Version 01.00

November 2007

R&S®SFE100 Test Transmitter

The powerful broadcast signal generator for production test systems

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

ROHDE&SCHWARZ

Front view of the R&S® SFE100

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 particularly valuable 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.

Single-standard signal generator with realtime coding

The R&S®SFE100 is a single-standard instrument specially designed for use in production. Realtime coding offers a number of advantages in this area as well. Realtime coders generate endless and seamless test signals. Therefore, the signal generators do not need to be synchronized with the production cycle. Moreover, very long sequences can be replayed and the modulation parameters can be set as required.

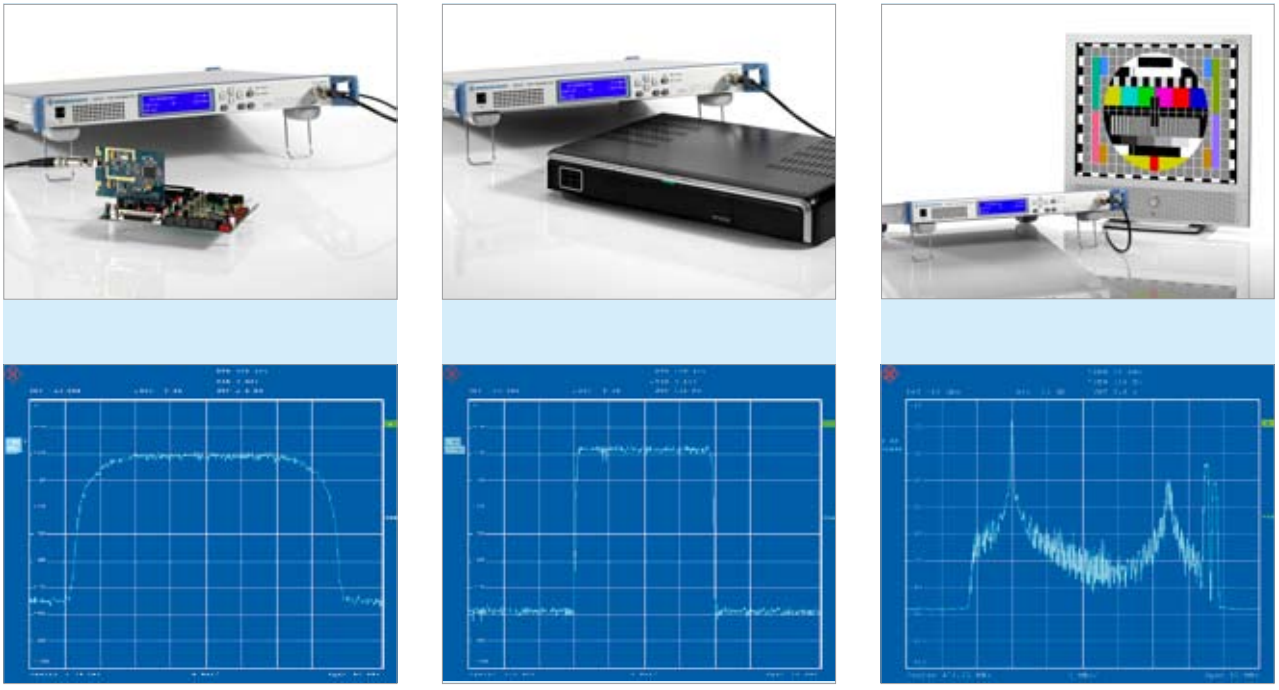
- *Coder for realtime signal generation*
  The R&S®SFE100 has a powerful hardware platform for baseband signal processing. The platform provides the I and Q bit streams for the broadband vector modulator. It is factory-configured for the specific transmission standard required
- *Adjustable modulation parameters*
  With each transmission standard, various modulation parameters such as constellation, code rate, and FFT mode must be defined. These parameters can be varied irrespective of the transport stream or A/V signal to be transmitted. All conceivable versions of a standard can thus be tested. The realtime coder automatically adjusts the corresponding signaling information for the receiver

Models for all common digital and analog broadcasting standards

As a single-standard instrument, the R&S®SFE100 comes with a factory-installed coder. R&S®SFE100 models are available for all major standards and technologies. For signal generation systems in production, this is a major advantage: No matter whether digital or analog receivers or terrestrial, satellite, or cable set-top boxes are being manufactured, all test signals can be generated with the same type of test transmitter.

