

R&S® SFC Compact Modulator Specifications



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Definitions

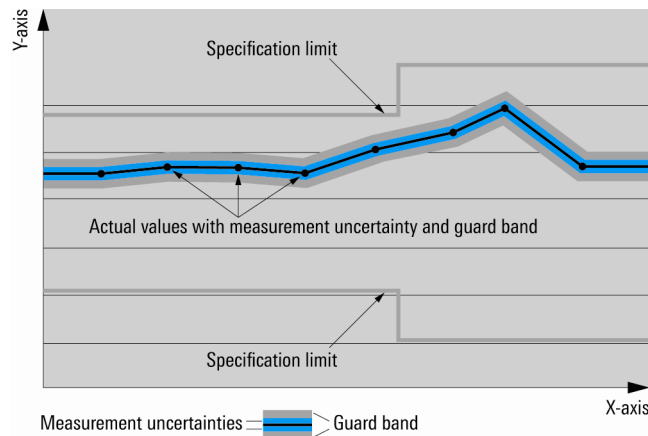
General

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 $<$, \leq , $>$, \geq , \pm , 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.

Typical data as well as nominal and measured values are not warranted by Rohde & Schwarz.

Specifications

RF characteristics

Frequency

Frequency range	standard	30 MHz to 900 MHz
	with R&S®SFC-K83 option	30 MHz to 3000 MHz
Uncertainty	internal reference	see "Reference frequency"
	external reference ¹	< 0.5×10^{-9} typ. < 1.0×10^{-10}
Setting resolution		1 Hz
Setting time	to within < 1×10^{-7} with GUI update stopped within standard frequency range	20 ms

Reference frequency

Uncertainty		< 1.0×10^{-6}
Aging	after 14 days of uninterrupted operation	< 3.0×10^{-9} /day
Temperature effect	in operating temperature range	< 1.0×10^{-6}
Input for external reference signal	frequency (sine wave)	10 MHz
	maximum deviation	3×10^{-6}
	input level	≥ -5 dBm to ≤ 19 dBm
	recommended limits	0 dBm to 19 dBm
	input impedance	50 Ω
	connector	BNC female, front

Level

RF output	connector	SMA female, front
	output impedance	50 Ω
Maximum level	$f \leq 470$ MHz	+16.5 dBm (PEP) ²
	470 MHz < $f \leq 2.2$ GHz	+13.5 dBm (PEP)
	2.2 GHz < $f \leq 3.0$ GHz	+10.5 dBm (PEP)
Setting range	standard	-31.5 dBm to maximum level
	with R&S®SFC-K84 option	-110.0 dBm to maximum level
	resolution	0.1 dB
Dynamic range of attenuator		110 dB
Level uncertainty	"auto" attenuator mode, temperature range +18 °C to +33 °C	< ± 1.5 dB
Output VSWR in 50 Ω system	frequency ≤ 900 MHz	< 1.8 (typ. < 1.4)
Setting time	to < 0.1 dB deviation from final value; with GUI update stopped	10 ms
Uninterruptible level setting	"fixed" attenuator mode, setting range	18 dB
Back-feed (from ≥ 50 Ω source)	maximum permissible RF power in output frequency range of RF path	+30 dBm, permanent
	permissible DC voltage	± 20 V

¹ Averaged over 10 minutes measurement time, 10 minutes after switching to external reference.

² PEP = peak envelope power (CW); for other modulation modes, depending on back-off.

Spectral purity

Harmonics	level ≤ 0 dBm, CW	typ. < -30 dBc
Nonharmonics	level ≥ -20 dBm, CW, carrier frequency, carrier offset > 10 kHz, 30 MHz $\leq f \leq 900$ MHz	reference: signal power < -60 dBc
	900 MHz $< f \leq 3000$ MHz	limited by carrier leakage and sideband suppression
Broadband noise	carrier offset > 10 MHz, measurement bandwidth 1 Hz	< -130 dBc (typ. < -140 dBc)
SSB phase noise	carrier offset 20 kHz, measurement bandwidth 1 Hz	typ. < -100 dBc

I/Q modulation**I/Q modulator**

Modulation frequency range		DC to 35 MHz
Modulation frequency response ³	up to 35 MHz 900 MHz $< f \leq 3000$ MHz	$< \pm 2.0$ dB
	up to 25 MHz 30 MHz $< f \leq 3000$ MHz	$< \pm 1.0$ dB
	up to 5 MHz 30 MHz $< f \leq 3000$ MHz	$< \pm 0.5$ dB
Carrier leakage	$f \leq 900$ MHz	< -80 dBc
	$f > 900$ MHz	< -50 dBc
	without input signal, referenced to full-scale input ⁴	typ. < -65 dBc after local adjustment
Sideband suppression	$f \leq 900$ MHz	< -80 dBc
	$f > 900$ MHz	< -45 dBc
	modulation frequency ≤ 100 kHz, referenced to signal power	typ. < -60 dBc after local adjustment
I/Q swap	I and Q signals swapped	ON, OFF

Internal baseband I/Q

Signal characteristics		see "Digital modulation systems"
D/A converter	sample rate	100 MHz
	resolution	12 bit
	sampling rate	400 MHz (internal interpolation $\times 4$)

Extended I/Q input (R&S[®]SFC-K80 option)

The R&S[®]SFC-K80 option allows external digital signals to be fed into the baseband signal processing unit of the R&S[®]SFC. Noise signals can be superimposed on input signals if the noise option has been installed.

