

Specifications

Common specifications

Frequency

Frequency range	model .02	
	downstream input	47 MHz to 1794 MHz
	model .03	
	downstream input	47 MHz to 1794 MHz
	upstream input	5 MHz to 204 MHz
Frequency resolution		1 Hz
SSB phase noise	downstream input, 1002 MHz	< –93 dBc (1 Hz) at 1 kHz
		< –107 dBc (1 Hz) at 10 kHz
		< –127 dBc (1 Hz) at 100 kHz
		< –146 dBc (1 Hz) at 1 MHz
		< –150 dBc (1 Hz) at 10 MHz
		< –150 dBc (1 Hz) at 100 MHz
	upstream input, 204 MHz (model .03 only)	< –110 dBc (1 Hz) at 1 kHz
		< –110 dBc (1 Hz) at 10 kHz
		< –130 dBc (1 Hz) at 100 kHz
		< –150 dBc (1 Hz) at 1 MHz

Level

Downstream input		75 Ω, male, F connector
Maximum safe input level		+67 dBmV
Noise figure	0 dB attenuation, preamplifier on	5 dB (typ.)
	0 dB attenuation, preamplifier off	24 dB (typ.)
Return loss	preamplifier off	14 dB (typ.)
	preamplifier on	10 dB (typ.)
Upstream input	model .03 only	75 Ω, male, F connector
Maximum safe input level		+67 dBmV
Noise figure	0 dB attenuation, preamplifier on	9 dB (typ.)
	0 dB attenuation, preamplifier off	24 dB (typ.)
Return loss	preamplifier off	15 dB (typ.)
	preamplifier on	12 dB (typ.)
Port-to-port isolation		> 40 dB
Spurious response, inherent	RF attenuation = 0 dB, RBW < 1 MHz, without input signal	< –90 dBm
Amplitude accuracy	+25 °C	±0.5 dB
	+5 °C to +40 °C	±1 dB
Level units		dBm, dBmV, dBµV, dBV

Connectivity

Reference in		10 MHz or 10.24 MHz, auto-select
	BNC female	50 Ω
		max. ±0.75 ppm external frequency tolerance
	input range, sinusoidal	0 dBm to +13 dBm
		+15 dBm max. input level
Reference out		10 MHz or 10.24 MHz; selectable
	BNC female	50 Ω
		9.5 dBm ±1.0 dBm
Trigger in	BNC female	50 Ω
	input impedance	10 kΩ
	input range	0 V to +5.0 V DC
		max. +5 V
Trigger out	BNC female	50 Ω
		5.0 V, 50 Ω output impedance
	max. sink/source current	100 mA
ASI	BNC female	75 Ω
		EN 50083-9 Annex B (270 Mbps)
SFP+		1 Gigabit Ethernet, 10 Gigabit Ethernet; selectable
		IPv4, ARP, ping
USB		USB 2.0, type A, 3 × front, 1 × rear
HDMI™	HDMI™ 1.4, type A	min. 1280 × 800 pixel (16 × 10 aspect ratio) display
LAN	RJ-45 connector	100BASE-T; 10 Mbps/100 Mbps, supports SCPI and SNMP
Generator control	RJ-45 connector	proprietary DOCSIS timing interface for interoperation with SFD DOCSIS® signal generator

DOCSIS 3.1 downstream analyzer

Compliant to standard		CM-SP-PHYv3.1
Settings	DOCSIS 3.1 downstream analyzer	RF (center)
		subcarrier 0 frequency
		equalizer (on/freeze)
		auto level
		MER optimize
		MER comp
		attenuation (0.0 dB to 30.0 dB with preamplifier on, 0.0 dB to 55.0 dB with preamplifier off)
		preamplifier (on/off)
		prefilter (on/off)
		acquisition mode (auto, manual)
		subcarrier spacing (50 kHz/4k FFT, 25 kHz/8k FFT)
		cyclic prefix length (0.9375/1.25/2.5/3.75/5 µs)
		rolloff (0/0.3125/0.625/0.9375/1.25 µs)
		time interleaver depth (1 to 16)
		subcarrier configuration file
		profile filter (selected profile, all profiles)
		BER mode (automatic, manual)
		BER test depth
		BER source (MACLFSR, estimate from FEC)
		BER test depth source (before LDPC, after LDPC, after BCH)
		SFP+ output
	alarm thresholds	minimum MER RMS
		maximum BER PLC
		maximum BER NCP
		maximum BER before LDPC/profile
		maximum BER after LDPC/profile
		maximum BER post BCH/profile
	meas config	MER averaging (on/off)
	constellation	plot type (constellation, density)
		data filter (overall, profile, pilot, PLC, NCP, zero bit loaded)
		visual (data color, background color)
		save I/Q

