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R&S® SFE100 Test Transmitter

Data sheet



ROHDE & SCHWARZ

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Introduction

The R&S®SFE100 is a single-standard test transmitter with realtime coding for broadcast signals. R&S®SFE100 models are available for all common TV standards and a number of sound broadcasting standards.

The R&S®SFE100 is a compact and reliable instrument that can be equipped with a power amplifier unique in this class, making it ideal for use in production test systems. Plus, it can be used as a simple and economical signal generator as well as for special applications as a second RF channel for the R&S®SFU.

Every R&S®SFE100 model can be equipped with the appropriate digital or analog baseband signal source with which test signals from Rohde & Schwarz libraries or customer-specific test signals can be replayed. The R&S®SFE100 thus combines two functions in one box, thereby significantly simplifying complex production test systems.

The R&S®SFE100 model with an arbitrary waveform generator enables you to generate modulation signals of any type and to replay customer-specific waveform files, irrespective of the available realtime coder models.

Occupying only one height unit, the R&S®SFE100 is extremely compact. Nevertheless, all functions can be selected locally on the instrument. Alternatively, the R&S®SFE100 can be remote-operated from a PC. In this case, operation is performed using the same convenient graphical user interface as for the R&S®SFE and R&S®SFU.

Overview

- Single-standard signal generator with realtime coding
- Models for all common digital and analog broadcasting standards
- Model with arbitrary waveform generator
- Wide frequency range with very good signal quality
- Integrated power amplifier for high output levels
- Integrated transport stream player or audio/video generator
- Convenient control elements and remote operation



Main features

Single-standard signal generator with realtime coding

- Coder for realtime signal generation
- Adjustable modulation parameters

Models for all common digital and analog broadcasting standards

- Terrestrial digital TV: DVB-T, DTMB, ATSC/8VSB, ISDB-T, ISDTV
- Cable TV: DVB-C, J.83/B, ISDB-C
- Satellite TV: DVB-S/DSNG, DVB-S2, DirecTV
- Mobile TV: DVB-H, T-DMB, ISDB-T 1-segment, MediaFLO™, ATSC/AVSB
- Analog TV: B/G, D/K, I, M/N, L
- Sound broadcasting: DAB, ISDB-Tsb, DRM (as ARB waveform), AM/FM/RDS

Wide frequency range with very good signal quality in this class

- Frequency range 100 kHz to 2.5 GHz
- SSB phase noise at 300 MHz typ. <-115 dBc at 20 kHz carrier offset
- MER typ. >40 dB

Integrated power amplifier for high output levels

- Maximum output power +27 dBm (bands I to V)
- -37 dB to 0 dB attenuation, adjustable
- RF monitor output with 50 dB attenuation
- Signal level -100 dBm to +15 dBm CW without power amplifier

Integrated transport stream player or audio/video generator

- TS generator (R&S®SFE100-K20)
- Transport stream libraries from Rohde & Schwarz
- Compatible with the advanced stream combiner from Rohde & Schwarz
- TRP player (R&S®SFE100-K22)
- ATV video generator (R&S®SFE100-K23)
- ATV video library from Rohde & Schwarz

Model with arbitrary waveform generator

- 128 Msample memory space
- Sample rate up to 100 Msample/s
- Waveform libraries from Rohde & Schwarz
- Compatible with R&S®WinIQSIM™

Convenient control elements and remote operation

- Keypad and display on front panel
- Remote control via LAN
- Remote-control commands compatible with those of the R&S®SFU and R&S®SFE
- Remote operation with Remote Desktop or VNC
- Easy software updates via USB 2.0 or LAN



Specifications

Specifications apply under the following conditions:

20 minutes warm-up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to, and all internal adjustments performed. Data designated "overrange" or "underrange" and data without tolerance limits is not binding.

