Version 03.00

August 2007

R&S®SFU Broadcast Test System

The all-in-one solution for broadcast and mobile TV

Main functions at a glance

- Multistandard platform
- Realtime TV signal and audio broadcasting signal generation
- Digital and analog transmission standards
- Available as a production solution (non-realtime)
- Wide output frequency range from 100 kHz to 3 GHz
- Internal digital and analog interferer simulation
- Realtime transmission simulations
- Bit error ratio (BER) measurement
- TS baseband generator
- TRP and ETI player, recorder
- I/Q arbitrary waveform generator

ROHDE&SCHWARZ

Introduction

The R&S®SFU broadcast test system has been designed as a platform for different applications and for future options. It provides a number of instruments and applications in a cabinet of only four height units and offers 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.

You can easily switch operating parameters (e.g. roll-off, puncturing rate, QAM mode) and select operating parameters whose values exceed those defined in the standard for lab applications. For special tasks such as in DVB-T/H, modulation, individual carriers and carrier groups can be deactivated. Sweeps across the entire RF range are possible.

General characteristics

- Multistandard platform
- Digital TV signal generation
- Analog TV signal generation
- Audio broadcasting signal generation
- Output frequency from 100 kHz to 3 GHz
- Generation of internal interferers
- 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, 8.4")
- Intuitive user interface with Windows XP Embedded
- Context-sensitive help system
- User-definable favorites for fast access
- Easy software update by means of USB and Windows

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

Front view of the R&S®SFU

Unrivaled flexibility for research and development

- Expandable multistandard platform
- Universal coder for realtime signal generation
- Transmission simulations
- TS baseband generator
- TRP and ETI player, recorder
- Video and audio generator
- Arbitrary waveform generator with 128 Msample, supported by R&S®WinIQSIM™ software
- Variety of signal libraries with waveforms and transport streams
- Internal hard disks for storing waveforms and streams
- Integrated power measurement with external power sensors

Ideal for use in production

- Wear-free electronic attenuator of up to 3 GHz over the full level range
- Minimum space requirements: TS/video generator and test transmitter are accommodated in one instrument of only four height units
- Favorably priced and future-proof non-realtime production solution, since it can be upgraded with software at any time
- Fast, flexible software option solutions for new requirements

Easy remote access

- Remote control via GPIB and LAN (VXI 11)
- User-friendly remote operation by VNC or Remote Desktop
- USB connectors for keyboard, mouse and USB memory stick

One-box solution

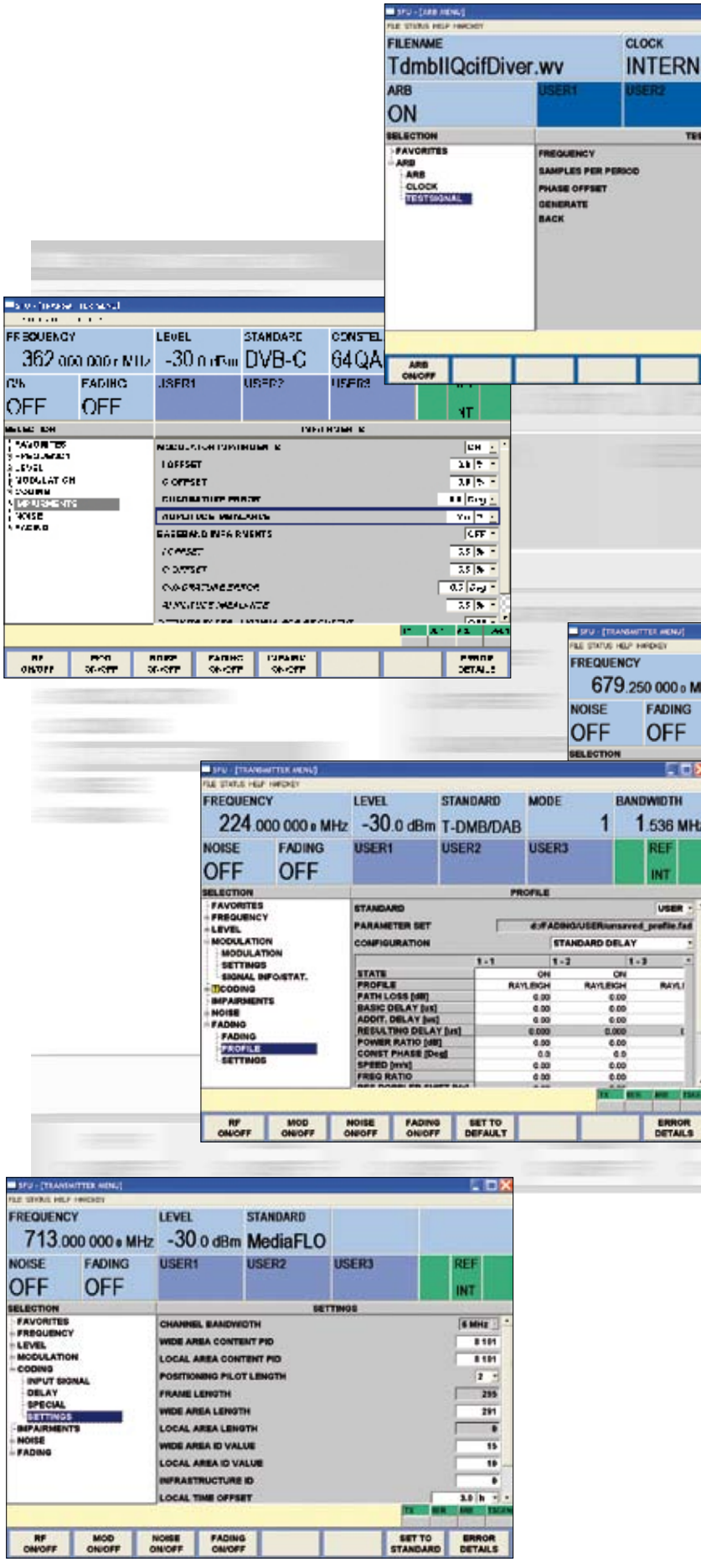
Test transmitter
RF signals for a variety of analog and digital transmission standards can be transmitted over a wide, user-variable frequency range by the integrated test transmitter. It is easily possible to switch over between the different standards for terrestrial, satellite, or cable transmission. The software is reloaded to provide the multistandard test transmitter functionality, and a highly accurate spectrum is generated.