Signal status		PLC lock
		demodulator lock
Alarm tab		shows MER and BER violations
Numerical measurements		signal power
		occupied bandwidth
		signal power per 6 MHz
		frequency offset
		symbol clock offset
		NCP CRC errors
		payload data rate for selected profile
		constellation order
		MER overall, MER for profile A
		MER for selected profile or all profiles
		MER for pilot
		MER for PLC
		MER for NCP
		MER for zero bit loaded
		BER for PLC
		BER for NCP
		BER before LDPC (of selected profile or all profiles)
		BER after LDPC (of selected profile or all profiles)
		BER after BCH (of selected profile or all profiles)
		CER for PLC
		CER for NCP
		CER after LDPC (of selected profile or all profiles)
		CER after BCH (of selected profile or all profiles)
		average payload/codeword (bits) (of selected profile or all profiles)
		average LDPC iterations (of selected profile or all profiles)

Graphical measurements		MER versus time (selectable time span and data filter)
		MER versus subcarrier
		BER versus time
		signal power versus time
		CCDF plot
		amplitude and phase response
		amplitude and group delay response
		echo pattern
	constellation	NCP: QPSK, QAM16, QAM64
		profile: QAM16 to QAM4096
		overrange: QAM8192, QAM16384
Residual MER floor	RF ≤ 600 MHz	≥ 50 dB (nom.)
	600 MHz < RF ≤ 1000 MHz	≥ 48 dB (nom.)
	RF ≥ 1000 MHz	≥ 47 dB (nom.)

DOCSIS 3.1 upstream analyzer (DSA-K1500 option)

Compliant to standard		CM-SP-PHYv3.1
Settings	DOCSIS 3.1 upstream analyzer	RF (center)
		rolloff (0/0.3125/0.625/0.9375/1.25/1.5625/ 1.875/2.1875 µs)
		cyclic prefix length (0.9375/1.25/1.5625/1.875/2.1875/2.5/ 2.8125/3.125/3.75/5/6.25 µs)
		symbols per frame (6 to 36)
		subcarrier spacing (25 kHz/4k FFT, 50 kHz/2k FFT)
		randomizer (on/off)
		randomizer seed
		exclusion bands (up to 3)
		minislot configuration mode (file, manual)
		pilot pattern (1 to 6 and 8 to 14)
		initial ranging (starting minislot in frame, number of minislots, number of subcarriers, preamble pattern, preamble length, preamble offset)
		fine ranging (starting minislot in frame, number of minislots, number of subcarriers, preamble pattern, preamble offset)
		wideband probe (start subcarrier, subcarrier skip, stagger, symbol in frame)
		bandwidth request (minislot in frame, subslot)
		equalizer (on/off)
		auto level
		MER optimize (with trigger only)
		attenuation (0 dB to 4330 dB with preamplifier on, 0 dB to 430 dB with preamplifier off)
		preamplifier (on/off)
		prefilter (on/off)
		prefilter length (short, medium, long)
		scheduling (periodic, single)
		scheduling repeat interval in frames
		trigger input offset
		trigger input slope polarity (positvehigh, lownegative)

		trigger input generate trigger
		trigger output (on/off)
		trigger output offset
		trigger output levelpolarity (high, low)
		trigger output pulse width
		trigger output period
		meas config MER averages
		MER sign (positive, negative)
		MER data filter (IUC, probe)
		BER mode (automatic, manual)
		BER test depth
		BER source (estimate from FEC, PN23)
		BER test depth source (before LDPC, after LDPC)
		CER codeword length filer (all, short, medium, long)
		SFP+ output
	alarm thresholds	minimum MER RMS
		maximum BER before LDPC/IUC
		maximum BER after LDPC/IUC
	meas config	MER averages
	constellation	plot type (constellation, density)
		data filter (IUC, probe)
		visual (data color, background color)
		save I/Q
Signal status		burst demodulation lock
		FEC lock
Alarm tab		shows MER and BER violations
Numerical measurements	Note: Initial ranging, bandwidth requests, and probes provide a subset of measurements.	signal power
		burst timing offset
		frequency offset
		payload data rate/IUC
		minislots
		burst coverage
		constellation order
		MER overall
		MER for pilot
		MER for complementary pilot
		MER for IUC (1 to 13, all)
		bursts expected
		bursts received