The R&S®SFE100 is available for the following 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, DMB-TH
- Analog TV: B/G, D/K, I, M/N, L
- Sound broadcasting: DAB, ISDB-Tsb, DRM (as ARB waveform), AM/FM/RDS

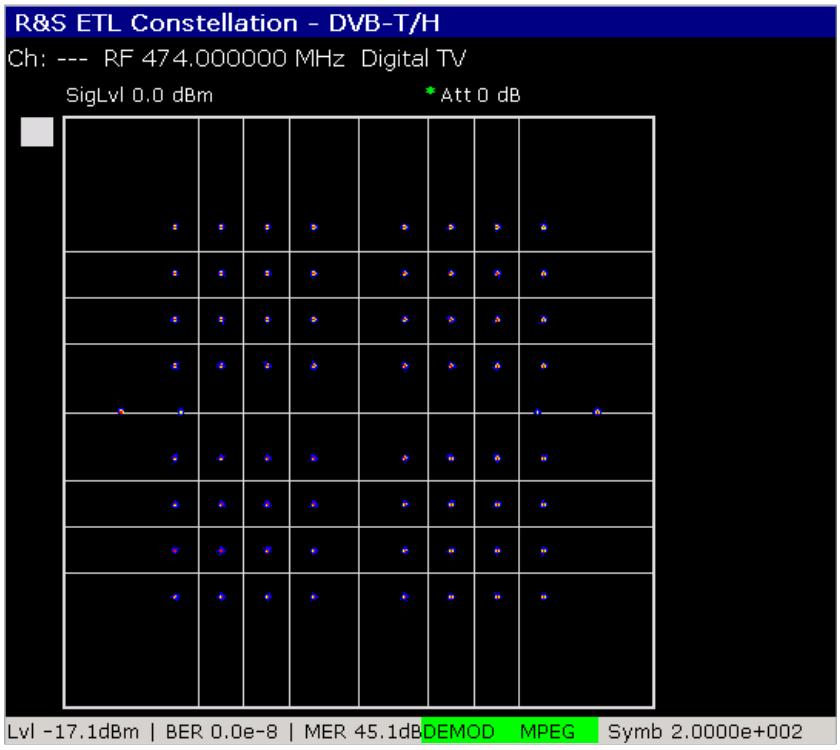


R&S®SFE100 models for satellite, terrestrial, and analog TV standards

Wide frequency range with very good signal quality

The instrument's RF characteristics make it clear that the R&S®SFE100 is a high-quality signal generator despite its compact design and economical price. It covers the entire frequency range that is relevant for broadcast applications, from IF, VHF, and UHF up to the L band. And it does so with a signal quality that is unprecedented in this class.

- *Frequency range 100 kHz to 2.5 GHz*
  The frequency can be adjusted in steps of 1 Hz. Either the center frequency or the channel number is entered, which is especially useful in analog TV
- *Low phase noise and high MER*
  Advanced COFDM modulation methods place high requirements on the stability and spectral purity of the oscillator signal. With an SSB phase noise of <–115 dBc (typ. at 300 MHz and 20 kHz carrier offset), very high MER values of over 40 dB (typ.) are attained. Furthermore, the R&S®SFE100 stands out due to its low wideband noise and good harmonics suppression



Constellation diagram of an R&S® SFE100 DVB-T signal with excellent MER

Example of a section of the DVB-H transport stream library

Integrated power amplifier for high output levels

In production test systems, the signals of multiple test transmitters are combined in a coupling network and then distributed over large distances. To compensate for the accompanying losses, a high signal level is required. The R&S®SFE100 offers an optional, extremely powerful integrated amplifier for this purpose. It thus attains a level of performance that exceeds that of competitor instruments even when they have extra external equipment attached.

Rear RF output connector of the R&S®SFE100 high power amplifier

- *Maximum output power +27 dBm*
  The optional power amplifier of the R&S®SFE100 provides maximum output power of 0.5 W in bands I to V
- *0 dB to 10 dB attenuation, adjustable*
  To adjust the levels of the test system channels, the output level can be diminished by 0 dB to 10 dB
- *RF monitor output with 50 dB attenuation*
  With the power amplifier built in, the RF output is located on the rear of the R&S®SFE100, thereby simplifying rack mounting. The receptacle on the front panel then functions as RF monitor output whose signal level is 50 dB less than that of the RF output
- *Signal level –100 dBm to +15 dBm CW without power amplifier*
  Without the optional power amplifier, the R&S®SFE100 has the characteristics of a signal generator. The output level is then adjustable by means of an electronic attenuator over a wide dynamic range of –100 dBm to +15 dBm in 0.1 dB steps

Integrated transport stream player or audio/video generator

Digital transmission methods require transport streams as the baseband signal; ATV modulators on the other hand require analog CCVS signals. Every R&S®SFE100 model can be equipped with the baseband source that is appropriate for the individual transmission standard – external baseband generators are no longer required. This significantly reduces the number of instruments involved, especially in complex production test systems.