Digital I/Q input	connector	Mini D Ribbon, 26 pins, rear
	level	LVDS
	word width	16 bit
	analog bandwidth	0 Hz to 35 MHz
	symbol rate	3 ksymbol/s to 100 Msymbol/s

³ This frequency response is superimposed on all frequency responses of this specification.

⁴ Value applies after 1 h warm-up time and recalibration for 4 h of operation as well as temperature variations of less than ± 5 °C.

Digital baseband

Internal test signals

MPEG-2 TS packet	header + 184 byte payload PID = 1FFF (hex)	payload: PRBS
MPEG-specific TS packet	sync byte + 187 byte payload	payload: PRBS
DIRECTV TS packet	header + 127 byte payload	payload: PRBS
DIRECTV TS packet without header	130 byte payload	payload: PRBS
PRBS	PRBS in line with ITU-T O.151	$2^{23} - 1$, $2^{15} - 1$ (selectable)

MPEG-2 inputs

ASI/SMPTE310M/ETI serial input	connector	BNC female
	ASI input level	200 mV to 880 mV
	SMPTE310M input level	400 mV to 880 mV
	ETI input level	0 V to ± 2.37 V (HDB3)
	input impedance	75 Ω
	ASI data rate	270 Mbit/s
	SMPTE310M data rate	19.392658 Mbit/s
Stuffing	ETI data rate	2048 kbit/s
	ASI, SMPTE310M stuffing packets	ON/OFF see MPEG-2 TS packet under "Internal test signals"
Display	measured values	packet length, input data rate, useful data rate

TRP player (R&S®SFC-K22 option, always included)

Replay	file format	TRP, T10, BIN, (any recorded data streams)
	length of transport stream packets	corresponding to externally applied/recorded transport stream
	replay time/sequence length	endless (but not seamless) replay with cut at transition from end of file to beginning of file; seamless in case of TRP file
	data rate	corresponding to hard disk's recording data rate and setting (100 kbit/s to max. 90 Mbit/s)
	data volume	limited only by hard disk size

Analog baseband

Audio player

Waveform memory	sequence duration	80 s
	resolution	16 bit for AF1 and 16 bit for AF2
Audio	number of signals	2 channels, AF1 and AF2
	bandwidth	DC to 15 kHz
	level	16 bit full scale in each channel corresponds to standard deviation
	frequency response	< ±0.3 dB
Clock generation	clock rate	50 kHz
Marker	position	restart waveform

Internal audio signal generator

Audio signals	number of signals	2, can be set separately
	frequency	30 Hz to 15 kHz, in 1 Hz steps
	level	-60 dBu to +12 dBu, in 0.01 dB steps, 6 dBu corresponds to standard deviation

Internal NICAM audio signal generator

Audio signals	number of signals	2, can be set separately
	frequency	30 Hz to 15 kHz, in 1 Hz steps
	level	-60 dBu to +12 dBu, in 0.01 dB steps, 6 dBu corresponds to standard headroom

Internal video signal generator (R&S® SFC-K23 option, always included)

Internal video generator		
Video signals	ATV video basic test signals	COLORBARS_75 (PAL) COLORBARS_75 (PAL M) COLORBARS_75 (PAL N) COLORBARS_75 (NTSC) COLORBARS_75 (SECAM) FuBK (PAL)
Insertion test signal structure	in line with country-specific standards	
PAL color bar 75 %	first field line 16 line 17 line 18 line 19 line 20 line 21 second field line 319 line 329 line 330 line 331 line 332 line 333 line 334 line 335	2T pulse CCIR17 CCIR18/1 CCIR18/2 data line teletext insertion test signal ramp modulated ramp CCIR330/5 CCIR331/1 red line sin x/x 15 kHz, 200 ns 250 kHz, 100 ns
PAL M color bar 75 %	first field line 16 line 17 line 18 second field line 11 line 12 line 13 line 14 line 15 line 16 line 17 line 18	2T pulse NTC7 composite FCC composite ramp modulated ramp red line 15 kHz, 250 ns 250 kHz, 125 ns FCC multiburst NTC7 combined sin x/x
PAL N color bar 75 %	first field line 16 line 17 line 18 line 19 line 20 line 21 second field line 319 line 329 line 330 line 331 line 332 line 333 line 334 line 335	2T pulse CCIR17 CCIR18/1 CCIR18/2 data line teletext insertion test signal ramp modulated ramp CCIR330/5 CCIR331/1 red line sin x/x 15 kHz, 200 ns 250 kHz, 100 ns