RF characteristics

Frequency

Range		100 kHz to 2.5 GHz
Uncertainty		depending on reference frequency
Resolution of setting		1 Hz

Reference frequency

Uncertainty		$<1 \times 10^{-6}$
Aging	after 14 days of uninterrupted operation	$<2.7 \times 10^{-9}/\text{day}$
Temperature effect	in operating temperature range 0 °C to +50 °C	$<6 \times 10^{-8}$
Input for external reference signal	frequency (sinewave)	10 MHz
	maximum deviation	3×10^{-6}
	input level	≥ -5 dBm to ≤ 19 dBm
	limits recommended	0 dBm to 19 dBm
	input impedance	50 Ω /high-impedance, settable
	connector	BNC female, rear
Output for internal reference signal	frequency (sinewave)	10 MHz
	level	typ. +6 dBm, ± 3 dB
	load impedance	$>200 \Omega$
	connector	9-pin D-Sub female on rear panel, BNC female on rear panel (on request), alternatively trigger OUT

Level

RF output	connector	N female, front
	output impedance	50 Ω
Maximum level	$f \leq 1$ GHz	+15 dBm (PEP) ¹
	$1 \text{ GHz} < f \leq 2 \text{ GHz}$	+12 dBm (PEP)
	$2 \text{ GHz} < f$	+10 dBm (PEP)
Setting range	level	-100 dBm to +20 dBm
	resolution	0.1 dB
Dynamic range of attenuator		100 dB
Level uncertainty	"auto" attenuator mode, temperature range +18 °C to +33 °C	
	level > -90 dBm	$< \pm 1.0$ dB
Output matching	at maximum level	< 1.8 (typ. < 1.5)
VSWR in 50 Ω system	at maximum level -15 dB	< 1.5 (typ. < 1.3)
Uninterruptible level setting	"fixed" attenuator mode, setting range	18 dB
Back-feed (from $\geq 50 \Omega$ source)	maximum permissible RF power in output frequency range of RF path	+30 dBm, permanent
	permissible DC voltage	± 20 V

¹ PEP = peak envelope power (CW); for other modulation modes, depending on back-off.

Spectral purity

Harmonics	level ≤ 12 dBm, CW	< -30 dBc
Nonharmonics	level ≥ -20 dBm, CW	
	carrier frequency, offset > 10 kHz from carrier	reference: signal power
	100 kHz to 87 MHz	< -50 dBc
	> 87 MHz to 1 GHz	< -60 dBc
Broadband noise	> 1 GHz to 2.5 GHz	< -50 dBc
	carrier offset > 10 MHz, measurement bandwidth 1 Hz	
	f > 87 MHz	< -135 dBc
SSB phase noise	f ≤ 87 MHz	< -115 dBc
	carrier offset 20 kHz, measurement bandwidth 1 Hz	
	f ≤ 87 MHz	< -90 dBc
	87 MHz $< f < 375$ MHz	< -110 dBc
	375 MHz $\leq f < 750$ MHz	< -100 dBc
	750 MHz $\leq f < 1$ GHz	< -100 dBc
	f > 1 GHz	< -95 dBc
	carrier offset 500 kHz, measurement bandwidth 1 Hz	
	f ≤ 87 MHz	< -100 dBc
	87 MHz $< f < 375$ MHz	< -130 dBc
	375 MHz $\leq f < 750$ MHz	< -130 dBc
	750 MHz $\leq f < 1$ GHz	< -120 dBc
	f > 1 GHz	< -115 dBc

RF characteristics with the R&S® SFE100-B90 high-power option

Frequency

Range	47 MHz to 862 MHz
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Level

RF output	connector	N female, rear
	output impedance	50 Ω
Maximum level		$\geq +27$ dBm (rms)
Setting range	level	-10 dBm to $+30$ dBm (rms)
	resolution	0.1 dB
Level uncertainty	"auto" attenuator mode, temperature range $+18$ °C to $+33$ °C	$\leq \pm 1.5$ dB
VSWR tolerance	in output frequency range	max. 10:1
	maximum permissible DC voltage	0 V
Linearity	shoulder distance in digital modulation systems level $+27$ dBm	typ. 40 dB (DVB-T)

Spectral purity

Harmonics	level ≤ 12 dBm, CW	< -30 dBc
	level ≤ 27 dBm	< -20 dBc

RF monitor output ²

RF monitor output	connector	BNC female, front
	output impedance	50 Ω
Level	level ratio to RF output on rear panel	-50 dB ± 5 dB
Back-feed (from ≥ 50 Ω source)	maximum permissible RF power in output frequency range of RF path	0 dBm, permanent
	permissible DC voltage	0 V

² The amplifier input signal can be checked at the monitor output.