		BER before LDPC (of selected IUC or all IUCs)
		BER after LDPC (of selected IUC or all IUCs)
		CER after LDPC (of selected codeword length or all codeword lengths)
		average LDPC iterations (of selected codeword length or all codeword lengths)
		average payload/CW/IUC (of selected codeword length or all codeword lengths)
		codeword coverage, IUC (of selected codeword length or all codeword lengths)
Graphical measurements	Note: Initial ranging, bandwidth requests, and probes provide a subset of measurements.	MER versus time (selectable time span and data filter)
		MER versus subcarrier
		MER versus minislot
		BER versus time
		signal power versus time
		CCDF plot
		amplitude and phase response
		amplitude and group delay response
		echo pattern
	constellation	BPSK, QPSK, QAM8, QAM16, QAM32, QAM64, QAM128, QAM256, QAM512, QAM1024, QAM2048
Residual MER floor	with K = 9, CP = 256 sample, rolloff = 128 sample, pilot pattern: 2 (2k) or 9 (4k), constellation: QAM256	> 50 dB (nom.) (with a grant size of 48 minislots in 96 minislots encompassed spectrum)

DOCSIS 3.0 downstream analyzer and J.83 analyzer (DSA-K1501 option)

Compliant to standard	DOCSIS 3.0 downstream analyzer	CM-SP-PHYv3.0
		CM-SP-DRFI
	J.83 analyzer	CM-SP-DRFI
		ITU-T J.83
		ETSI EN 300429
Interleaver	J.83/A/C	12, 17
	J.83/B	(I,J) = (128,1); (64,2); (32,4); (16,8); (8,16); I = 128 and J = 1 to 8
Settings	DOCSIS 3.0 downstream analyzer	standard (EuroDOCSIS 3.0, DOCSIS 3.0, DOCSIS 3.0 SC QAM J.83C)
		RF (center)
		constellation (64QAM, 256QAM)
		spectral inversion (on/off)
		equalizer (on/off/freeze)
		auto level
		MER optimize
		MER comp
		attenuation (0.0 dB to 30.0 dB with preamplifier on, 0.0 dB to 55.0 dB with preamplifier off)
		preamplifier (on/off)
		ASI output (on/off)
		phase tracking loop (1 kHz/6 kHz/60 kHz)
		BER mode (automatic, manual)
		BER test depth
		BER source (PN23, estimated from FEC)
		BER test depth source (before Viterbi, after Viterbi, before Reed-Solomon, after Reed-Solomon)
	J.83 analyzer	standard (J.83/A/C, J.83/B)
		RF (center)
		constellation J.83/A/C: QPSK, QAM16, QAM32, QAM64, QAM128, QAM256, QAM1024
		constellation J.83/B: QAM64, QAM256
		symbol rate (0.4 to 7.2 Msymbol/s)
		rolloff (0.12 to 0.20 in steps of 0.01)
		spectral inversion (on/off)
		equalizer (on/off/freeze)

		auto level
		MER optimize
		MER comp
		attenuation (0.0 dB to 30.0 dB with preamplifier on, 0.0 dB to 55.0 dB with preamplifier off)
		preamplifier (on/off)
		ASI output (on/off)
		phase tracking loop (1 kHz/6 kHz/60 kHz)
		BER mode (automatic, manual)
		BER test depth
		BER source (PN23, estimate from FEC)
		BER test depth source (before Reed-Solomon, after Reed-Solomon)
	alarm thresholds	minimum MER RMS
		maximum BER before Viterbi (only DOCSIS 3.0)
		maximum BER before Reed-Solomon
		maximum BER after Reed-Solomon
	meas config	MER averaging (on/off)
	constellation	plot type (constellation, density)
		visual (data color, background color, grid color, grid on/off)
		save I/Q
Signal status		demodulator lock
		decode lock
		MPEG lock
Alarm tab		shows MER and BER violations
Numerical measurements		signal power
		frequency offset
		symbol clock offset
		channel bit rate
		interleaver
		MER overall
		BER before Reed-Solomon
		BER after Reed-Solomon
		BER before Viterbi (only DOCSIS 3.0)
		BER after Viterbi (only DOCSIS 3.0)
		CER corrected
		CER uncorrected

Graphical measurements		MER versus time
		BER versus time
		signal power versus time
		CCDF plot
		amplitude and phase response
		amplitude and group delay response
		echo pattern
	constellation	J.83/A/C: QPSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 1024QAM
		DOCSIS, J.83/B: 64QAM, 256QAM
Residual MER floor (equalizer on)	47 MHz ≤ RF ≤ 100 MHz	≥ 54 dB (nom.)
	100 MHz < RF ≤ 1200 MHz	≥ 56 dB (nom.)