NTSC color bar 75 %	first field line 16 line 17 line 18 second field line 11 line 12 line 13 line 14 line 15 line 16 line 17 line 18	2T pulse NTC7 composite FCC composite ramp modulated ramp red line 15 kHz, 250 ns 250 kHz, 125 ns FCC multiburst NTC7 combined sin x/x
SECAM color bar 75 %	first field lines 7 to 15 line 16 line 17 line 18 line 19 line 20 line 21 second field line 319 lines 320 to 328 line 329 line 330 line 331 line 332 line 333 line 334 line 335	discriminating signal 2T pulse CCIR17 CCIR18/1 CCIR18/2 data line teletext insertion test signal ramp discriminating signal modulated ramp CCIR330/5 CCIR331/1 red line sin x/x 15 kHz, 200 ns 250 kHz, 100 ns
PAL FuBK	first field line 16 line 17 line 18 line 19 line 20 line 21 second field line 319 line 329 line 330 line 331 line 332 line 333 line 334 line 335	2T pulse CCIR17 CCIR18/1 CCIR18/2 data line teletext insertion test signal ramp modulated ramp CCIR330/5 CCIR331/1 red line sin x/x 15 kHz, 200 ns 250 kHz, 100 ns
Other video signals		see R&S® ATV Video

Digital modulation systems

Terrestrial standards

DVB-T2 (R&S®SFC-K16 option)

DVB-T2	in line with EN 302755	Europe
Modulation	modulation	COFDM
	PLP number	1 (single PLP) to 6 (multi-PLP)
	bandwidth	1.7 MHz, 5 MHz, 6 MHz, 7 MHz, 8 MHz, (overrange 10 MHz)
	MER	> 43 dB ⁵
	modulation frequency response	< ±0.2 dB
	shoulder attenuation	> 45 dB
Coding	baseband mode	normal (NM), high efficiency (HEM)
	code rate	1/2, 3/5, 2/3, 3/4, 4/5, 5/6
	constellation	QPSK, 16QAM, 64QAM, 256QAM
	rotation	ON/OFF
	time interleaver	settable
	FFT mode	1k, 2k, 4k, 8k, 16k and 32k COFDM
	extended carrier mode	ON/OFF
	pilot pattern	PP1, PP2, PP3, PP4, PP5, PP6, PP7, PP8
	guard interval	1/4, 19/128, 1/8, 19/256, 1/16, 1/32, 1/128
	T2 frames per superframe	settable
	OFDM symbols per T2 frame	settable
	PAPR	OFF, tone reservation (TR) ⁶
Test signals		TS test packet with settable payload (PRBS, 0x00, 0xFF) (see "Internal test signals")

DVB-T/H (R&S®SFC-K1 option)

DVB-T/H	in line with EN 300744/EN 302304	Europe
Modulation	modulation	COFDM
	bandwidth	5 MHz, 6 MHz, 7 MHz, 8 MHz
	MER	> 40 dB ⁵
	modulation frequency response	< ±0.2 dB
	shoulder distance	> 48 dB
	back-off	13.5 dB
Coding	constellation	QPSK, 16QAM, 64QAM, hierarchical coding
	code rate	1/2, 2/3, 3/4, 5/6, 7/8
	guard interval	1/4, 1/8, 1/16, 1/32
	FFT mode	2k, 4k and 8k COFDM
	interleaver	native and in-depth
TPS	in line with DVB-T/DVB-H	
Special functions	Reed-Solomon encoder	can be switched off
Test signals		TS test packet (see "Internal test signals"), PRBS after convolutional encoder

⁵ With internal test signals.

⁶ Reserved carriers are always modulated with 0+j0.

T-DMB/DAB (R&S® SFC-K11 option)

T-DMB/DAB	in line with T-DMB/EN 300401	Korea/Europe
Modulation	modulation	COFDM
	mode	I, II, III, IV
	bandwidth	1.536 MHz
	modulation frequency response	< 0.2 dB
	shoulder distance	> 45 dB
	back-off	13 dB
Single-frequency network	network mode	MFN
	control	MID, manual
Special function	PRBS	can be inserted into a subchannel ⁷

DTMB (R&S® SFC-K12 option)

DTMB	in line with GB20600-2006	
Modulation	modulation	COFDM/single carrier
	bandwidth	6 MHz, 7 MHz, 8 MHz
	modulation frequency response	< 0.2 dB
	shoulder distance	> 50 dB
	back-off	12 dB
	Coding	constellation
code rate		0.4, 0.6, 0.8
guard interval		420, 595, 945 symbols
guard interval PN		variable/constant
time interleaver		240, 720 symbols
FFT mode		4k COFDM/single carrier
dual pilot tone		ON/OFF (single carrier)
Network mode		
Special functions	DMB-TH mode	selectable
Test signals		TS test packet (see "Internal test signals")

CMMB (R&S® SFC-K15 option)

CMMB	in line with GY/T 220.1-2006	
Modulation	modulation	COFDM
	bandwidth	2 MHz, 8 MHz
	modulation frequency response	< 0.2 dB
	shoulder attenuation	> 50 dB
	Coding	FFT mode
scrambling mode		0 to 7
number of timeslots		40
services		
Reed-Solomon		(240, 240) (240, 224) (240, 192) (240, 176)
byte interleaver		1 to 3
LDPC		1/2, 3/4
constellation		BPSK, QPSK, 16QAM

MediaFLO™ (R&S® SFC-K10 option)

MediaFLO™	in line with QUALCOMM 80-T0455-1 Rev. E	
Modulation	modulation	COFDM
	bandwidth	5 MHz, 6 MHz, 7 MHz, 8 MHz
	modulation frequency response	< 0.2 dB
	shoulder distance	40 dB
	back-off	15.5 dB
	Coding	FFT mode
Test signals		PRBS

⁷ Can be inserted into an existing, user-selectable subchannel of an incoming, valid ETI data stream.