I/Q modulation

I/Q modulator

Modulation frequency range		DC to 35 MHz
Modulation frequency response ³	up to 35 MHz up to 5 MHz	<±2 dB <±0.4 dB
Carrier leakage	without input signal, referenced to full-scale input ⁴	<-55 dBc typ. <-65 dBc after local adjustment
Sideband suppression	modulation frequency ≤100 kHz, referenced to signal power	<-50 dBc 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	16 bit
	sampling rate	400 MHz (internal interpolation × 4)
Aliasing filter	with amplitudes, group delay and Si correction	
	bandwidth 0.1 dB	35 MHz

Extended I/Q (R&S[®]SFE100-K80 option)

The R&S[®]SFE100-K80 option allows external digital signals to be fed into the baseband signal processing of the R&S[®]SFE100.

Digital I/Q IN		
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

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
DirectTV TS packet	header + 127 byte payload	payload: PRBS
DirectTV 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, 2 × rear
	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 packets under "Internal test signals"
Display	measured values	packet length, input data rate, useful data rate

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.

TS generator (R&S®SFE100-K20 option)

Transport stream	files	Rohde & Schwarz data streams
	file format	generated transport streams (GTS) format
	length of transport stream packets	ATSC: 188 DVB: 188
	sequence length	generation of endless and seamless transport streams with repetition of video, audio, and data contents
	data rate	100 kbit/s to 214 Mbit/s (including null packets)
	net data rate	max. 90 Mbit/s
Signal set	data volume	max. 80 Mbyte payload
		moving picture sequences and test patterns with test tones, for 625 and 525 lines; DVB/ATSC systems, additional signals via options

TRP player (R&S®SFE100-K22 option)

Replay	file format	TRP, T10, BIN, DAB/DAB_C (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
	data rate	corresponding to recording data rate and setting (100 kbit/s to max. 90 Mbit/s) from hard disk
	data volume	corresponding to recorded data volume, limited only by hard disk size

Analog baseband

Analog video/audio input

Video input	connector	BNC-female, rear
	CCVS input level	$V_{pp} = 1 \text{ V}$
	input impedance	75 Ω
	level clamping	back porch clamping
Audio inputs 1/2	connector	9-pin D-Sub female, rear
	input level	100 mV to 1.55 V (V_{rms})
	input impedance	600 Ω balanced
BTSC	connector	D-Sub, 9-pin female, rear
	input level	0.25 V to 2 V (V_{rms})
	input impedance	75 Ω

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 video signal generator (R&S®SFE100-K23 option)

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	
	lines 8, 10	2T pulse
	line 16	data line 1
	lines 17, 18	CCIR17
	line 19	CCIR18/2
	lines 20, 21	teletext insertion test signal
	second field	
	line 323	teletext insertion test signal
	line 329	data line 2
	lines 330, 331	CCIR330/5
	line 332	CCIR331/1
	line 333	sinx/x
	lines 334, 335	teletext insertion test signal
PAL M color bar 75 %	first field	
	line 17	NTC7 composite
	line 18	FCC composite
	second field	
	line 17	NTC7 combined
line 18	sinx/x	
PAL N color bar 75 %	first field	
	lines 8, 10	2T pulse
	line 16	data line 1
	line 17	CCIR17
	line 18	CCIR18/1
	line 19	CCIR18/2
	lines 20, 21	teletext insertion test signal
	second field	
	line 323	teletext insertion test signal
	lines 330, 331	CCIR330/5
	line 332	CCIR331/1
	line 333	sinx/x
	lines 334, 335	teletext insertion test signal
NTSC color bar 75 %	first field	
	line 17	NTC7 composite
	line 18	FCC composite
	second field	
	line 17	NTC7 combined
line 18	sinx/x	
SECAM color bar 75 %	first field	
	lines 7 to 14	discriminating signal
	line 15	teletext insertion test signal
	line 17	CCIR17
	line 18	CCIR18, 6 multiburst packets
	second field	
	lines 320 to 328	discriminating signal
	line 330	CCIR330
lines 331,332	CCIR331	
line 333	CCIR331/1	
PAL FuBK	first field	
	lines 8, 10	2T pulse
	line 16	data line 1
	lines 17, 18	CCIR17
	line 19	CCIR18/2
	lines 20, 21	teletext insertion test signal
	second field	
	line 323	teletext insertion test signal
	line 329	data line 2
	lines 330, 331	CCIR330/5
	line 332	CCIR331/1
	line 333	sinx/x
	lines 334, 335	teletext insertion test signal
Other video signals	see ATV video option	

Digital modulation systems

One digital/analog modulation method or the ARB option can be activated.