Upstream RF IN for J.83 (DSA-K1502 option), requires DSA-K1501 option

Compliant to standard	J.83 analyzer	CM-SP-DRFI
		ITU-T J.83
		ETSI EN 300429
Frequency range	model .03	
	upstream input	5 MHz to 204 MHz
Settings	J.83 analyzer	standard (J.83/A/C, J.83/B)
		RF (center)
		constellation J.83/A/C: QPSK, QAM16, QAM32, QAM64, QAM128, QAM256, QAM1024
		constellation J.83/B: QAM64, QAM256
		symbol rate (0.4 to 7.2 Msymbol/s)
		rolloff (0.12 to 0.20 in steps of 0.01)
		spectral inversion (on/off)
		equalizer (on/off/freeze)
		auto level
		MER comp
		attenuation (0.0 dB to 30.0 dB with preamplifier on, 0.0 dB to 43.0 dB with preamplifier off)
		preamplifier (on/off)
		ASI output (on/off)
		phase tracking loop (1 kHz/6 kHz/60 kHz)
		BER mode (automatic, manual)
		BER test depth
		BER source (PN23, estimate from FEC)
		BER test depth source (before Reed-Solomon, after Reed-Solomon)
	alarm thresholds	minimum MER RMS
		maximum BER before Reed-Solomon
		maximum BER after Reed-Solomon
	meas config	MER averaging
	constellation	plot type (constellation, density)
		visual (data color, background color, grid color, grid on/off)
		save I/Q
Signal status		demodulator lock
		decode lock
		MPEG lock

Alarm tab		shows MER and BER violations
Numerical measurements		signal power
		frequency offset
		symbol clock offset
		channel bit rate
		interleaver
		MER overall
		BER before Reed-Solomon
		BER after Reed-Solomon
		CER corrected
		CER uncorrected
		codewords, corrected
		codewords, uncorrected
Graphical measurements		MER versus time
		BER versus time
		signal power versus time
		CCDF plot
		amplitude and phase response
		amplitude and group delay response
		echo pattern
	constellation	J.83/A/C: QPSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 1024QAM
		J.83/B: 64QAM, 256QAM
Residual MER floor (equalizer on)	5 MHz ≤ RF ≤ 204 MHz one channel	≥ 56 dB (nom.)

DOCSIS 3.0 upstream analyzer (DSA-K1500 option)

Compliant to standard	DOCSIS 3.0 upstream analyzer	CM-SP-PHYv3.0
		CM-SP-DRFI
Settings	DOCSIS 3.0 ATDMA upstream analyzer	RF (center)
		constellation (QPSK, QAM8, QAM16, QAM32, QAM64)
		symbol rate (1.28 Msymbol/s, 2.56 Msymbol/s, 5.12 Msymbol/s)
		FEC parameter T (0 to 16)
		FEC parameter k (16 to 253)
		last codeword length (fixed, shortened)
		preamble pattern
		preamble length (0 to 1536)
		preamble offset (0 to 1534)
		preamble type (QPSK0, QPSK1)
		scrambler (on/off)
		scrambler seed (0 × 0000 to 0 × 7fff)
		guard time size (9 to 255)
		Reed-Solomon interleaver mode (disabled, fixed, dynamic)
		Reed-Solomon interleaver depth (2 to 128)
		Reed-Solomon interleaver block size (32 to 2048)
		minislot size (1, 2, 4, 8, 16, 32, 64, 128)
		equalizer (on/off)
		auto level
		MER optimize (with trigger only)
		attenuation (0.0 dB to 30.0 dB with preamplifier on, 0.0 dB to 43.0 dB with preamplifier off)
		preamplifier (on/off)
		grant size (1 to 255)
		starting minislot
		scheduling (single, periodic)
		repeat interval
		number of bursts (1 to 255)
		ranging mode (on/off)
		untimed burst length (1 to 255)
		trigger input offset (0 s to 1.0 s)
		trigger input slope (positive, negative)
		generate input trigger

		trigger output (on/off)
		trigger output offset
		trigger output level (high, low)
		trigger output pulse width
		trigger output period
		meas config MER averages
		MER sign (positive, negative)
		SFP+ output
		BER mode (automatic, manual)
		BER test depth
		BER source (PN23, estimated from FEC)
		BER test depth source (before Reed-Solomon, after Reed-Solomon)
	alarm thresholds	minimum MER RMS
		maximum BER before Reed-Solomon
		maximum BER after Reed-Solomon
	meas config	MER averages
	constellation	plot type (constellation, density)
		visual (data color, background color, grid color, grid on/off)
		save I/Q
Signal status		demodulator lock
		FEC lock
Alarm tab		shows MER and BER violations
Numerical measurements		burst RX power
		burst timing offset
		frequency offset
		payload data rate/IUC
		minislots
		burst coverage
		MER
		amplitude imbalance
		quadrature error
		received bursts
		expected bursts
		BER before Reed-Solomon
		BER after Reed-Solomon
		CER corrected
		CER uncorrected
		average payload/codeword/IUC
		codeword coverage, IUC

Graphical measurements		MER versus time
		BER versus time
		signal power versus time
		CCDF plot
		amplitude and phase response
		amplitude and group delay response
		echo pattern
	constellation	QPSK, QAM8, QAM16, QAM32, QAM64
Residual MER floor	with QPSK1 preamble, 2300 byte bursts, QAM64, symbol rate = 1.28 MHz (1.6 MHz bandwidth), 5.8 MHz ≤ RF ≤ 84.2 MHz	> 45 dB (nom.)