ATSC/8VSB (R&S® SFC-K4 option)

ATSC/8VSB	in line with ATSC Doc. A/53 (8VSB)	
Modulation	modulation	8VSB
	bandwidth	6 MHz
	symbol rate	10.762 Msymbol/s
	range	settable $\pm 5\%$
	pilot	1.25
	pulse filtering	root-raised-cosine roll-off, $\alpha = 0.115$
	MER	> 40 dB
	modulation frequency response	< ± 0.25 dB
	shoulder distance	> 45 dB
	back-off	9 dB
Coding	input data rate	19.392658 Mbit/s
	range	$\pm 5\%$ (depending on symbol rate)
Test signals	TS test packet (see "Internal test signals")	

ATSC-M/H (R&S® SFC-K18 option)

ATSC Mobile DTV ATSC-M/H	in line with ATSC Doc. A/153	mobile TV USA
Modulation	mode	8VSB
	bandwidth	6 MHz
	symbol rate	10.762 Msymbol/s
	range	settable $\pm 5\%$
	pilot	1.25 (can be switched off)
	range	settable (from 0 to 5 in steps of 0.001)
	pulse filtering	root-raised-cosine roll-off, $\alpha = 0.115$
	MER	> 40 dB ⁸
	modulation frequency response	< ± 0.25 dB
	shoulder attenuation	> 45 dB
Coding	input data rate	19.392658 Mbit/s
	range	$\pm 5\%$ (depending on symbol rate)
Special functions	randomizer, Reed-Solomon, interleaver, Trellis initialization	can be switched off
Test signals	TS test packet (see "Internal test signals")	

ISDB-T/ISDB-T_{SB}/ISDB-T_B (R&S® SFC-K6 option)

ISDB-T, ISDTV ISDB-T _{SB} ISDB-T _B	in line with ARIB STD-B31 version 1.5 in line with ARIB STD-B29 ISDB-T _{SB} Brazil	
Modulation	modulation	OFDM
	bandwidth	6 MHz (variable: ± 1000 ppm)
	number of segments	
	STD-B31	13
	STD-B29	1, 3
	MER	> 40 dB
	modulation frequency response	< 0.2 dB
	shoulder distance	> 48 dB
	back-off	13 dB
	Coding	FFT mode
number of layers		1 to 3 (1 or 2 in line with ISDB-T _{SB})
constellation		QPSK, DQPSK, 16QAM, 64QAM
code rate		1/2, 2/3, 3/4, 5/6, 7/8
guard interval		1/4, 1/8, 1/16, 1/32
time interleaver		0, 1, 2, 4, 8, 16 (additionally 32 with ISDB-T _{SB})
Special function	AC information	PRBS, All 1
Test signals	TS test packet (see "Internal test signals")	

⁸ With internal test signals.

Cable standards

DVB-C/ISDB-C (R&S[®]SFC-K2 option)

DVB-C ISDB-C	in line with ITU-T J.83/A (EN 300429) in line with ITU-T J.83/C	
Modulation	modulation	16QAM, 32QAM, 64QAM, 128QAM, 256QAM
	symbol rate	1 Msymbol/s to 8 Msymbol/s, settable
	pulse filtering	root-raised-cosine roll-off, $\alpha = 0.13, 0.15$
	MER	> 40 dB
	modulation frequency response	± 0.25 dB
	shoulder distance	> 48 dB
	back-off	9 dB
Special functions	Reed-Solomon encoder	can be switched off
Test signals		TS test packet (see "Internal test signals"), PRBS before mapper

J.83/B (R&S[®]SFC-K5 option)

J.83/B	in line with ITU-T J.83/B	
Modulation	modulation	64QAM, 256QAM, 1024QAM
	bandwidth	6 MHz
	symbol rate	
	64QAM	5.0569 Msymbol/s
	256QAM	5.3605 Msymbol/s
	1024QAM	5.3605 Msymbol/s
	pulse filtering	root-raised-cosine roll-off, $\alpha = 0.18$ (64QAM), 0.12 (256/1024QAM)
	MER	> 40 dB
	modulation frequency response	± 0.25 dB
	shoulder distance	
	64QAM	> 50 dB
	256QAM	> 45 dB
	1024QAM	> 45 dB
back-off	9 dB	
Coding	input data rate	
	64QAM	26.97035 Mbit/s
	256QAM	38.81070 Mbit/s
	1024QAM	49.02525 Mbit/s
	data interleaver	level 1 and level 2
Special functions	Reed-Solomon encoder	can be switched off
Test signals		TS test packet (see "Internal test signals"), PRBS before mapper

Satellite standards

DVB-S/DVB-DSNG (R&S®SFC-K3 option)

DVB-S/DVB-DSNG	in line with EN 300421/EN 301210	
Modulation	modulation	QPSK, 8PSK, 16QAM
	symbol rate	100 ksymbol/s to 45 Msymbol/s, settable
	pulse filtering	root-raised-cosine roll-off, $\alpha = 0.35, 0.25$
	MER	38 dB (27.5 Msymbol/s)
	modulation frequency response	± 0.25 dB
	shoulder distance	> 45 dB
	back-off	9 dB
Coding	code rate	QPSK: 1/2, 2/3, 3/4, 5/6, 7/8 8PSK: 2/3, 5/6, 8/9 16QAM: 3/4, 7/8
Special functions	Reed-Solomon encoder	can be switched off
Test signals		TS test packet (see "Internal test signals"), PRBS before convolutional encoder