- *TS generator (R&S®SFE100-K20)*
  An optional transport stream generator in the baseband internally provides test streams for the realtime coder and allows you to generate endless and seamless high-bit-rate MPEG-2 transport streams. An external MPEG-2 generator is thus no longer necessary. The SDTV transport stream library integrated as standard includes ATSC and DVB test streams. The numerous Rohde & Schwarz transport streams cover a wide variety of applications and test scenarios
- *Transport stream libraries from Rohde & Schwarz*
  A large number of additional libraries can be integrated. They make development faster and easier and allow new products to be tested
  – SDTV – test streams for DVB and ATSC
  – HDTV – tests of HDTV receivers
  – DVB-H – tests of mobile receivers
  – ISDB-T – test streams
  – H.264 – test streams
  – TCM – STB tests
  – The range of transport stream libraries is constantly being expanded
- *Compatible with the advanced stream combiner from Rohde & Schwarz*
  The R&S®DV ASC advanced stream combiner provides full flexibility when generating your own streams, which can be used with the R&S®SFE100K20 TS generator. It allows you to generate your own transport streams, also for DVB-H

- *TRP player (R&S®SFE100-K22)*
  The optional TRP player ideally complements the TS generator and lets you replay your own transport streams in TRP format. The transport streams can be copied via the USB or LAN interface to the R&S®SFE100 file system and then replayed from there. In addition, the TRP player is used to replay T-DMB and DAB ETI streams, which it does by replaying predefined ETI test streams for T-DMB and DAB from the T-DMB/DAB library (R&S®SFU-K221)
- *ATV video generator (R&S®SFE100-K23)*
  By using the ATV video generator, you can generate test patterns and audio signals for analog TV. The ATV video generator includes FuBK and color bar test patterns for PAL, SECAM, and NTSC
- *ATV video library from Rohde & Schwarz*
  The ATV video library provides a wealth of test patterns for analog TV that far exceeds the scope of the ATV video generator alone. It also includes Cross Hatch, Color Bar, Philips, and Monoscope/Reteoma

Model with arbitrary waveform generator

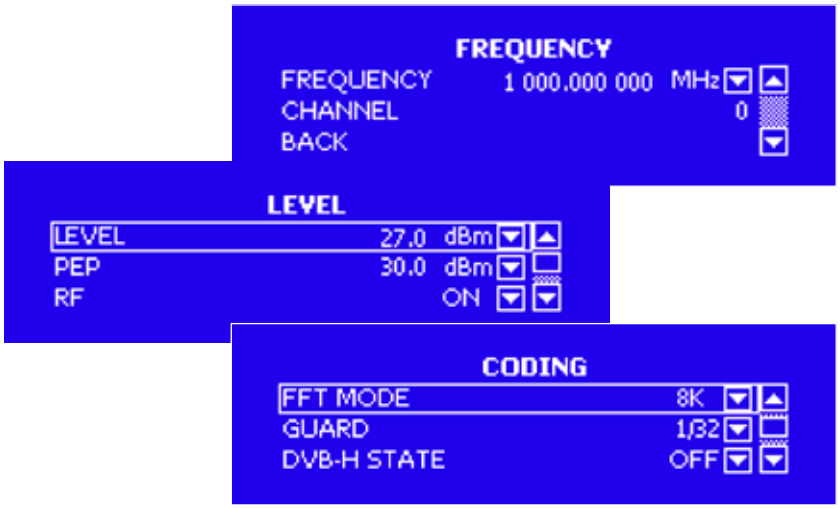
In addition to the realtime coder models, Rohde & Schwarz offers an R&S®SFE100 model with an arbitrary waveform generator (ARB). It can replay proprietary I/Q waveforms as well as waveform libraries from Rohde & Schwarz for various transmission standards, thus opening up a wide range of additional applications. This allows you to generate any externally computed RF signals – from complex modulation signals to special interferers such as notched noise. I/Q waveform files can be loaded into the instrument via the USB or LAN interface.