DOCSIS timing analysis (DSA-K1505 option)

Numerical measurements	downstream: • DOCSIS 3.0 SC-QAM [1] • DOCSIS 3.1 OFDM	RMS DOCSIS timestamp jitter
		peak-to-peak DOCSIS timestamp jitter
		configurable measurement interval (1 s to 17.4 s)
		residual jitter in peak-to-peak measurement 5 ns typical at maximum measurement interval for OFDM signal, 200 ns typical at maximum measurement interval for SC-QAM signal
	upstream [2]: • DOCSIS 3.0 A-TDMA • DOCSIS 3.1 OFDMA	RMS burst timing jitter
		peak-to-peak burst timing jitter
		configurable measurement interval (10 to 8192 bursts)
		residual jitter in peak-to-peak measurement 10 ns typical over 32 burst measurement intervals
	1 pulse per second (PPS) input	timestamp offset
		mean timestamp offset
		RMS timestamp offset
		peak-to-peak timestamp offset
		configurable measurement interval (1 s to 60 s)
		configurable calibration offset (–0.5 s to 0.5 s)
		mean offset repeatability ± 10 ns typical at maximum measurement interval for fixed OFDM channel configuration
	synchronous upstream I/Q streaming over SFP+	symbol rate synchronous to locked downstream OFDM or SC-QAM channel
		DOCSIS 3.1 timestamp added to I/Q Ethernet packets
		sample rate (OFDMA) 102.4 Msps
		sample rate (ATDMA) 4 times symbol rate (20.48 Msps, 10.24 Msps, 5.12 Msps as configured)

[1] Requires DSA-K1501 option.

[2] Requires DSA-K1500 option.

Graphical measurements	downstream: • DOCSIS 3.0 SC-QAM [1] • DOCSIS 3.1 OFDM	timestamp jitter versus time
	upstream [2]: • DOCSIS 3.0 A-TDMA • DOCSIS 3.1 OFDMA	burst timing jitter versus time
1PPS in		uses trigger input port (50 Ω termination recommended)

Dynamic upstream analysis (requires DSA-K1500 option)

Compliant to standard		CM-SP-PHYv3.1
		CM-SP-PHYv3.0
		CM-SP-DRFI
Settings		IUC filter
		SID filter
	downstream signal configuration, DOCSIS 3.0	standard (EuroDOCSIS 3.0, DOCSIS 3.0, DOCSIS 3.0 SC QAM J.83C)
		RF (center)
		constellation (64QAM, 256QAM)
		spectral inversion (on/off)
		equalizer (on/off)
		auto level
		attenuation (0.0 dB to 30.0 dB with preamplifier on, 0.0 dB to 50.0 dB with preamplifier off)
		preamplifier (on/off)
	downstream signal configuration, DOCSIS 3.1	RF (center)
		equalizer (on/freeze)
		auto level
		attenuation (0.0 dB to 30.0 dB with preamplifier on, 0.0 dB to 50.0 dB with preamplifier off)
		preamplifier (on/off)
	upstream signal configuration	UCID
		attenuation (0.0 dB to 30.0 dB with preamplifier on, 0.0 dB to 43.0 dB with preamplifier off)
		preamplifier (on/off)
		traffic detect threshold
		OFDMA occupied bandwidth threshold (1.0 MHz to 96.0 MHz)
		prefilter (on/off)
		prefilter length (short, medium, long)
Signal status		MAC addresses list with MAC address filter
		acquisition log
	DOCSIS 3.0	see DOCSIS 3.0 upstream analyzer
	DOCSIS 3.1	see DOCSIS 3.1 upstream analyzer
Numerical measurements	DOCSIS 3.0	see DOCSIS 3.0 upstream analyzer
	DOCSIS 3.1	see DOCSIS 3.1 upstream analyzer
Graphical measurements	DOCSIS 3.0	see DOCSIS 3.0 upstream analyzer
	DOCSIS 3.1	see DOCSIS 3.1 upstream analyzer

SFD upstream analysis (requires DSA-K1500 option and SFD DOCSIS® signal generator with software version 1.3.1 or higher)