DVB-S2 (R&S®SFC-K8 option)

DVB-S2	in line with EN 302307, broadcast services	
Modulation	modulation	QPSK, 8PSK, 16APSK, 32APSK
	symbol rate	
	QPSK, 8PSK	1 Msymbol/s to 35 Msymbol/s (overrange 45 Msymbol/s)
	16APSK	2 Msymbol/s to 30 Msymbol/s
	32APSK	2 Msymbol/s to 25 Msymbol/s
	pulse filtering	root-raised-cosine roll-off, $\alpha = 0.20$ variable roll-off (0.15, 0.20, 0.25, 0.35)
	MER	38 dB (20 Msymbol/s)
	modulation frequency response	± 0.25 dB
	shoulder distance	45 dB
	back-off	12 dB
Coding	code rate	QPSK: 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 8PSK: 3/5, 2/3, 3/4, 5/6, 8/9, 9/10 16APSK: 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 32APSK: 3/4, 4/5, 5/6, 8/9, 9/10
	FEC frame	normal (64800 bit)/short (16200 bit)
	pilot insertion	can be switched off
	error insertion	after CRC-8, BCH, or LDPC
Special function		
Test signals		TS test packet (see "Internal test signals")

DIRECTV legacy modulation (R&S®SFC-K9 option)

DIRECTV legacy modulation	in line with DIRECTV transmission specifications	
Modulation	modulation	QPSK
	symbol rate	20 Msymbol/s
	overrange	1 Msymbol/s to 30 Msymbol/s
	pulse filtering	root-raised-cosine roll-off, $\alpha = 0.20$ variable roll-off (0.15, 0.20, 0.25, 0.35)
	MER	38 dB (20 Msymbol/s)
	modulation frequency response	< ± 0.25 dB
	shoulder distance	45 dB
	back-off	11.5 dB
Coding	code rate	1/2, 2/3, 6/7
Special functions	customer-specific DIRECTV streams	can be replayed in 188-byte format
	error insertion	after convolutional encoder
Test signals		TS test packet (see "Internal test signals")

Analog modulation systems

AM/FM/RDS (R&S®SFC-K170 option) ⁹

FM	FM operating modes	stereo, mono
	audio signals	
	internal audio signal generator	see "Internal audio signal generator"
	AF frequency range	30 Hz to 15 kHz
	AF frequency response	< 0.2 dB
	attenuation at 19 kHz	> 70 dB
	preemphasis	OFF, 50 µs, 75 µs
residual AM	< 0.1 % (at AF = 1 kHz, deviation ±50 kHz)	
FM stereo	stereo operating modes	L, R, L = R, L = -R, L ≠ R internal generation of RDS signal, simultaneous generation of MPX and RDS signals possible
	MPX frequency deviation	
	deviation	0 Hz to ±100 kHz
	resolution	10 Hz
	stereo crosstalk attenuation	> 50 dB (at AF = 30 Hz to 15 kHz)
	total harmonic distortion ¹⁰	< 0.1 % (at 60 kHz audio frequency deviation, AF = 1 kHz)
	SNR (stereo/RDS signal) ¹⁰	at ±40 kHz audio frequency deviation
	ITU-R weighted (quasi-peak)	> 64 dB
	ITU-R unweighted (RMS)	> 70 dB
	pilot tone	
	frequency	19 kHz ± 1 Hz
	deviation	0 Hz to ±15 kHz
	resolution	10 Hz
	phase	0° to ±180°
	resolution	0.1°
	RDS	
	subcarrier frequency	57 kHz ± 3 Hz
deviation	0 Hz to ±10 kHz	
resolution	10 Hz	
FM mono	mono frequency deviation	
	deviation	0 Hz to ±100 kHz
	resolution	10 Hz
	total harmonic distortion ¹¹	< 0.1 % (at ±67.5 kHz audio frequency deviation, AF = 1 kHz)
AM	audio signals	
	internal audio signal generator	see "Internal audio signal generator"
	AF frequency range	30 Hz to 15 kHz
	AF frequency response	< 0.2 dB
	modulation	
	modulation depth	0 % to 100 %
	resolution	1 %
	AM total harmonic distortion	at AF = 1 kHz
	m = 30 %	< 0.2 %
	m = 80 %	< 0.2 %

⁹ Currently being prepared; preliminary data.

¹⁰ Generator without preemphasis, receiver with deemphasis.

¹¹ Generator and receiver without preemphasis/deemphasis.