- *128 Msample memory space*
  A hardware resampler and the resulting large sequence length reduce the memory space needed for storing I/Q waveforms on the hard disk. This allows you to store a large number of I/Q waveforms directly on the hard disk
- *Sample rate up to 100 Msamples/s*
  Due to its high sample rate, the ARB generator can generate signals with a baseband bandwidth up to 30 MHz
- *Waveform libraries from Rohde & Schwarz*
  Additional waveform libraries permit the quick evaluation of new modulation modes. I/Q waveform libraries are available for the following signals:
  T-DMB/DAB (R&S®SFU-K351),
  DVB-H (R&S®SFU-K352),
  DRM (R&S®SFU K353),
  DTV interferer (R&S®SFU-K354),
  MediaFLO™ (R&S®SFU K355), and
  cable interferer (R&S®SFU-K356). The set of available waveform libraries is constantly being expanded
- *Compatible with R&S®WinIQSIM™*
  Waveforms generated with the R&S®WinIQSIM™ PC software can be loaded into the ARB generator of the R&S®SFE100 and replayed

Generation of ARB waveforms with R&S® WinIQSim™

Convenient control elements and remote operation

When used in production, signal generators are usually set up in racks where space is very limited. This means that all functions need to be selectable directly on the instrument. On the other hand, it must be possible to configure and monitor all instruments of the entire system via remote control. The R&S®SFE100 makes both possible – with a keypad and display on the front panel on the one hand and a convenient graphical user interface for remote operation on the other.



Menus on the front panel display

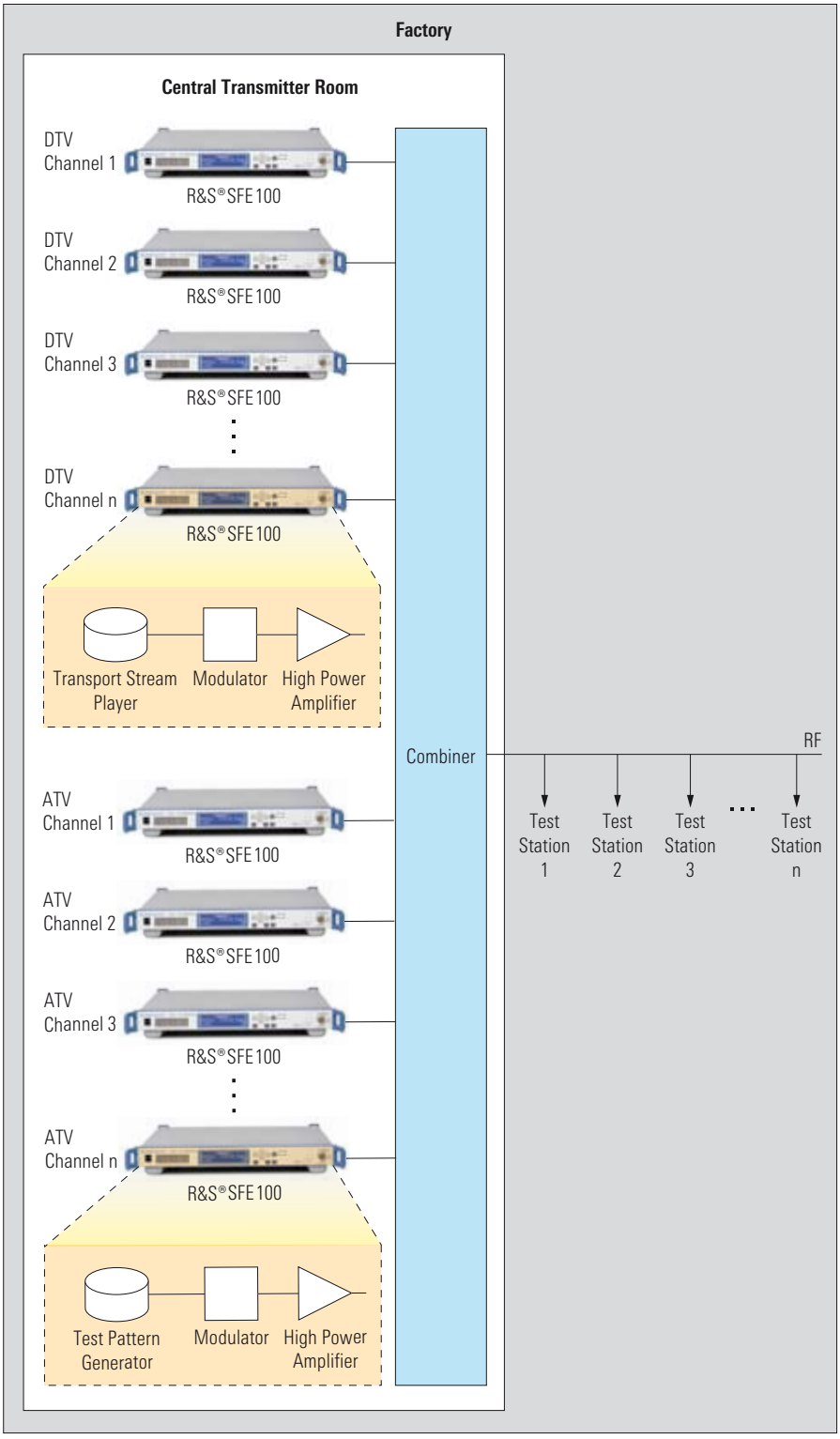
- *Keypad and liquid crystal display (LCD) on the front panel*
  The graphical display lets you view the current settings quickly and easily. Parameters and their settings can be selected with the cursor keys and the Enter key
- *Easy software updates via USB 2.0 or LAN*
  Owing to USB 2.0 and LAN interfaces, you can perform software updates for the R&S®SFE100 quickly and with little effort. You merely need to copy the new software to the R&S®SFE100 by means of a USB memory stick or via FTP and start the fully automatic installation
- *Remote operation with Remote Desktop or VNC*
  The R&S®SFE100 can be easily remote-operated via an Ethernet connection or in a LAN network over IP. It is preconfigured for DHCP use by means of the preinstalled Remote Desktop software or the VNC software that comes with the instrument. For remote operation, the R&S®SFE100 has the same highly-convenient graphical user interface that has already proven its mettle in the R&S®SFE and R&S®SFU
- *Remote control via LAN*
  Remote control is possible by means of SCPI control commands via LAN (VXI11). The R&S®SFE100 can thus be integrated into existing test programs very easily
- Remote control commands are compatible with those of the R&S®SFU and R&S®SFE