DVB-T/H (R&S® SFE100-K1 option)

DVB-T/H	in line with DIN EN 300744/DIN EN 302304	
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/H
Special functions	Reed-Solomon encoder	can be switched off
Test signals		TS test packet (see "Internal test signals") PRBS after convolutional encoder

DVB-C (R&S® SFE100-K2 option)⁶

DVB-C	in line with DIN EN 300429	
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 = 0.15, 0.13
	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

DVB-S/DVB-DSNG (R&S® SFE100-K3 option)⁶

DVB-S/DVB-DSNG	in line with DIN EN 300421/DIN EN 301210	
Modulation	modulation	QPSK, 8PSK, 16QAM
	symbol rate	1 Msymbol/s to 45 Msymbol/s settable
	pulse filtering	root raised cosine, roll-off, alpha = 0.35 variable roll-off (0.25, 0.35)
	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

⁵ With internal test signals.

⁶ Currently being prepared. Data preliminary.

DVB-S2 (R&S® SFE100-K8 option) ⁷

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 40 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 bits)/short (16200 bits)
Special functions	pilot insertion	can be switched off
	error insertion	after CRC-8, BCH, or LDPC
Test signals	TS test packet (see "Internal test signals")	

T-DMB/DAB (R&S® SFE100-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 ⁸

ATSC/8VSB (R&S® SFE100-K4 option) ⁷

ATSC/8VSB	in line with ATSC Doc. A/53 (8VSB)	
Modulation	modulation	8VSB
	bandwidth	6 MHz
	symbol rate	10.762 Msymbol/s
	range	settable ±5 %
	pilot	1.25 (can be switched off)
	range	settable (from 0 to 5 in steps of 0.001)
	pulse filtering	root raised cosine = 0.115 roll-off
	MER	>40 dB ⁹
	modulation frequency response	<±0.25 dB
	shoulder distance	>45 dB
	back-off	9 dB
	Coding	input data rate
Test signals	TS test packet (see "Internal test signals")	

⁷ Currently being prepared. Data preliminary.

⁸ Can be inserted into an existing, user-selectable subchannel of an incoming, valid ETI data stream.

⁹ With internal test signals.

J.83/B (R&S® SFE100-K5 option) ¹⁰

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	can be switched off, level 1 and level 2
Test signals	TS test packet (see "Internal test signals")	

DirecTV legacy modulation (R&S® SFE100-K9 option) ¹⁰

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, requires R&S® SFE100-K22 option after convolutional encoder
	error insertion	
Test signals	TS test packet (see "Internal test signals")	

DTMB (R&S® SFE100-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
	constellation	4QAM(QPSK), 4QAM-NR, 16QAM, 32QAM, 64QAM
Coding	code rate	0.4, 0.6, 0.8
	guard interval	420, 595, 945 symbols
	time interleaver	0, 240, 720 symbols
	FFT mode	4K COFDM/single carrier
	network mode	MFN
Single-frequency network	network mode	MFN
Test signals	TS test packet (see "Internal test signals")	

¹⁰ Currently being prepared. Data preliminary.

ISDB-T (R&S® SFE100-K6 option)

ISDB-T	in line with ARIB STD-B31 version 1.5 in line with ARIB STD-B29 ISDB-T _{SB}	
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
Coding	back-off	13 dB
	FFT mode	2K, 4K, and 8K
	number of layers	1 to 3 (1 or 2 in the case of 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 of ISDB-T _{SB})
Test signals		TS test packet (see "Internal test signals")

MediaFLO™ (R&S SFE100-K10 option) ¹¹

MediaFLO™	in line with QUALCOMM 80-T0455-1 Rev. E	
Modulation	modulation	COFDM
	bandwidth	5 MHz, 6 MHz
	modulation frequency response	<0.2 dB
	shoulder distance	40 dB
	back-off	15.5 dB
Coding	FFT mode	4K COFDM