B/G standard (R&S® SFC-K190 option) ¹²

B/G standard	in line with country-specific standard		
Vision modulation	modulation	B/G	
	group delay		
	precorrection	CCIR – B/G general half (can be switched off)	
	frequency response	< 20 ns (with/without vestigial sideband filtering)	
	vestigial sideband		
	filtering	B/G (can be switched off)	
	amplitude frequency response	< 0.5 dB (–0.6 MHz to +4.8 MHz) (with/without vestigial sideband filtering)	
	residual carrier	0 % to 30 %, settable in 0.1 % steps	
	signal-to-noise ratio		
	video	> 60 dB, weighted	
	back-off	6 dB	
	Sound modulation	operating mode	mono, stereo, dual tone, NICAM, mono/NICAM
		modulation of sound carrier 1, 2	
modulation mode		FM	
frequency deviation		30 kHz (settable)	
preemphasis		50 µs/75 µs (can be switched off)	
vision/sound intercarrier frequency		5.5 MHz/5.742 MHz (settable)	
vision/sound carrier power ratio		13 dB/20 dB (settable)	
pilot tone		in sound carrier 2 (can be switched off)	
signal-to-noise ratio			
sound		> 60 dB, weighted (CCIR)	
Video signals	internal video signal generator	see R&S® SFC-K23	
Audio signals	internal audio generator	see "Internal audio signal generator" see "Internal NICAM audio signal generator"	
	audio player	see "Audio player"	

D/K standard (R&S® SFC-K191 option) ¹²

D/K standard	in line with country-specific standard		
Vision modulation	modulation	D/K	
	group delay		
	precorrection	OIRT – D/K half (can be switched off)	
	frequency response	< 20 ns (with/without vestigial sideband filtering)	
	vestigial sideband		
	filtering	DK, DK-FM2, DK-NICAM (can be switched off)	
	amplitude frequency response	< 0.5 dB (–1 MHz to +5.8 MHz) (with/without vestigial sideband filtering)	
	residual carrier	0 % to 30 %, settable in 0.1 % steps	
	signal-to-noise ratio		
	video	> 60 dB, weighted	
	Sound modulation	operating mode	mono, stereo, dual tone, NICAM, mono/NICAM
		modulation of sound carrier 1, 2	
		modulation mode	FM
frequency deviation		30 kHz (settable)	
preemphasis		50 µs/75 µs (can be switched off)	
vision/sound intercarrier frequency		6.5 MHz/6.742 MHz (settable)	
vision/sound carrier power ratio		13 dB/20 dB (settable)	
pilot tone		in sound carrier 2 (can be switched off)	
signal-to-noise ratio			
sound		> 60 dB, weighted (CCIR)	
Video signals	internal video signal generator	see R&S® SFC-K23	
Audio signals	internal audio generator	see "Internal audio signal generator" see "Internal NICAM audio signal generator"	
	audio player	see "Audio player"	

¹² Currently being prepared; preliminary data.

I standard (R&S®SFC-K192 option) ¹³

I standard	in line with country-specific standard		
Vision modulation	modulation	I	
	group delay		
	precorrection	UK – I (can be switched off)	
	frequency response	< 20 ns (with/without vestigial sideband filtering)	
	vestigial sideband		
	filtering	I, I1 (can be switched off)	
	amplitude frequency response	< 0.5 dB (–1 MHz to +4.8 MHz) (with/without vestigial sideband filtering)	
	residual carrier	0 % to 30 %, settable in 0.1 % steps	
	signal-to-noise ratio		
	video	> 60 dB, weighted	
	back-off	6 dB	
	Sound modulation	operating mode	mono, NICAM, mono/NICAM
		modulation of sound carrier 1	
modulation mode		FM	
frequency deviation		30 kHz (settable)	
preemphasis		50 µs/75 µs (can be switched off)	
vision/sound intercarrier frequency		6 MHz (settable)	
vision/sound carrier power ratio		13 dB (settable)	
modulation of sound carrier 2			
modulation mode		NICAM	
vision/sound intercarrier frequency		6.552 MHz (settable)	
vision/sound carrier power ratio		20 dB (settable)	
signal-to-noise ratio			
sound		> 60 dB, weighted (CCIR)	
Video signals	internal video signal generator	see R&S®SFC-K23	
Audio signals	internal audio generator	see "Internal audio signal generator"	
	audio player	see "Audio player"	

M/N standard (R&S®SFC-K193 option) ¹³

M/N standard	in line with country-specific standard		
Vision modulation	modulation	M/N	
	group delay		
	precorrection	FCC – M/N (can be switched off)	
	frequency response	< 20 ns (with/without vestigial sideband filtering)	
	vestigial sideband		
	filtering	M, N (can be switched off)	
	amplitude frequency response	< 0.5 dB (–0.6 MHz to +4 MHz) (with/without vestigial sideband filtering)	
	residual carrier	0 % to 30 %, settable in 0.1 % steps	
	signal-to-noise ratio		
	video	> 60 dB, weighted	
	back-off	6 dB	
	Sound modulation	operating mode	BTSC mono, stereo Korea, dual Korea
		modulation of sound carrier 1, 2	
modulation mode		FM	
frequency deviation		25 kHz (settable)	
preemphasis		50 µs/75 µs (can be switched off)	
vision/sound intercarrier frequency		4.5 MHz/4.742 MHz (settable)	
vision/sound carrier power ratio		13 dB/20 dB (settable)	
pilot tone		in sound carrier 2 (can be switched off)	
signal-to-noise ratio			
sound		> 60 dB, weighted (CCIR)	
Video signals		internal video signal generator	see R&S®SFC-K23
Audio signals		internal audio generator	see "Internal audio signal generator"
		audio player	see "Audio player"

¹³ Currently being prepared; preliminary data.

