Specifications

Version 03.00

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Broadcast Test System R&S®SFU

Specifications

ROHDE&SCHWARZ

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Introduction

The Broadcast Test System R&S SFU has been designed as a platform for different applications and for future options. It combines several instruments in one cabinet of only four height units to offer unrivaled RF and baseband characteristics.

Due to its modular design, the R&S SFU can be optimally adapted to the requirements of different applications. It is an ideal research and development tool for making improvements to introduced standards and for generating new standard signals. Applications that previously required many different instruments are now fully covered by the R&S SFU. The modern, intuitive concept of the R&S SFU ensures fast and easy operation.

Application overview

- Broadcast test transmitter with all important standards in one box
- Wide level range for transmitter and chip test applications
- Wide frequency range for limit tests
- RF generator and IF generator functionality
- Frequency steps of 0.1 Hz and uninterrupted level change for margin tests (PLL, AGC)
- Digital noise source for highly precise C/N, also for channel simulation
- Dynamic fading (channel) simulation for testing mobile and multipath reception, diversity simulations
- Internal transport stream generator and special test signals
- Internal transport stream recorder and player for recording and replaying data streams
- Internal arbitrary waveform generator together with R&S WinIQSIM™ software
- User-definable signal impairments and signal modification for research and development
- Modifiable standard parameters for research and development
- Wear-free electronic attenuator for production
- BER measurement on PRBS as well as on MPEG-2 transport streams

Key features

General

- DTV multistandard platform
- Output frequency from 100 kHz to 3 GHz
- Support for internal interferer generation
- Fully digital baseband signal processing
- Upgradeability to multifunctional broadcast test system
- Easy installation of most options at customer site

Intuitive, fast and easy operation

- Color display with 1024 × 768 pixels (XVGA format)
- Intuitive user interface with Windows XP Embedded
- Context-sensitive help system
- User-definable favorites for fast access

Outstanding signal quality

- I/Q modulator with 180 MHz RF bandwidth
- Very low SSB phase noise of typ. –135 dBc at 1 GHz (20 kHz carrier offset, 1 Hz measurement bandwidth)
- High optional output power of up to +19 dBm (PEP), overrange +26 dBm
- High-stability reference oscillator as standard

Unrivaled flexibility for research and development

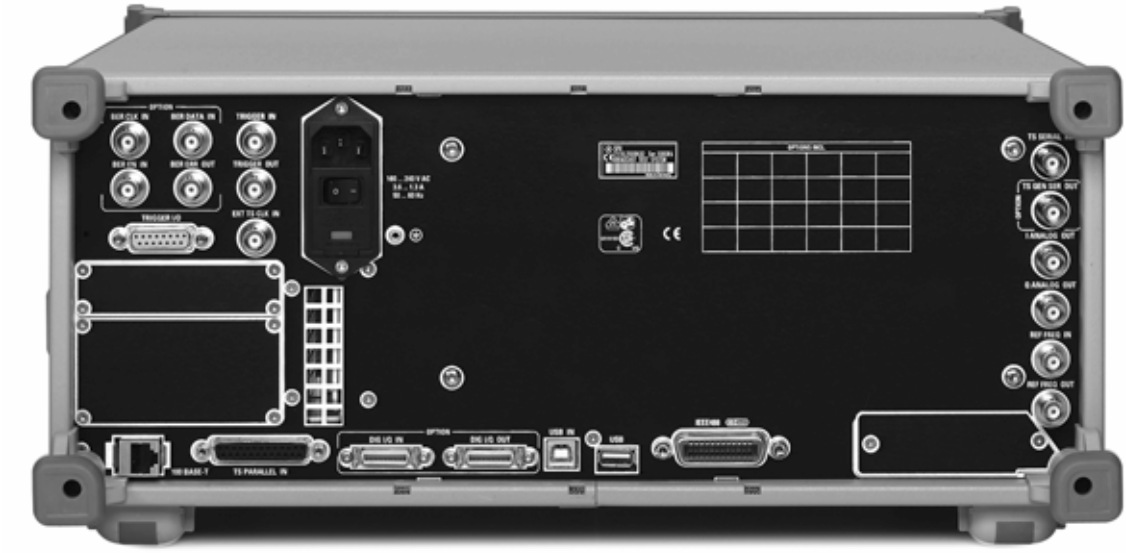
- Multistandard platform that supports expansions
- Transmission simulations
- TS baseband generator and recorder with universal coder for realtime signal generation
- Arbitrary waveform generator with 64 Msample, supported by R&S WinIQSIM™ software
- Internal hard disk as standard for storing waveforms and modulation data