ARB/waveforms

Arbitrary waveform generator (R&S® SFE100-K35 option) (see ordering information)

Waveform memory	length	512 sample to 128 Msample in one-sample steps
	resolution	2 × 16 bit
	loading time for 10 Msample	3 s
	memory location for data	hard disk
Clock generation	clock rate	400 Hz to 100 MHz
	uncertainty	0.001 Hz
	operating mode	internal
	frequency accuracy (internal)	accuracy of reference frequency
Interpolation	bandwidth	
	with clock rate = 100 MHz (no interpolation), bandwidth 0.1 dB	40 MHz
	with clock rate <100 MHz, reduction to -0.1 dB	0.31 × clock rate
	sampling rate	automatically interpolated to the internal 100 MHz data rate
Triggering	modes	auto
		retrigger
		armed auto
		armed retrigger
	source	internal
		external
	delay	0 to 2 ³² -1 sample, settable
inhibit	0 to 2 ³² -1 sample, settable	
Marker	position	restart waveform
	delay	0 to waveform length, settable in samples
Special function		can be used together with R&S® WinIQSIM™ ¹²

¹¹ Currently being prepared. Data preliminary.

¹² With software version 4.24 or later, files generated for the R&S® SFU can also be used for the R&S® SFE100.

R&S®SFE100-K35 supports the same waveform libraries as the ARB generator of the R&S®SFU.

T-DMB/DAB waveforms (R&S®SFU-K351 option)

For specifications, see R&S®SFU.

DVB-H waveforms (R&S®SFU-K352 option)

For specifications, see R&S®SFU.

DRM waveforms (R&S®SFU-K353 option)

For specifications, see R&S®SFU.

DTV waveforms (R&S®SFU-K354 option)

For specifications, see R&S®SFU.

MediaFlo™ waveforms (R&S®SFU-K355 option)

For specifications, see R&S®SFU.

Cable interferers (R&S®SFU-K356 option)

For specifications, see R&S®SFU.

Analog modulation systems

One digital/analog modulation method can be activated.

Standard B/G (R&S®SFE100-K190 option)

Standard B/G	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)
	signal-to-noise ratio	
	video	>60 dB weighted
	back-off	6 dB
Sound modulation	operating mode	mono, stereo, dual tone, mono/NICAM
	modulation 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/5.74 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®SFE100-K23
	external video input	see video input
Audio signals	internal audio generator	
	external audio input	see audio input

Standard D/K (R&S® SFE100-K191 option)

Standard D/K	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)
	signal-to-noise ratio	
	video	>60 dB weighted
	back-off	6 dB
Sound modulation	operating mode	mono, stereo, dual tone, NICAM, mono/NICAM
	modulation 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/6.74 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® SFE100-K23
	external video input	see video input
Audio signals	internal audio generator	
	external audio input	see audio input

Standard I (Option R&S® SFE100-K192)

Standard I	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)
	signal-to-noise ratio	
	video	>60 dB weighted
	back-off	6 dB
Sound modulation	operating mode	mono, mono/NICAM, NICAM
	modulation 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 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
external video input		see video input
Audio signals	internal audio generator	
	external audio input	see audio input

Standard M/N (R&S® SFE100-K193 option)

Standard M/N	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, M1, N (can be switched off)
	amplitude frequency response	<0.5 dB (–0.6 MHz to +4 MHz) (with/without vestigial sideband filtering)
	signal-to-noise ratio	
	video	>60 dB weighted
	back-off	6 dB
Sound modulation	operating mode	BTSC mono
	modulation sound carrier 1, 2	
	modulation mode	BTSC
	frequency deviation	25 kHz (settable)
	preemphasis	50 µs/75 µs (can be switched off)
	vision/sound intercarrier frequency	4.5 MHz (settable)
	vision/sound carrier power ratio	7 dB (settable)
	signal-to-noise ratio	
	sound	>60 dB weighted (CCIR)
Video signals	internal video signal generator	see R&S® SFE100-K23
	external video input	see video input
Audio signals	internal audio generator	
	external audio input	see audio input

Standard L (R&S® SFE100-K194 option)

Standard L	in line with country-specific standard		
Sound 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)	
	back-off	6 dB	
	Sound modulation	operating mode	mono, mono/NICAM, NICAM
		modulation sound carrier 1	
modulation mode		NICAM	
vision/sound intercarrier frequency		5.85 MHz (settable)	
vision/sound carrier power ratio		27 dB (settable)	
modulation 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® SFE100-K23	
	external video input	see video input	
Audio signals	internal audio generator		
	external audio input	see audio input	

Internal NICAM encoder

Included in the following options: R&S®SFU-K190, R&S®SFU-K191, R&S®SFU-K193, and R&S®SFU-K194.