L standard (R&S® SFC-K194 option)¹⁴

L standard	in line with country-specific standard		
Vision modulation	modulation	L	
	group delay		
	precorrection	TDF – L (can be switched off)	
	frequency response	< 20 ns (with/without vestigial sideband filtering)	
	vestigial sideband		
	filtering	L, L NICAM (can be switched off)	
	amplitude frequency response	< 0.5 dB (–1 MHz to +5.8 MHz) (with/without vestigial sideband filtering)	
	residual carrier	0 % to 30 %, settable in 0.1 % steps	
	signal-to-noise ratio		
	video	> 60 dB, weighted	
	back-off	6 dB	
	Sound modulation	operating mode	AM mono, NICAM, AM mono/NICAM
		modulation of sound carrier 1	
modulation mode		mono/NICAM	
vision/sound intercarrier frequency		5.85 MHz (settable)	
vision/sound carrier power ratio		27 dB (settable)	
modulation of sound carrier 2			
modulation mode		AM	
frequency deviation		modulation depth 54 % (settable)	
vision/sound intercarrier frequency		6.5 MHz (settable)	
vision/sound carrier power ratio	10 dB (settable)		
Video signals	internal video signal generator	see R&S®SFC-K23	
Audio signals	internal audio generator	see "Internal audio signal generator" see "Internal NICAM audio signal generator"	
	audio player	see "Audio player"	

ATV multistandard (R&S® SFC-K195 option) Fehler! Textmarke nicht definiert.

B/G standard		see R&S®SFC-K190
D/K standard		see R&S®SFC-K191
I standard		see R&S®SFC-K192
M/N standard		see R&S®SFC-K193
L standard		see R&S®SFC-K194

Internal NICAM encoder

Included in the following options: R&S®SFC-K190, R&S®SFC-K191, R&S®SFC-K192, R&S®SFC-K194 and R&S®SFC-K195.

Audio coding	internal audio generator	see "Internal NICAM audio signal generator"
	audio player	see "Audio player"
	operating mode	mono, stereo, dual tone
	preemphasis	J.17 (can be switched off)
	headroom (400 Hz)	–6 dB to +6 dB, can be set different from standard
Encoder	data	audio coding, NICAM728 data input, PRBS, NICAM audio generator
	pulse filtering	root-raised-cosine roll-off, $\alpha = 0.40$ (B/G, D/K, L standards) $\alpha = 1.00$ (I standard)

¹⁴ Currently being prepared; preliminary data.

Simulation

AWGN generator (R&S®SFC-K40 option)

Maximum 3 dB spectrum (AWGN)	DVB-T/DVB-H	2.2 × channel bandwidth
	DVB-T2	2.2 × channel bandwidth
	T-DMB/DAB	7.9 MHz
	DTMB	3.6 × channel bandwidth
	CMMB	2.4 × channel bandwidth
	MediaFLO™	1.8 × channel bandwidth
	ATSC/8VSB	20.7 MHz
	ATSC-M/H	20.7 MHz
	ISDB-T/ISDB-T _{SB} /ISDB-T _B	15.6 MHz
	DVB-C/ISDB-C	1.9 × symbol rate
	J.83/B	1.9 × symbol rate
	DVB-S/DVB-DSNG	3.8 × symbol rate
	DVB-S2	80.6 MHz
	DIRECTV	80.6 MHz
	Audio BC	5.5 MHz
Analog TV	25.2 MHz	
Noise	density distribution function	Gaussian, statistical, separate for I and Q
	crest factor	18 dB
C/N	setting range	-30 dB to +60 dB
	resolution	0.01 dB
	uncertainty (for system bandwidth = symbol rate and C/N < 20 dB)	< 0.2 dB
System bandwidth (bandwidth for calculating noise power)	range	100 kHz to 80 MHz

Trigger inputs/outputs

1 PPS input	connector	BNC female, rear
	input impedance	high impedance
	input level	LVTTTL

General data

System data

System	operating system	PC platform Windows XP Embedded min. 160 Gbyte internal hard disk
External control	control	external mouse and keyboard via USB
	monitor interface	DVI-D
Remote control	command set	SCPI 1999.5
	Ethernet	10/100BaseT
Connectors	Ethernet	RJ-45, rear
	USB	USB 2.0
	AC supply input	IEC 60320 C14, rear

Operating data

Power supply		
AC input voltage range		100 V to 240 V \pm 10 %
supply frequency		50 Hz to 60 Hz \pm 5 %
input current		1.7 A to 0.8 A
power consumption	R&S [®] SFC-B15 active	typ. 44 W
	R&S [®] SFC-B15 inactive	typ. 37 W
Electromagnetic compatibility	power factor correction	in line with EN 55011 class A, EN 61326 in line with EN 61000-3-2
Immunity against RF fields		up to 10 V/m
Environmental conditions		
operating temperature range		+5 °C to +45 °C ¹⁵ in line with EN 60068-2-1, EN 60068-2-2
permissible temperature range		0 °C to +50 °C
storage temperature range		-20 °C to +60 °C
climatic resistance	cyclic test at +25 °C/+40 °C	85 % rel. humidity
Mechanical resistance		
vibration	sinusoidal	5 Hz to 150 Hz, max. 1.8 g at 55 Hz, 55 Hz to 150 Hz, 0.5 g constant, in line with EN 60068-2-6
	random	10 Hz to 300 Hz, acceleration 1.2 g (RMS), in line with EN 60068-2-64
shock		40 g shock spectrum, in line with EN 60068-2-27, MIL-STD-810E
Electrical safety		in line with IEC 61010-1, EN 61010-1 and UL 61010-1, CSA C22.2 No. 61010-1
Dimensions	W × H × D (without handles)	229 mm × 54.4 mm × 406 mm (9.02 in × 2.14 in × 15.98 in)
Weight		4 kg (8.82 lb)
Recommended calibration interval		3 years
Standard warranty period		1 year

¹⁵ Reduced LCD brightness at higher operating temperatures.