Compliant to standard		CM-SP-PHYv3.1
		CM-SP-PHYv3.0
		CM-SP-DRFI
Settings		SFD pilot frequency (5 MHz to 204 MHz)
		attenuation (0.0 dB to 30.0 dB with preamplifier on, 0.0 dB to 43.0 dB with preamplifier off)
		preamplifier (on/off)
		prefilter (on/off)
		prefilter length (short, medium, long)
		MER sign (positive, negative)
		SFP+
		meas config MER averages
	DOCSIS 3.0 ATDMA alarm thresholds	minimum MER RMS
		maximum BER before Reed-Solomon
		maximum BER after Reed-Solomon
	DOCSIS 3.1 OFDMA alarm thresholds	minimum MER RMS
		maximum BER before LDPC/IUC
		maximum BER after LDPC/IUC
Signal status	DOCSIS 3.0	see DOCSIS 3.0 upstream analyzer
	DOCSIS 3.1	see DOCSIS 3.1 upstream analyzer
Alarm tab	DOCSIS 3.0	see DOCSIS 3.0 upstream analyzer
	DOCSIS 3.1	see DOCSIS 3.1 upstream analyzer
Numerical measurements	DOCSIS 3.0	see DOCSIS 3.0 upstream analyzer
	DOCSIS 3.1	see DOCSIS 3.1 upstream analyzer
Graphical measurements	DOCSIS 3.0	see DOCSIS 3.0 upstream analyzer
	DOCSIS 3.1	see DOCSIS 3.1 upstream analyzer

Cable modem ranging analysis (requires DSA-K1500 option and SFD DOCSIS® signal generator with software version 1.3.1 or higher)

Compliant to standard		CM-SP-PHYv3.1
		CM-SP-PHYv3.0
		CM-SP-DRFI
Settings	SFD DOCSIS® signal generator downstream signal configuration, DOCSIS 3.0	transmit power
		frequency
		interleaver (only DOCSIS 3.0 standard)
		constellation
		channel bonding
	SFD DOCSIS® signal generator downstream signal configuration, DOCSIS 3.1	transmit power
		frequency
		subcarrier spacing
		rolloff
		subcarrier 0 frequency
		cyclic prefix length
		time interleaver depth
		subcarrier configuration file
	cable modem upstream signal configuration, DOCSIS 3.0	frequency (5 MHz to 204 MHz)
		constellation (QPSK, QAM8, QAM16, QAM 32, QAM64)
		symbol rate (1.28 Msymbol/s, 2.56 Msymbol/s, 5.12 Msymbol/s)
		FEC parameter t (0 to 16)
		FEC parameter k (16 to 253)
		last codeword length (fixed, shortened)
		preamble pattern
		preamble length
		preamble offset
		preamble type (QPSK0, QPSK1)
		scrambler (on/off)
		scrambler seed
		guard time size
		Reed-Solomon interleaver mode (disabled, fixed, dynamic),
		Reed-Solomon interleaver depth (2 to 128)
		Reed-Solomon interleaver block size (32 to 2048)
		minislot size (1, 2, 4, 8, 16, 32, 64, 128)
		meas config MER averages

	cable modem upstream signal configuration, DOCSIS 3.1	frequency (5 MHz to 204 MHz)
		rolloff (0 µs to 2.1875 µs)
		cyclic prefix length (0.9375 µs to 6.25 µs)
		symbols per frame (10 to 36)
		subcarrier spacing (50 kHz/2k FFT, 25 kHz/4k FFT)
		randomizer seed
		up to 3 exclusion bands
		minislot configuration mode (manual, file)
		constellation (QPSK, QAM8, QAM16, QAM32, QAM64, QAM128, QAM256, QAM512, QAM1024, QAM2048)
		pilot pattern (8 to 14)
		starting minislot
		number of minislots
		first active subcarrier
		last active subcarrier
		initial ranging starting minislot in frame
		initial ranging number of minislots
		initial ranging number of subcarriers
		initial ranging preamble pattern
		initial ranging preamble length
		initial ranging preamble offset
		fine ranging starting minislot in frame
		fine ranging number of minislots
		fine ranging number of subcarriers
		fine ranging preamble pattern
		fine ranging preamble offset
		wideband probe start subcarrier
		wideband probe subcarrier skip
		wideband probe stagger (on/off)
		wideband probe symbol in frame
		bandwidth requests minislot in frame
		bandwidth requests subslot
		meas config MER averages
		equalizer (on/off) (only DOCSIS 3.0)
		auto level
		attenuation (0 dB to 30 dB with preamplifier on, 0 dB to 43 dB with preamplifier off)
		preamplifier (on/off)