Ideal for production

- Wear-free electronic attenuator of up to 3 GHz over the full level range
- Minimum space requirements: TS generator and test transmitter are accommodated in one instrument of only four height units

Easy remote access

- Remote control via GPIB and LAN
- User-friendly remote access by VNC or Remote Desktop
- USB connectors for keyboard, mouse and memory stick



Specifications

Specifications apply under the following conditions:
30 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	 underrange	300 kHz to 3 GHz 100 kHz to <300 kHz
Accuracy		depends on reference frequency
Resolution of setting		0.1 Hz
Resolution of synthesis	standard, fundamental frequency range 750 MHz to 1500 MHz	5 µHz

Frequency sweep

Digital sweep in discrete steps		
	operating modes sweep range step width (lin) step width (log)	automatic, single shot, manual or external trigger, linear or logarithmic full range full range 0.01% to 100%

Reference frequency

Accuracy		$<1 \cdot 10^{-7}$
Aging	after 30 days of uninterrupted operation	$<1 \cdot 10^{-9}$/day
Temperature effect	in operating temperature range 0 °C to +50 °C, standard	 $<6 \cdot 10^{-8}$
Warm-up time	to nominal thermostat temperature	≤10 min
Input for external reference signal	frequency (approx. sinewave) maximum deviation input level limits recommended input impedance connector	5 MHz, 10 MHz or 13 MHz $3 \cdot 10^{-6}$ ≥–6 dBm to ≤19 dBm 0 dBm to 19 dBm 50 Ω BNC female, rear
Output for internal reference signal	frequency (approx. sinewave) level source impedance connector	10 MHz or external input frequency typ. 5 dBm, ±3 dB 50 Ω BNC female, rear

Level

RF output	connector output impedance	N female, front 50 Ω
Maximum level	without option with option R&S SFU-B90 (high power and overvoltage protection)	≥+13 dBm (PEP)[1] ≥+19 dBm (PEP)
Setting range	without option with option R&S SFU-B90 (high power and overvoltage protection) resolution	–120 dBm to +20 dBm –120 dBm to +30 dBm 0.1 dB
Level accuracy	attenuator mode "auto", temperature range +18 °C to +33 °C f ≤ 3 GHz / level ≥–100 dBm	 <0.5 dB
Additional uncertainty with ALC OFF, S&H (sample & hold)	(This function is needed only for some special applications.)	<0.2 dB
Output impedance VSWR in 50 Ω system	ALC state ON, standard f ≤ 3 GHz ALC state ON, with option R&S SFU-B90 attenuator mode "normal" attenuator mode "high power"	 <1.6, typ. <1.4 <1.8, typ. <1.6 <1.9, typ. <1.7

[1] PEP = peak envelope power (CW), for other modulation types depending on crest factor.

Uninterrupted level setting	with attenuator mode fixed, ALC state ON setting range	 >20 dB
Back-feed (from ≥50 Ω source)	maximum permissible RF power in output frequency range of RF path maximum permissible DC voltage with option R&S SFU-B90 (high power and overvoltage protection) maximum permissible RF power in output frequency range of RF path maximum permissible DC voltage	50 W for max. 5 ms, 0.5 W continuous 20 V 50 W 35 V