Remote operation with PC

Applications

In the production of broadcast consumer electronic equipment such as set-top boxes and televisions, a number of test signals for various transmission standards are required at various frequencies and with different contents. The required signal generators are usually kept in a central transmitter room. The signals are combined in a coupling network and distributed to the individual test stations in the factory via cable, partly over considerable distances. For each channel, a baseband signal is generated, modulated to the corresponding RF, and then amplified to a sufficient level before being fed to the distribution network. This task normally requires three different instruments – baseband generator, modulator, and power amplifier.

The R&S®SFE100 is optimally designed for this application: It combines the baseband signal source, modulator, and power amplifier in only one instrument. This makes such a system far less complex. The advantages are readily apparent: A system with the R&S®SFE100 is not only more economical; it also requires less space, is more reliable, easier to maintain, and involves less spare equipment.



Schematic picture of a central transmitter room

Production test system

Benefits

- **Integrated instrument for efficient production**
  The cost pressure within the fiercely competitive consumer electronics market is enormous. The focus on material and development costs is accompanied by the growing importance of cost-optimized production. And this is where the advantages of the R&S®SFE100 truly become apparent: With its integrated baseband generator and power amplifier, the R&S®SFE100 combines three instruments in one. This not only translates into lower procurement and operating costs. It also increases reliability and simplifies maintenance – which all adds up to more efficient production.
- **Remote compatibility eliminates duplicated effort**
  Not only are sales prices for consumer electronic equipment falling steadily – innovation cycles are also becoming ever shorter. The time window available between the start of product development and the start of series production is becoming tighter and tighter. This makes it all the more important to be able to transfer results from development quickly and easily to production. The R&S®SFU, R&S®SFE, and R&S®SFE100 broadcast signal generators from Rohde & Schwarz provide a valuable contribution: They are designed with optimum compatibility in mind. Test scenarios as well as remote-control programs from development can be transferred to production easily and smoothly.
- **Same look and feel as the R&S®SFU and R&S®SFE**
  Both the tried-and-true operating concept and the straightforward graphical user interface of the R&S®SFU and R&S®SFE are largely the same in the R&S®SFE100. Customers who are already familiar with the R&S®SFU or R&S®SFE will be able to operate the R&S®SFE100 immediately and without any additional training. This makes switching between the R&S®SFU, R&S®SFE, and R&S®SFE100 easy and effortless.