	DSA upstream signal path configuration	prefilter (on/off) (only DOCSIS 3.1)
		prefilter length (short, medium, long) (only DOCSIS 3.1)
		SFP+ output
		plot type (constellation, density)
		data filter (IUC, all)
		visual (data color, background color)
		save I/Q
	constellation	demodulator lock
		FEC lock
		acquisition log
		burst RX power
Signal status		power/1.6 MHz
		frequency offset
		burst timing offset
Numerical measurements		payload data rate/IUC
		minislots
		burst coverage
		MER (for selected IUC, pilot, compl. pilot)
		ranging power versus ranging opportunity
		burst MER versus ranging opportunity
		MER versus time (selectable data filter)
		MER versus subcarrier (only DOCSIS 3.1)
		MER versus minislot (only DOCSIS 3.1)
		BER versus time
Graphical measurements		signal power versus time
		CCDF plot (only DOCSIS 3.1)
		constellation

Spectrum analyzer

RBW	span ≥ 10 kHz	10 Hz to 3 MHz
	zero span	10 Hz to 200 MHz
VBW		10 Hz to 10 MHz
Span		0 Hz, 10 kHz to 1.747 GHz
Averages		1 to 65535
FFT		windowing flattop
Settings		center frequency
		start frequency
		stop frequency
		span
		full span
		minimum span
		zero span
		up to 2 frequency lines definable
		reference level (–21.2 dBmV to +68.8 dBmV)
		range (1.0 dB to 100.0 dB)
		auto y-axis
		auto level
		attenuation downstream (0.0 dB to 30.0 dB with preamplifier on, 0.0 dB to 50.0 dB with preamplifier off)
		upstream (0.0 dB to 30.0 dB with preamplifier on 0.0 dB to 43.0 dB with preamplifier off)
		preamplifier (on/off)
		up to 2 level lines definable
		detector (RMS, sample, peak)
Marker		up to 5 markers storable: • visible (on/off) • frequency • assign delta marker (1 to 5) • assign marker trace (1 to 5) • marker functions (max. peak, center, reference level, next peak right, next peak left, next point right, next point left, peak excursion)
		phase noise markers
Traces		up to 5 traces storable: • visible (on/off) • color

States		up to 5 spectrum analyzer configurations storable: • store • clear • recall • view
Masks		up to 5 masks storable: • visible (on/off) • configuration (upper limit, lower limit) • clear • color
Numerical measurements		marker frequency
		marker level
		band power
Graphical measurements		min. hold
		max. hold
		adjacent channel power

General data

Environmental conditions		
Temperature range	operating	0 °C to +45 °C
	storage	–20 °C to +70 °C
Damp heat		+40 °C, 80 % rel. humidity, steady state
Mechanical resistance		
Vibration	office vibration	sine swipe with an acceleration of 1 g, swipe from 5 Hz to 100 Hz
		in line with NEBS GR-63-CORE, 5.4.2 frame mounted equipment
	shipping air and ground transport vibrations	sine swipe with an acceleration of 0.5 g, swipe from 5 Hz to 50 Hz
		sine swipe with an acceleration of 3 g, swipe from 50 Hz to 500 Hz
		in line with NEBS GR-63-CORE, 5.4.3, transportation packaged equipment
Power rating		connector, in line with IEC 60320
Rated voltage		100 V to 240 V AC (± 10 %)
Rated frequency		50 Hz to 60 Hz
Fuse		cylindrical 5 mm × 20 mm, slow blow non-indicating, 250 V AC, 4 A
Rated power		350 VA
Product conformity		
Electromagnetic compatibility	EU, in line with EMC Directive 2014/30/EU	applied harmonized standards: • EN 61326-1, class A • EN 55011, class A • EN 61000-3-2 • EN 61000-3-3
Electrical safety	EU, in line with Low Voltage Directive 2014/35/EU	applied harmonized standards: • EN 61010-1 • EN 61010-2-30
	USA	• UL 61010-1 • UL 61010-2-030
	Canada	• CAN/CSA C22.2 No. 61010-1 • CAN/CSA C22.2 No. 61010-2-30
International safety approvals	TÜV SÜD America Inc.	TÜV SÜD mark No. U8 17 06 18396 003
Calibration interval	recommended for highest accuracy	12 months
	for general test and measurement applications	24 months

Dimensions	W × H × D	358 mm × 196 mm × 411 mm (14.1 in × 7.72 in × 16.2 in) ¾ 19", 4 HU
Weight		7.5 kg (16.5 lb)
Display		10.1" color TFT LCD with LED backlight, touchscreen
Usable screen area		217.0 mm × 135.6 mm (8.54 in × 5.34 in)
Resolution		1280 × 800 pixel (16 × 10 aspect ratio)