Spectral purity

Harmonics	levels ≤ 8 dBm, CW levels ≤ 12 dBm with option R&S SFU-B90 attenuator mode "high power", CW	<–30 dBc <–30 dBc
Nonharmonics	CW, vector modulation (full-scale input), >10 kHz offset from carrier and outside the modulation spectrum 0.3 MHz ≤ f ≤ 200 MHz 200 MHz < f ≤ 1.5 GHz 1.5 GHz < f ≤ 3.0 GHz >850 kHz offset from carrier and outside the modulation spectrum 0.3 MHz ≤ f ≤ 200 MHz 200 MHz < f ≤ 1.5 GHz 1.5 GHz < f ≤ 3.0 GHz	 <–77 dBc <–80 dBc <–74 dBc <–77 dBc <–86 dBc <–80 dBc
Subharmonics	f > 1.5 GHz to 3.0 GHz	<–74 dBc
Wideband noise	carrier offset > 5 MHz, measurement bandwidth 1 Hz CW 20 MHz ≤ f ≤ 200 MHz 200 MHz < f ≤ 1.5 GHz 1.5 GHz < f ≤ 3 GHz vector modulation with full-scale input I/Q input gain +3 dB 20 MHz ≤ f ≤ 200 MHz 200 MHz < f ≤ 1.5 GHz 1.5 GHz < f ≤ 3 GHz	 <–146 dBc <–150 dBc <–150 dBc <–143 dBc <–146 dBc <–146 dBc
SSB phase noise	carrier offset 20 kHz, measurement bandwidth 1 Hz 20 MHz ≤ f ≤ 200 MHz f = 1 GHz f = 2 GHz f = 3 GHz	 <–128 dBc <–131 dBc <–125 dBc <–121 dBc
Residual FM	rms value at f = 1 GHz 300 Hz to 3 kHz 20 Hz to 23 kHz	 <1 Hz <4 Hz
Residual AM	rms value 20 Hz to 23 kHz at f = 1 GHz	<0.02%

High power and overvoltage protection (option R&S SFU-B90)

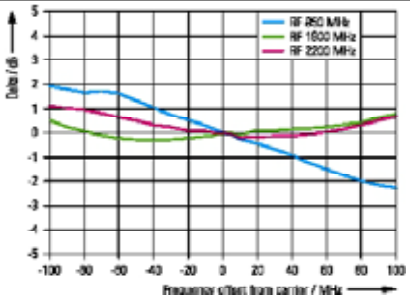
Extends the output level and protects the instrument against externally applied RF power from a 50 Ω source.		
Maximum level		19 dBm
Maximum permissible RF power		50 W
Maximum permissible DC voltage		35 V

I/Q modulation

I/Q modulator

Operating modes		external wideband I/Q internal baseband I/Q
Modulation frequency range	I/Q wideband	100 MHz
I/Q modulation inputs	connector input impedance VSWR up to 30 MHz input voltage for full-scale input minimum input voltage for ALC state ON	BNC female, front 50 Ω <1.2 $\sqrt{V_i^2 + V_q^2}$ = 0.5 V 0.1 V
Static error vector	rms value f ≤ 200 MHz f > 200 MHz peak value f ≤ 200 MHz f > 200 MHz	 <0.3% <(0.2% + 0.1% · f/GHz) <0.6% <(0.4% + 0.2% · f/GHz)
Modulation frequency response	I/Q wideband up to 50 MHz up to 5 MHz	 <3 dB <0.6 dB
Carrier leakage	without input signal, referenced to full-scale input[2]	<–55 dBc
I/Q impairments	I offset, Q offset setting range resolution gain imbalance setting range resolution quadrature offset setting range resolution	 –10% to +10% 0.01% –1 dB to +1 dB 0.001 dB –10° to +10° 0.1°
I/Q swap	I and Q signals swapped	ON, OFF

External wideband I/Q

I/Q inputs (I/Q EXT) (connector equal to I/Q analog IN)	connector input impedance VSWR up to 50 MHz input voltage for full-scale input minimum input voltage for ALC state ON	BNC female, front 50 Ω <1.2 $\sqrt{V_i^2 + V_q^2}$ = 0.5 V 0.1 V
Modulation frequency range[3]		100 MHz
Carrier leakage	without input signal, referenced to full-scale input[2]	<–55 dBc
Static error vector	rms value f ≤ 200 MHz f > 200 MHz peak value f ≤ 200 MHz f > 200 MHz	 <0.3% <(0.2% + 0.1% · f/GHz) <0.6% <(0.4% + 0.2% · f/GHz)

[2] Value applies after 1 hour warm-up and recalibration for 4 hours operation and temperature variations of less than 5 °C.

[3] I/Q wideband ON.

Internal baseband I/Q

Signal characteristics		see digital modulation systems
D/A converter	data rate resolution sampling rate	100 MHz 16 bit 400 MHz (internal interpolation × 4)
Aliasing filter	with amplitude, group delay and Si correction bandwidth, roll-off to –0.1 dB	 40 MHz
I/Q impairment	I offset, Q offset setting range resolution gain imbalance setting range resolution quadrature offset setting range resolution	 –10% to +10% 0.01% –1 dB to +1 dB 0.01 dB –10° to +10° 0.1°

Internal optimization of RF parameters is always ON.