Audio coding	input	see analog audio inputs 1/2
	operating mode	mono/data, stereo, dual tone
	preemphasis	J.17, can be switched off
	headroom (400 Hz)	-6 dB to +6 dB, can be set different from the standard
Encoder	data	audio coding, NICAM728 data input, PRBS
	pulse filtering	root raised cosine roll-off alpha = 0.40 (B/G, D/K, L standards) alpha = 1.00 (I standard)
NICAM728 data input	connector	9-pin D-Sub female, rear
	input level	1 V to 10 V (V_{pp})
	input impedance	50 Ω

Trigger inputs/outputs

Triggers and connectors for future use

Trigger OUT	connector	9-pin D-Sub female, rear BNC female rear (on request) alternatively reference OUT
	load impedance	>200 Ω
	output level	LVTTTL
1PPS input/trigger IN	connector	BNC female, rear
	input impedance	high impedance
	input level	LVTTTL

General data

System data

System	operating system	PC platform Windows XP Embedded 40 Gbyte internal hard disk
Local control	display	LCD 200 × 64
	control	hardkeys
Remote control	command set	SCPI 1999.5
	Ethernet	10/100BaseT
	USB	2.0
Connectors	Ethernet	RJ-45, rear
	USB	USB, front and rear
	AC supply input	IEC 60320 C14, rear

Operating data

Power supply	input voltage range AC supply frequency	100 V to 240 V ±10 % 50 Hz to 60 Hz ±5 % 1.8 to 0.8 A
Electromagnetic compatibility	power factor correction	in line with EN 55011 class B, 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 ¹³ in line with DIN EN 60068-2-1, DIN EN 60068-2-2
	storage temperature range	-20 °C to +60 °C
	climatic resistance, cyclic test at +25 °C/+40 °C	85 % rel. humidity
Mechanical resistance	vibration, sinusoidal °C	5 Hz to 150 Hz, max. 2 g at 55 Hz, 55 Hz to 150 Hz, 0.5 g constant, in line with DIN EN 60068-2-6
	vibration, random	10 Hz to 300 Hz, acceleration 1.2 g (rms), in line with DIN EN 60068-2-64
	shock	40 g shock spectrum, in line with DIN 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	427 mm × 44 mm × 450 mm (1 HU) (16.81 in × 1.73 in × 17.72 in)
Weight	fully equipped	6 kg (13.28 lb)
Recommended calibration interval		3 years
Standard warranty period		1 year

¹³ Reduced LCD brightness at higher operating temperatures.

Ordering information

Option identification: R&S®SFE100-Bxy = hardware option, R&S®SFE100-Kxy = software option.
 Delivery of R&S®SFE100 base unit only with at least one built-in coder.

Order designation	Type	Order No.
Test Transmitter For digital standards or ARB generator, including power cable, Quick Start Guide, CD-ROM (includes operating manuals)	R&S®SFE100	2112.4100.02
Test Transmitter For analog standards, including power cable, Quick Start Guide, CD-ROM (includes operating manuals)	R&S®SFE100	2112.4100.03