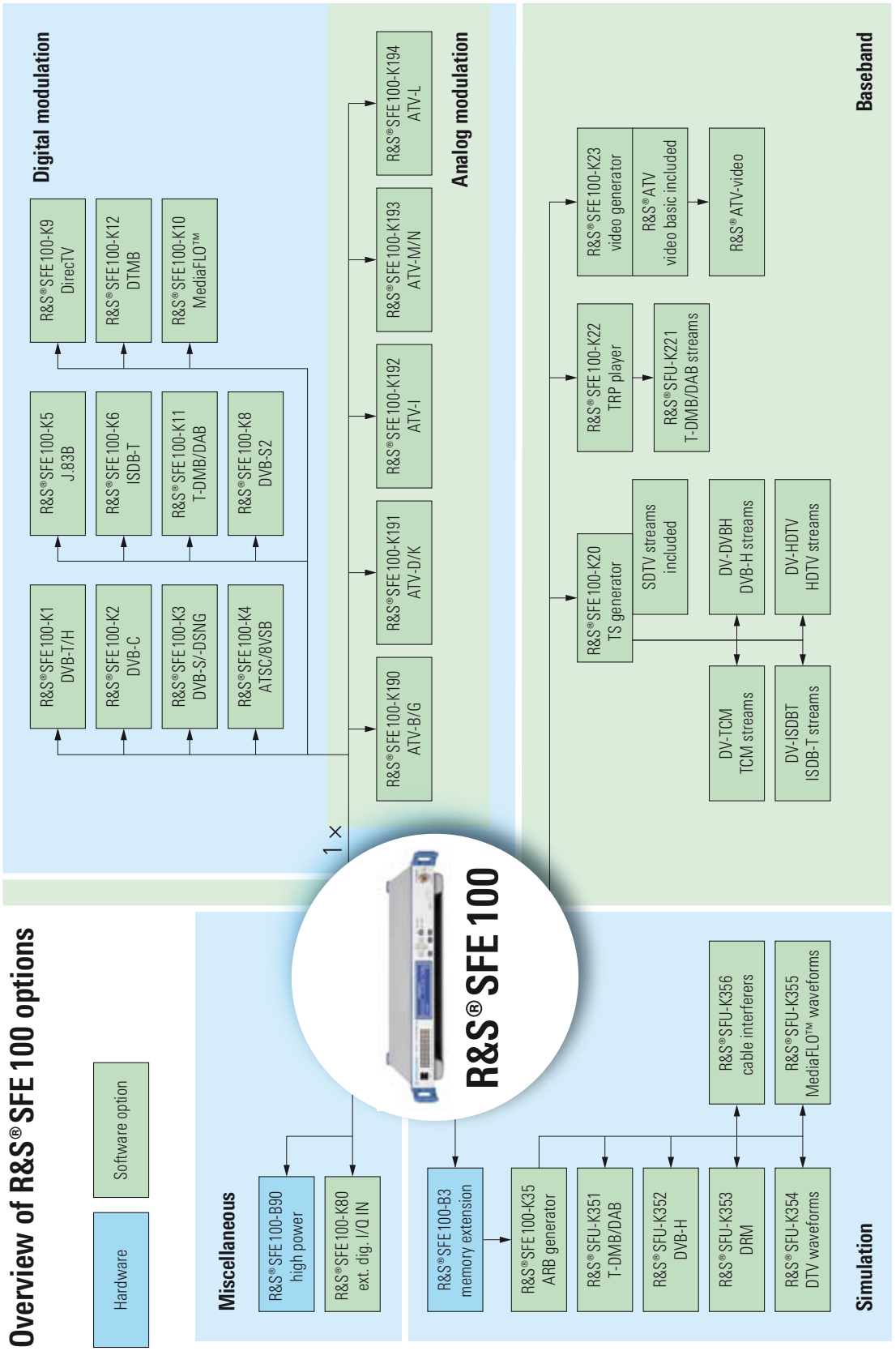
Specifications in brief

Parameter	Condition	Value
RF signal	frequency range	100 kHz to 2.5 GHz
	frequency resolution	1 Hz
	level	–100 dBm to +15 dBm
	level accuracy	<1.0 dB
Spectral purity	SSB phase noise, at 300 MHz with 20 kHz offset typ.	<–115 dBc/Hz
	broadband noise >10 MHz	<–135 dBc/Hz
Digital modulation models	terrestrial TV	DVB-T, DTMB, ISDB-T, ATSC/8VSB
	cable TV	DVB-C, J.83/B
	satellite TV	DVB-S/DSNG, DVB-S2, DirecTV
	mobile TV	DVB-H, T-DMB, ISDB-T 1-segment (partial reception), DMB-TH, MediaFLO™
	digital sound broadcasting	DAB, DRM (waveform), ISDB-Tsb
Analog modulation models	analog TV	B/G, D/K, I, M/N, L
	analog sound broadcasting	AM/FM/RDS
I/Q modulator	frequency range	DC to 35 MHz
Noise generator	RF bandwidth	96 MHz
	distribution function	Gaussian, statistical, separate for I and Q
BER measurement	PRBS measurement	BER clock input, data, enable
	MPEG-2 TS measurement	ASI input
TS generator	net data rate	max. 90 Mbit/s
General information	PC platform	Windows XP Embedded
	remote control	SCPI 199.5
	Ethernet	10/100BaseT, RJ-45
	USB	2.0
	operating temperature range	+5 °C to +45 °C
	power supply	90 V AC to 240 V AC, 50 Hz to 60 Hz
	dimensions	235 mm × 55 mm × 465 mm 9.25 in × 6.1 in × 18.3 in
	weight	<6 kg <13.23 lb

Ordering information

Designation	Type	Order No.
Base unit		
Test Transmitter	R&S®SFE100	2112.4100.02/ 2112.4100.03
Options		
Digital modulation models		
DVB-T/H	R&S®SFE100-K1	2113.4003.02
DVB-C	R&S®SFE100-K2	2113.4026.02