Software Tools

Rohde and Schwarz R&S®DSA-K950 TVSCAN 2.0 automated measurement of multiple TV channels

Licensing	configuration tool (channel tables, limit values, device settings)	free of charge, no DSA required
	measurement tool	requires Rohde and Schwarz R&S®DSA-K950 option being installed on the DSA
	visualization tool	free of charge, no DSA required
Maximum number of DSA DOCSIS® signal analyzers in parallel		unlimited, for each DSA a new window can be opened
Database	standard SQLite database	included in Rohde and Schwarz TVSCAN 2.0
	user-specific database	supported
Memory requirement for database	100 scans with 100 channels each	20 Mbyte (typ.)
Maximum number of channels		unlimited
Scan of individual channel(s)		yes, selection out of channel list
Time between two scans		immediate or configurable
Duration of scan session		infinite or configurable
Settings that can be individually assigned to each channel	DOCSIS 3.0/EuroDOCSIS 3.0/ DOCSIS 3.0 SC-QAM J.83/C	channel name, description, TV standard, center frequency, frequency offset, power limit offset, reference level mode, preamplifier, attenuation, sideband position, QAM order, equalizer, phase track loop bandwidth
	DOCSIS 3.1	channel name, description, TV standard, center frequency, frequency offset, power limit offset, reference level mode, preamplifier, attenuation, equalizer, subcarrier 0 frequency, pre-filter, profile
	digital TV (J.83/A/B/C, DVB-C)	channel name, description, TV standard, center frequency, frequency offset, power limit offset, reference level mode, preamplifier, attenuation, sideband position, QAM order, symbol rate, rolloff factor, equalizer
Measurement parameters	DOCSIS 3.0/EuroDOCSIS 3.0/ DOCSIS 3.0 SC-QAM J.83/C	see list below
	DOCSIS 3.1	see list below
	digital TV (J.83/A/B/C, DVB-C)	see list below

Visualization for a session		all channel parameters as chart, single channel parameter in time domain (2D graph), single parameter over time and frequency (3D graph), single channel limit violations, all session limit violations
System requirements	32 bit version for installation on a PC or notebook, visualization tool is not included	operating system: Windows 10, 8.1, 8, 7, administrator rights, dual core processor ≥ 1 GHz, RAM ≥ 2 Gbyte, 100 Mbyte free memory + memory for the scan results (data base)
	64 bit version for installation on a PC or notebook	operating system 64 bit: Windows 10, 8.1, 8, 7 or Linux (tested with Ubuntu 16.0.4), administrator rights, quad core processor ≥ 2 GHz, OpenGL graphics, for visualization of 3D diagrams, RAM ≥ 4 Gbyte, 100 Mbyte free memory + memory for the scan results (database), network connection to DSA for measurements

DSA Rohde and Schwarz TVSCAN 2.0 supported measurements for DOCSIS and digital TV

Parameter	DOCSIS 3.0	EuroDOCSIS 3.0	DOCSIS 3.0 SC-QAM J.83/C	DOCSIS 3.1	digital TV (J.83/A/B/C, DVB-C)
Power	●	●	●	●	●
Carrier frequency offset digital	●	●	●	●	●
Symbol rate offset	●	●	●	●	●
Demod lock	●	●	●	●	●
MPEG lock	●	●	●		●
Decode lock	●	●	●		●
PLC lock				●	
MER RMS dB	●	●	●		●
MER peak dB	●	●	●		●
CER corrected	●	●	●		●
CER uncorrected	●	●	●		●
BER before Viterbi	●				
BER after Viterbi	●				
BER before RS		●	●		●
BER after RS	●	●	●		●
Channel bit rate	●	●	●		●
Occupied bandwidth				●	
Signal power per 6 MHz				●	
NCP CRC errors				●	
Payload data rate				●	
MER overall RMS				●	
MER overall peak				●	
MER profile A RMS				●	
MER profile A peak				●	
MER profile RMS				●	
MER profile peak				●	
MER pilot RMS				●	
MER pilot peak				●	
MER PLC RMS				●	
MER PLC peak				●	
MER NCP RMS				●	
MER NCP peak				●	
MER zero bit loaded RMS				●	
MER zero bit loaded peak				●	
BER PLC				●	
BER NCP				●	

Parameter	DOCSIS 3.0	EuroDOCSIS 3.0	DOCSIS 3.0 SC-QAM J.83/C	DOCSIS 3.1	digital TV (J.83/A/B/C, DVB-C)
CER PLC				●	
CER NCP				●	
BER before LDPC				●	
BER after LDPC				●	
BER after BCH				●	
CER after LDPC				●	
CER after BCH				●	
Average payload per codeword				●	
Average LDPC iterations				●	