Ordering information

Option identification: R&S®SFC-Bxy = hardware option, R&S®SFC-Kxy = software option.
Delivery of R&S®SFC base unit only with at least one modulation system.

Designation	Type	Order No.
Compact Modulator (including power cable, Quick Start Guide, CD-ROM with operating manuals)	R&S®SFC	2115.3510.02
Options		
Digital modulation systems		
DVB-T/DVB-H Coder	R&S®SFC-K1	2115.5271.02
DVB-C/ISDB-C Coder	R&S®SFC-K2	2115.5294.02
DVB-S/DVB-DSNG Coder	R&S®SFC-K3	2115.5313.02
DVB-S2 Coder	R&S®SFC-K8	2115.5394.02
ATSC/8VSB Coder	R&S®SFC-K4	2115.5336.02
J.83/B Coder	R&S®SFC-K5	2115.5359.02
ISDB-T/ISDB-T _{SB} /ISDB-T _B Coder	R&S®SFC-K6	2115.5371.02
MediaFLO™ Coder	R&S®SFC-K10	2115.5859.02
T-DMB/DAB Coder	R&S®SFC-K11	2115.5436.02
DTMB/DMB-TH Coder	R&S®SFC-K12	2115.5459.02
DIRECTV Legacy Modulation Coder	R&S®SFC-K9	2115.5413.02
CMMB Coder	R&S®SFC-K15	2115.5471.02
DVB-T2 Coder (requires R&S®SFC-B15 option)	R&S®SFC-K16	2115.5494.02
ATSC-M/H Coder	R&S®SFC-K18	2115.5513.02
Analog modulation systems		
AM/FM/RDS Coder	R&S®SFC-K170	2115.5536.02
ATV Standard B/G Coder	R&S®SFC-K190	2115.5559.02
ATV Standard D/K Coder	R&S®SFC-K191	2115.5571.02
ATV Standard I Coder	R&S®SFC-K192	2115.5594.02
ATV Standard M/N Coder	R&S®SFC-K193	2115.5613.02
ATV Standard L Coder	R&S®SFC-K194	2115.5636.02
ATV Multistandard	R&S®SFC-K195	2115.5659.02
Simulation		
AWGN Generator	R&S®SFC-K40	2115.5794.02
Baseband inputs/outputs		
Extended I/Q Input	R&S®SFC-K80	2115.5771.02
Digital baseband		
TRP Player	R&S®SFC-K22	included in R&S®SFC base unit
T-DMB/DAB Streams	R&S®SFU-K221	2113.4348.02
MediaFLO™ Streams	R&S®SFU-K222	2110.2968.02
DAB+ Streams	R&S®SFU-K223	2110.4760.02
Brazilian ISDB-T Transport Streams	R&S®SFU-K224	2110.4777.02
CMMB Transport Streams	R&S®SFU-K225	2112.3649.02
ATSC and ATSC Mobile DTV Streams	R&S®SFU-K226	2110.3812.02
DVB-T2 MI Streams	R&S®SFU-K227	2115.2120.02
EMC Streams	R&S®SFU-K228	2115.2520.02
Customer-Specific Transport Streams	R&S®DV-SCA	on request
Analog baseband		
Video Generator	R&S®SFC-K23	included in R&S®SFC base unit
ATV Video Signals	R&S®ATV Video	2110.4831.02
Extensions		
Coder Extension Board	R&S®SFC-B15	2115.5836.02
Frequency Extension, 30 MHz to 3 GHz	R&S®SFC-K83	2115.5759.02
Electronic Attenuator, 0 dB to 110 dB	R&S®SFC-K84	2115.5736.02
Recommended extras		
Keyboard with USB Interface (US layout)	R&S®PSL-Z2	1157.6870.03
Optical Mouse with USB Interface	R&S®PSL-Z10	1157.7060.02
External USB CD-RW Drive	R&S®PSP-B6	1134.8201.12
19" Rackmount Kit for R&S®SFC and second instrument	R&S®ZZA-KN20	1175.3191.00
19" Rackmount Kit for R&S®SFC and cover	R&S®ZZA-KN26	1175.3256.00
LVDS cable for digital I/Q interface, length 2 m		1130.1302.00

Service options		
One-Year Warranty Extension	R&S®WE1SFC	Please contact your local Rohde & Schwarz sales office.
Two-Year Warranty Extension	R&S® WE2SFC	
Three-Year Warranty Extension	R&S® WE3SFC	
Four-Year Warranty Extension	R&S® WE4SFC	
Four-Year Calibration Coverage	R&S®CC4SFC	
Four-Year Warranty Extension and Calibration Coverage	R&S®CW4SFC	

For product flyer, see PD 5214.5910.32 and www.rohde-schwarz.com

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