I/Q output

I/Q output	connector output impedance At R_L = 50 Ω, the output voltage depends on the set modulation signal. output voltage	BNC female, rear 50 Ω 0.5 V (V_P)
Offset		<0.5 mV

Extended I/Q (option R&S SFU-K80)

Option R&S SFU-K80 allows external analog and digital signals to be fed into the digital baseband signal processing of the R&S SFU. Input signals can be faded in if the fading simulator option has been installed. In addition, the digital baseband signals are available externally.

Analog I/Q IN		
I/Q inputs (I/Q EXT) (connector equal to I/Q wideband IN)	connector input impedance VSWR (up to 25 MHz) input voltage for full-scale input frequency response up to 30 MHz A/D converter offset	BNC female, front 50 Ω <1.2 $\sqrt{V_i^2 + V_q^2}$ = 0.5 V 0.5 dB 100 MHz/14 bit <–55 dBfs
Digital I/Q IN		
I/Q digital input	connector output level	Mini D Ribbon, 26 pins, rear channel link
I/Q digital modulation inputs	level word width analog bandwidth symbol rate	LVDS 16 bit 400 Hz to 31 MHz 0.02442 Msps to 100 Msps
Digital I/Q OUT		
I/Q digital output	connector output level	Mini D Ribbon, 26 pins, rear channel link
I/Q digital modulation outputs	level word width symbol rate	LVDS 16 bit 100 Msps

MPEG-2 inputs

Parallel SPI input	connector input level input impedance	D-Sub female, 25 pins, front, rear LVDS 100 Ω, differential
ASI/SMPTE 310 serial input	connector ASI input level SMPTE 310 input level input impedance ASI data rate SMPTE 310 data rate	BNC female, front, rear 200 mV to 880 mV 400 mV to 880 mV 75 Ω 270 Mbit/s 19.392658 Mbit/s
Stuffing	ASI, SMPTE 310, SPI stuffing packets	ON/OFF see MPEG-2 TS packet at “Internal test signals”
TS EXT CLK	connector input level input impedance	BNC female, rear TTL, sinewave (0 dBm) 50 Ω
Indication	measured values	packet length data rate useful data rate

Internal test signals

MPEG-2 TS packet	payload (header + 184 byte payload) PID	00 (hex), FF (hex), PRBS (selectable) NULL (1FFF hex)/variable
Special TS packet	payload (sync byte + 187 byte payload)	00 (hex), FF (hex), PRBS (selectable)
PRBS	PRBS in accordance with ITU-T O.151	2^{23}–1, 2^{15}–1 (selectable)

Digital modulation systems

DVB-T/H (option R&S SFU-K1)

DVB-T/H	meets EN 300744/EN 302304	
Modulation	mode bandwidth MER modulation frequency response shoulder attenuation	COFDM 5 MHz, 6 MHz, 7 MHz, 8 MHz (settable for variable bandwidths: 4 MHz to 7.8 MHz) >40 dB[4] <±0.2 dB >48 dB
Coding	constellation code rate guard interval FFT mode interleaver TPS carrier modification	QPSK, 16QAM, 64QAM, hierarchical coding 1/2, 2/3, 3/4, 5/6, 7/8 1/4, 1/8, 1/16, 1/32, off 2K, 4K and 8K COFDM native and in-depth meets DVB-T/H carriers and carrier groups can be switched off
Special functions	scrambler, sync byte inversion, Reed-Solomon, convolutional interleaver, bit interleaver, symbol interleaver	can be disabled
Test signals		TS test packet (see internal test signals) PRBS before convolutional encoder PRBS after convolutional encoder PRBS before mapper

[4] With internal test signals.