DVB-S/DSNG	R&S®SFE100-K3	2113.4049.02
ATSC/8VSB	R&S®SFE100-K4	2113.4061.02
J.83/B	R&S®SFE100-K5	2113.4084.02
ISDB-T/ISDB-Tsb	R&S®SFE100-K6	2113.4103.02
DVB-S2	R&S®SFE100-K8	2113.4126.02
DirecTV	R&S®SFE100-K9	2113.4149.02
MediaFLO™	R&S®SFE100-K10	2113.4161.02
T-DMB/DAB	R&S®SFE100-K11	2113.4184.02
DTMB	R&S®SFE100-K12	2113.4203.02
Analog modulation models		
ATV-B/G	R&S®SFE100-K190	2113.4649.02
ATV-D/K	R&S®SFE100-K191	2113.4661.02
ATV-I	R&S®SFE100-K192	2113.4684.02
ATV-M/N	R&S®SFE100-K193	2113.4703.02
ATV-L	R&S®SFE100-K194	2113.4726.02
Baseband		
TS Generator (includes SDTV stream library)	R&S®SFE100-K20	2113.4861.02
TRP Player	R&S®SFE100-K22	2113.5268.02
Video Generator	R&S®SFE100-K23	2113.4884.02
Simulation		
ARB Generator model	R&S®SFE100-K35	2113.4926.02
T-DMB/DAB Waveforms	R&S®SFU-K351	2110.4277.02
DVB-H Waveforms	R&S®SFU-K352	2110.4425.02
DRM Waveforms	R&S®SFU-K353	2110.4554.02
DTV Interferer Waveforms	R&S®SFU-K354	2110.4690.02
MediaFLO™ Waveforms	R&S®SFU-K355	2110.2974.02
Cable Interferer Waveforms	R&S®SFU-K356	2110.3212.02
Baseband inputs		
Extended I/Q Input	R&S®SFE100-K80	2113.5245.02
Other extensions		
Power Amplifier	R&S®SFE100-B90	2112.4900.02
Memory Extension	R&S®SFE100-B3	2112.4400.02

Option overview



Certified Quality System
ISO 9001
DQS REG. NO 1954 QM

Certified Environmental System
ISO 14001
DQS REG. NO 1954 UM

For specifcations, see PD 5213.9234.22
and www.rohde-schwarz.com
(search term: SFE100)

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