Options		
Digital modulation systems		
Coder DVB-T/H	R&S®SFE100-K1	2113.4003.02
Coder DVB-C ¹⁴	R&S®SFE100-K2	2113.4026.02
Coder DVB-S/DVB-DSNG ¹⁴	R&S®SFE100-K3	2113.4049.02
Coder DVB-S2 ¹⁴	R&S®SFE100-K8	2113.4126.02
Coder ATSC/8VSB ¹⁴	R&S®SFE100-K4	2113.4061.02
Coder J.83/B ¹⁴	R&S®SFE100-K5	2113.4084.02
Coder ISDB-T	R&S®SFE100-K6	2113.4103.02
Coder MediaFLO™ ¹⁴	R&S®SFE100-K10	2113.4161.02
Coder T-DMB/DAB	R&S®SFE100-K11	2113.4184.02
Coder DTMB	R&S®SFE100-K12	2113.4203.02
Coder DirecTV Legacy Modulation ¹⁴	R&S®SFE100-K9	2113.4149.02
Analog modulation systems		
Coder ATV Standard B/G	R&S®SFE100-K190	2113.4649.02
Coder ATV Standard D/K	R&S®SFE100-K191	2113.4661.02
Coder ATV Standard I	R&S®SFE100-K192	2113.4684.02
Coder ATV Standard M/N	R&S®SFE100-K193	2113.4703.02
Coder ATV Standard L	R&S®SFE100-K194	2113.4726.02
ARB/waveforms		
ARB Waveform Generator requires an installed R&S®SFE100-B3 option	R&S®SFE100-K35	2113.4926.02
Memory Extension	R&S®SFE100-B3	2112.4400.02
T-DMB/DAB Waveforms can be used with the R&S®SFE100-K35 option	R&S®SFU-K351	2110.4277.04
DVB-H Waveforms can be used with the R&S®SFE100-K35 option	R&S®SFU-K352	2110.4425.02
DRM Waveforms can be used with the R&S®SFE100-K35 option	R&S®SFU-K353	2110.4554.02
DTV Interferers can be used with the R&S®SFE100-K35 option	R&S®SFU-K354	2110.4690.02
MediaFLO™ Waveforms can be used with the R&S®SFE100-K35 option	R&S®SFU-K355	2110.2974.02
Cable Interferers can be used with the R&S®SFE100-K35 option	R&S®SFU-K356	2110.3212.02

¹⁴ Currently being prepared.

Baseband inputs/outputs		
Digital I/Q Input	R&S®SFE100-K80	2113.5245.02
Digital baseband		
TS Generator including SDTV Streams	R&S®SFE100-K20	2113.4861.02
DVB-H Stream Library requires the R&S®SFE100-K20 option	R&S®DV-DVBH	2085.8704.02
Test Card M-Streams requires the R&S®SFE100-K20 option	R&S®DV-TCM	2085.7708.02
HDTV Sequences requires the R&S®SFE100-K20 option	R&S®DV-HDTV	2085.7650.02
H.264 Stream Library requires the R&S®SFE100-K20 option	R&S®DV-H264	2085.9052.02
ISDB-T Stream Library requires the R&S®SFE100-K20 option	R&S®DV-ISDBT	2085.9146.02
TRP Player requires an installed R&S®SFE100-B6 option (second hard disk)	R&S®SFE100-K22	2113.5268.02
Second Hard Disk	R&S®SFE100-B6	2112.4539.02
T-DMB/DAB Streams requires the R&S®SFE100-K22 option	R&S®SFU-K221	2113.4348.02
Analog baseband		
Video Generator	R&S®SFE100-K23	2113.4884.02
ATV Video Signals	R&S®ATV Video	2110.4831.02
Other extras		
High Power	R&S®SFE100-B90	2112.4900.02
Recommended extras		
Operating manual (English), printed		2112.4122.12
Documentation of R&S®SFE Calibration Values	R&S®SFE-DCV	2082.0490.32
19" Rack Adapter	R&S®ZZA-111	1096.3254.00
Adapter for Telescopic Sliders	R&S®ZZA-T45	1109.3774.00
External USB CD-RW Drive	R&S®PSP-B6	1134.8201.12
Service options (can only be ordered in connection with the purchase of an instrument)		
One-Year Repair Service following the warranty period	R&S®RO2SFE100	on request
Two-Year Repair Service following the warranty period	R&S®RO3SFE100	on request
Four-Year Repair Service following the warranty period	R&S®RO5SFE100	on request
Two-Year Calibration Service	R&S®CO2SFE100	on request
Three-Year Calibration Service	R&S®CO3SFE100	on request
Five-Year Calibration Service	R&S®CO5SFE100	on request



For product brochure, see PD 5213.9234.12
and www.rohde-schwarz.com
(search term: SFE100)



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