DVB-C (option R&S SFU-K2)

DVB-C	meets EN 300429	
Modulation	mode symbol rate pulse filtering MER modulation frequency response shoulder attenuation	16QAM, 32QAM, 64QAM, 128QAM, 256QAM 0.1 Msps to 8 Msps settable root cosine roll-off, alpha = 0.15 roll-off, variable roll-off (0.1 to 0.2) >40 dB ±0.25 dB >48 dB
Test signals		TS test packet (see “Internal test signals”) PRBS before mapper

DVB-S (option R&S SFU-K3)

DVB-S	meets EN 300421/EN 301210	
Modulation	mode symbol rate overrange pulse filtering MER modulation frequency response shoulder attenuation	QPSK, 8PSK, 16QAM 0.1 Msps to 45 Msps settable >45 Msps to 66 Msps root cosine roll-off, alpha = 0.35 roll-off, variable roll-off (0.25 to 0.45) >38 dB (27.5 Msps) ±0.25 dB >45 dB
Coding	code rate	QPSK: 1/2, 2/3, 3/4, 5/6, 7/8 8PSK: 2/3, 5/6, 8/9
Special functions	energy dispersal, Reed-Solomon coder (204, 188, t = 8), convolutional interleaver, convolutional encoder	can be disabled
Test signals		TS test packet (see “Internal test signals”) PRBS before convolutional encoder PRBS after convolutional encoder PRBS before mapper

DVB-S2 (option R&S SFU-K8) (see ordering information)

DVB-S2	meets EN 302307, broadcast services	
Modulation	mode symbol rate pulse filtering MER modulation frequency response shoulder attenuation	QPSK, 8PSK 1 Msps to 30 Msps root raised filtering, alpha = 0.20 roll-off, variable roll-off (0.15, 0.20, 0.25, 0.35) >38 dB (20 Msps) ±0.25 dB >45 dB
Coding	code rate pilot insertion	QPSK: 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 can be disabled
Special function	error insertion	after CRC-8, BCH or LDPC
Test signals		TS test packet (see “Internal test signals”)

AMC (advanced modulation coding, option R&S SFU-K108)

AMC	meets AMC	supports DIRECTV as well as parts of DVB-S and phase noise
Modulation	mode symbol rate overrange for DIRECTV pulse filtering MER modulation frequency response shoulder attenuation	QPSK DVB-S: 1 Msps to 42 Msps DIRECTV: 20 Msps 1 Msps to 30 Msps root cosine roll-off, alpha = 0.20 roll-off, variable roll-off (0.15, 0.2, 0.25, 0.35) >38 dB (20 Msps) <±0.25 dB >45 dB
Coding	constellation code rate hierarchical constellation code rate angle	QPSK DIRECTV: 2/3, 6/7 DVB-S: 1/2, 2/3, 3/4, 5/6, 7/8 H8PSK HP DIRECTV: 6/7 LP DVB-S2: 1/3, 1/4 LP 1/3: 13.8°, 11.0° LP 1/4: 12.33°, 10.0°
Special functions	phase noise	can be switched on

DMB-T (TDS-OFDM, option R&S SFU-K7) (see ordering information)

DMB-T (TDS-OFDM)	meets TDS-OFDM	field trials in China
Modulation	mode bandwidth modulation frequency response shoulder attenuation	COFDM 6 MHz, 7 MHz, 8 MHz (settable for variable bandwidths: 5.6 MHz to 7.962 MHz) <0.2 dB >50 dB
Coding	constellation code rate guard interval time interleaver FFT mode	QPSK, 16QAM, 64QAM 4/9, 2/3, 8/9 420, 945 48, 240, 720 4K COFDM
Special functions	byte interleaver, randomizer, sync word randomizer, pilot data, GI power boost randomizer restart	can be disabled packet/frame
Single frequency network	network mode control	MFN, SFN MIP, manual
Test signals		TS test packet (see “Internal test signals”)

Noise generator AWGN (option R&S SFU-K40)

RF bandwidth	3 dB spectrum (AWGN)	>96 MHz
Noise	density distribution function crest factor	Gaussian, statistical, separate for I and Q 18 dB
C/N	setting range resolution uncertainty for system bandwidth = symbol rate and C/N < 20 dB	–30 dB to +60 dB 0.1 dB <0.2 dB
System bandwidth	(bandwidth for determining the noise power) range	 100 kHz to 80 MHz

Phase noise (option R&S SFU-K41)

Phase noise	frequency response amplitude with $F_{carrier}$ ±100 Hz setting range resolution max. phase angle density distribution function	selection from profile files –10.0 dBc/Hz to –80.0 dBc/Hz, depending on selected profile 0.1 dB ±180° Gaussian

Impulsive noise (option R&S SFU-K42)

Pulsed addition of an AWGN signal to the useful signal with settable number of pulses per frame and within settable limits of randomly distributed pulse intervals.

AWGN signal not pulsed	data	see option R&S SFU-K40
Key generator		
Frame	duration	10 ms, fixed
Pulse	duration	0.25 µs, fixed
Pulses per frame	setting range	1 to 255
Minimum pulse interval	for number of pulses >1 setting range resolution	 0.25 µs to 63.75 µs 0.25 µs
Maximum pulse interval	for number of pulses >1 setting range resolution	 0.25 µs to 1023.75 µs max. 10 ms / (pulses per frame – 1) 0.25 µs
Distribution of pulse intervals	function	PRBS

BER measurements (option R&S SFU-K60)

BER measurements	for all digital modulation modes	
Indication	measurement value information information	BER error count measurement time
Start/restart		manual
PRBS measurements		
Input BER clock, BER data, BER enable	connectors input impedance input level	BNC female, rear 50 Ω HCT
BER data	input data rate PRBS	up to 90 Mbit/s 2^{23}–1, 2^{15}–1 (in accordance with ITU-T O.151)
BER clock, BER data	polarity	normal, inverted
BER enable		always, active high, active low
Output BER error	connector output impedance output level	BNC female, rear 50 Ω HCT
MPEG-2 TS measurements		
Input	input interfaces input signal payload (PRBS in accordance with ITU-T O.151) PID	ASI, SPI stuffing off, SMPTE 310 (see MPEG-2 inputs) TS packet (see “Internal test signals”) 2^{23}–1 / 2^{15}–1 NULL (1FFF (hex)), variable
DATA VALID	applicable for SPI interface	active always

Fading simulator (option R&S SFU-B30)

The following data is preliminary.

Number of paths	 with option R&S SFU-B31	20 40
System bandwidth		80 MHz
Path loss	range resolution accuracy	0 dB to 50 dB 0.01 dB <0.01 dB
Path delay	range resolution with option R&S SFU-K30	0 ms to 2.56 ms 10 ns 0.01 ns
Delay groups	maximum number with option R&S SFU-B30 with option R&S SFU-B31 allowed delay differences	 4 8 <40 µs per group
Speed range	range accuracy	0 km/h to 1725 km/h for 1 GHz <0.128%
Doppler frequency range	setting range accuracy	0 Hz to 1600 Hz <0.1%
Restart		automatic, manual
Insertion loss		0 dB to 18 dB, automatic or user-definable, with clipping indication
Correlation	correlation coefficient setting range resolution correlation phase setting range resolution	 0% to 100% 5% 0° to 360° 1°
Fading profiles		
Pure Doppler	frequency ratio resolution	–1 to +1 × current Doppler frequency 0.01 × current Doppler frequency
Static and constant phase	path loss phase resolution	0 dB to 50 dB 0° to 360° 1°
Rayleigh fading	pseudo noise interval	>93 h
Rice fading	combination of Rayleigh fading and pure Doppler power ratio[5]	 –30 dB to +30 dB
Lognormal fading	standard deviation resolution local constant	0 dB to 12 dB 1 dB 12 m to 200 m for f = 1 GHz

[5] Ratio of discrete component to distributed component.

Enhanced fading (option R&S SFU-K30) (see ordering information)

The following data is preliminary.

Fine delay 50 MHz mode		
Number of paths with option R&S SFU-B31		8 16
System bandwidth		50 MHz
Path delay	resolution	0.01 ns
Fine delay 30 MHz mode		
Number of paths with option R&S SFU-B31		12 24
System bandwidth		30 MHz
Path delay	resolution	0.01 ns
Moving delay mode		
System bandwidth		50 MHz
Number of fading paths		2 per signal path
Fading profiles		none
Basic delay	in steps of 10 ns	0 ms to 2.56 ms
Delay Variation Variation period Step size	peak to peak	 300 ns to 40 µs 10 s to 500 s <10 ps
Birth-death mode		
System bandwidth		50 MHz
Number of fading paths		2 per signal path
Fading profiles		pure Doppler
Delay Delay range Delay grid Positions		5 µs to 1000 µs 0 µs to 40 µs 0 µs to 20 µs[6] 3 to 50[6]
Hopping dwell	separately settable for each signal path	100 ms to 5 s 1 ms to 200 ms
Path delay	resolution	10 ns

TS generator (option R&S SFU-K20)

MPEG-2 TS OUTPUT ASI	connector output impedance output level data rate ASI operating mode	BNC female, rear 75 Ω 200 mV to 880 mV 270 Mbit/s packet or continuous
Transport stream	files length of transport stream packets	GTS format ATSC: 188/208 bytes (selectable) DVB: 188/204 bytes (selectable)
	sequence length data rate net data rate data volume	endless and seamless generation with repetition of video, audio and data contents 100 kbit/s to 214 Mbit/s (including null packets) max. 90 Mbit/s max. 80 Mbyte payload
PCR jitter	shape frequency amplitude	sine, rectangle and triangle 1 MHz to 100 kHz 0 ms to 1 ms, increment 0.1 µs
Signal set		moving picture sequences and test patterns with test tones, for 625 and 525 lines; DVB/ATSC systems, additional signals via options

[6] The maximum delay range of 40 µs must not be exceeded.

TS recorder (Option R&S SFU-K21)

Parallel SPI input	connector input level input impedance clock operating mode	D-sub female, 25 pins, front and rear LVDS 100 Ω, differential 84.375 kHz to 20 MHz TRP, 8 bit (8-bit data), T10 (8-bit data, 1-bit data valid, 1-bit packet sync)
ASI/SMPTE 310 serial input	connector ASI input level SMPTE 310 input level input impedance ASI data rate operating mode SMPTE 310 data rate	BNC female, front and rear 200 mV to 880 mV 400 mV to 880 mV 75 Ω 270 Mbit/s packet or continuous 19.392658 Mbit/s
TS OUTPUT	connector output impedance output level ASI data rate operating mode	BNC female, rear 75 Ω 200 mV to 880 mV 270 Mbit/s packet or continuous
Transport stream	files length of transport stream packets	TRP format (any recorded data streams) compliant with externally applied/recorded transport stream
	sequence length data rate net data rate data quantity recording time	endless and seamless replay with packet-exact cut at transition from end of file to beginning of file 100 kbit/s to 214 Mbit/s (including null packets) max. 90 Mbit/s from hard disk max. data quantity for recording limited only by size of hard disk depends on net data rate of applied transport stream and size of hard disk

Arbitrary waveform generator (option R&S SFU-K35)

Waveform memory	length resolution loading time for 10 Msamples nonvolatile memory	512 samples to 64 Msamples in one-sample steps 16 bit 15 s hard disk
Clock generation	clock rate accuracy operating mode frequency accuracy (internal)	400 Hz to 100 MHz 0.001 Hz internal, external accuracy of reference frequency
Interpolation	bandwidth with clock rate = 100 MHz (no interpolation), roll-off drop to –0.1 dB with clock rate ≤100 MHz, drop to –0.1 dB sampling rate	 40 MHz 0.31 × clock rate automatically interpolated to the internal 100 MHz data rate

With R&S WinIQSIM™: Software version 4.24 or later supports the download of I/Q data and the control of the R&S SFU-K35.

Trigger inputs/outputs

Triggers and connections reserved for future use

Triggers 1 to 10	connector input impedance input level	D-Sub female, 25 pins, rear high HCT
Main trigger IN Main trigger OUT	connector input impedance input level	BNC female, rear 50 Ω HCT

General data

Systems data

Systems	operational systems memory for settings	PC platform Windows XP Embedded internal hard disk 50
Local control	display controls	XVGA 1024 × 768 rotary knob, hardkeys and softkeys
External control	controls	external mouse and keyboard via USB
Remote control	command set IEC/IEEE address range IEC/IEEE interface functions Ethernet USB	SCPI 1999.5 IEC 60625 (IEEE 488) 1 to 30 SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT1, C0 10/100BaseT 1.1 (full speed)
Connectors	IEC/IEEE Ethernet USB power inlet	24-contact Amphenol, rear RJ-45, rear USB, front, rear IEC 60320 C14, rear

Operating data

Power supply	input voltage range, AC, nominal AC supply frequency power factor correction	100 V to 240 V 3.6 A to 1.3 A 47 Hz to 63 Hz meets EN 61000-3-2
EMC		meets EN 55011 Class B, EN 61326
Immunity to interfering field strength		up to 10 V/m
Environmental conditions	operating temperature range storage temperature range climatic resistance, 95% rel. humidity, cyclic test at +25 °C/+40 °C	+5 °C to +45 °C[7] meets DIN EN 60068-2-1, DIN EN 60068-2-2 –20 °C to +60 °C meets DIN EN 60068-2-3, DIN EN 60068-2-30
Mechanical resistance	vibration, sinusoidal random shock	5 Hz to 150 Hz, max. 2 g at 55 Hz, 55 Hz to 150 Hz, 0.5 g const., meets DIN EN 60068-2-6 10 Hz to 300 Hz, acceleration 1.2 g (rms), meets DIN EN 60068-2-64 40 g shock spectrum, meets DIN EN 60068-2-27, MIL-STD-810E
Electrical safety		meets IEC 61010-1, EN 61010-1, and UL 61010B-1, CSA C22.2 No. 1010.1
Dimensions	W × H × D in mm W × H × D in inches	435 × 192 × 460 (4 HU) 17.14 × 7.56 × 18.12 (4 HU)
Weight	fully equipped in kg fully equipped in lb	15 33.1
Recommended calibration interval		3 years
Standard warranty period		1 year

[7] Reduced brightness of LCD at higher operating temperatures.

Ordering information

Option identification: R&S SFU-Bxy = hardware option, R&S SFU-Kxy = software option.
Delivery of R&S SFU base unit only with minimum of one coder installed.

Designation	Type	Order No.
Broadcast Test System including power cable, hardcopy of quick start guide, CD-ROM (includes operating manuals and quick start guide)	**R&S SFU**	**2110.2500.02**
Options		
RF path		
High Power and Overvoltage Protection	R&S SFU-B90	2110.8008.02
Coding		
DVB-T/H	R&S SFU-K1	2110.7301.02
DVB-C	R&S SFU-K2	2110.7324.02
DVB-S	R&S SFU-K3	2110.7330.02
DMB-T (TDS-OFDM) (requires an installed R&S SFU-B1)	R&S SFU-K7	2110.7382.02
DVB-S2 (requires an installed R&S SFU-B1)	R&S SFU-K8	2110.7399.02
AMC (requires an installed R&S SFU-K8 and an installed R&S SFU-B1)	R&S SFU-K108	2110.7418.02
Coder Extension 1	R&S SFU-B1	2110.7424.02
Simulation		
Fading Simulator	R&S SFU-B30	2110.7530.02
Enhanced Fading (requires an installed R&S SFU-B30)	R&S SFU-K30	2110.7560.02
Fading Simulator Extension to 40 Paths (requires an installed R&S SFU-B30)	R&S SFU-B31	2110.7547.02
ARB Generator (requires an installed R&S SFU-B3)	R&S SFU-K35	2110.7601.02
Noise Generator AWGN	R&S SFU-K40	2110.7653.02
Phase Noise	R&S SFU-K41	2110.7660.02
Impulsive Noise	R&S SFU-K42	2110.7676.02
Transport stream generator		
TS Generator incl. SDTV Streams	R&S SFU-K20	2110.7476.02
TS Recorder (requires an installed R&S SFU-B6 and an installed R&S SFU-B4)	R&S SFU-K21	2110.7482.02
DVB-H Streams	R&S DV-DVBH	2085.8704.02
TCM Streams	R&S DV-TCM	2085.7708.02
HDTV Streams	R&S DV-HDTV	2085.7650.02
Measurements and analysis		
BER Measurements	R&S SFU-K60	2110.7782.02
Baseband inputs/outputs		
Extended I/Q	R&S SFU-K80	2110.7953.02
Other expansions		
Memory Extension 1	R&S SFU-B3	2110.7447.02
Memory Extension 2	R&S SFU-B4	2110.7453.02
User I/O (additional input/output)	R&S SFU-B5	2110.7460.02
2nd HD	R&S SFU-B6	2110.7501.02
Recommended extras		
Hardcopy of operating manuals; includes quick start guide (in English)		2110.2522.12
Hardcopy of service manuals (in English)		2110.2522.22
19" Rack Adapter	R&S ZZA-411	1096.3283.00
Adapter for Telescopic Sliders	R&S ZZA-T45	1109.3774.00
Keyboard with USB Interface (US assignment)	R&S PSL-Z2	1157.6870.03
Mouse with USB Interface, optical	R&S PSL-Z10	1157.7060.02
External USB CD-RW Drive	R&S PSP-B6	1134.8201.12

For more information, see
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