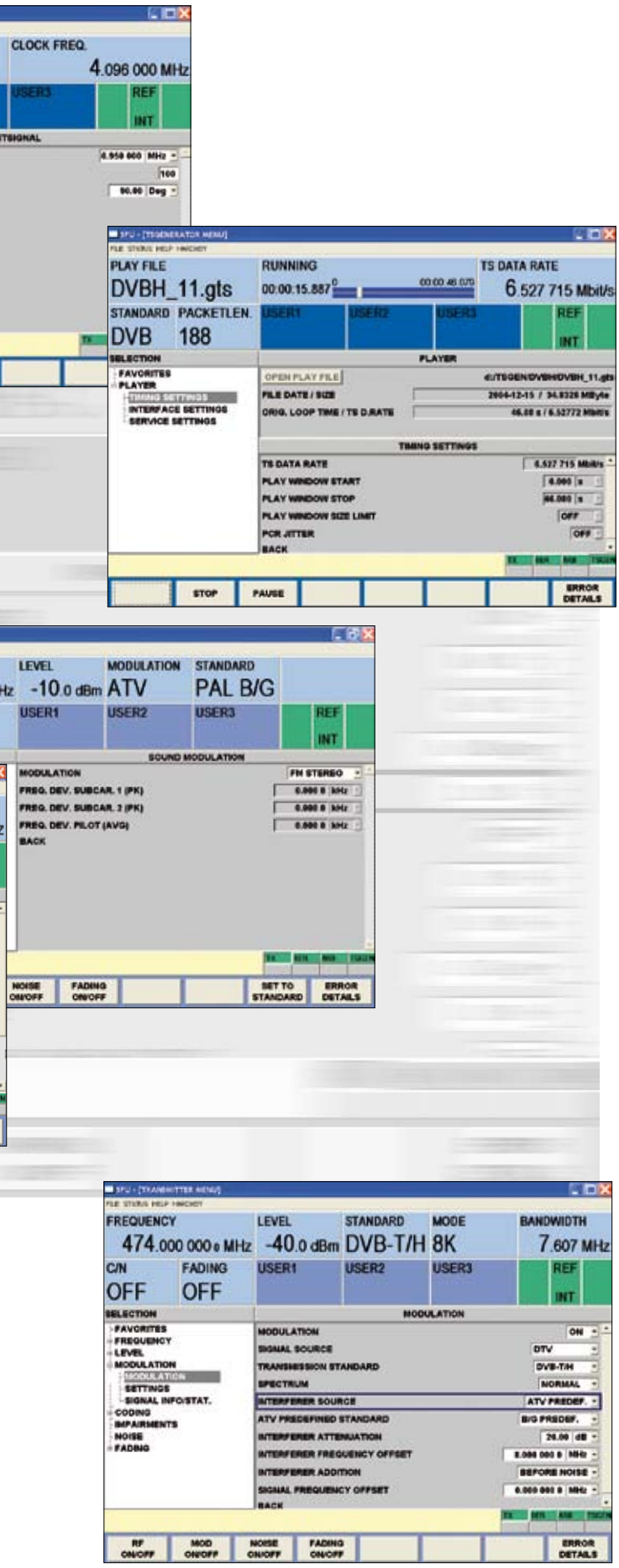
Bit error ratio meter
The integrated BER meter makes it possible to measure and evaluate errors on the transmission link. A BER value can be determined on the transport stream in parallel or serially as well as via the serial data and clock circuits.

Channel simulator
Integrated transmission simulators for AWGN, phase noise, impulsive noise and fading are available for simulating real and, above all, reproducible environmental conditions in the lab.

Transport stream signal source
Video and audio applications require baseband signals. A variety of transport stream or analog video signals are available as transport stream signal sources.

- Rohde & Schwarz libraries with ready-to-use special signals for tests and development can be replayed with the transport stream and video generator.
- Customer files can be easily loaded and replayed with the transport stream player.
- The internal transport stream recorder supports recording of customer transport streams from any sources.





I/Q signal generator
Customer I/Q waveforms or Rohde & Schwarz waveform libraries for different transmission standards can be replayed with the arbitrary waveform generator.

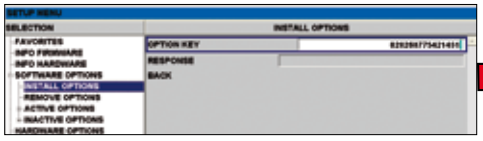
Power measurement
High-precision power measurements with power sensors from Rohde & Schwarz can be performed and displayed on the R&S®SFU's large screen.

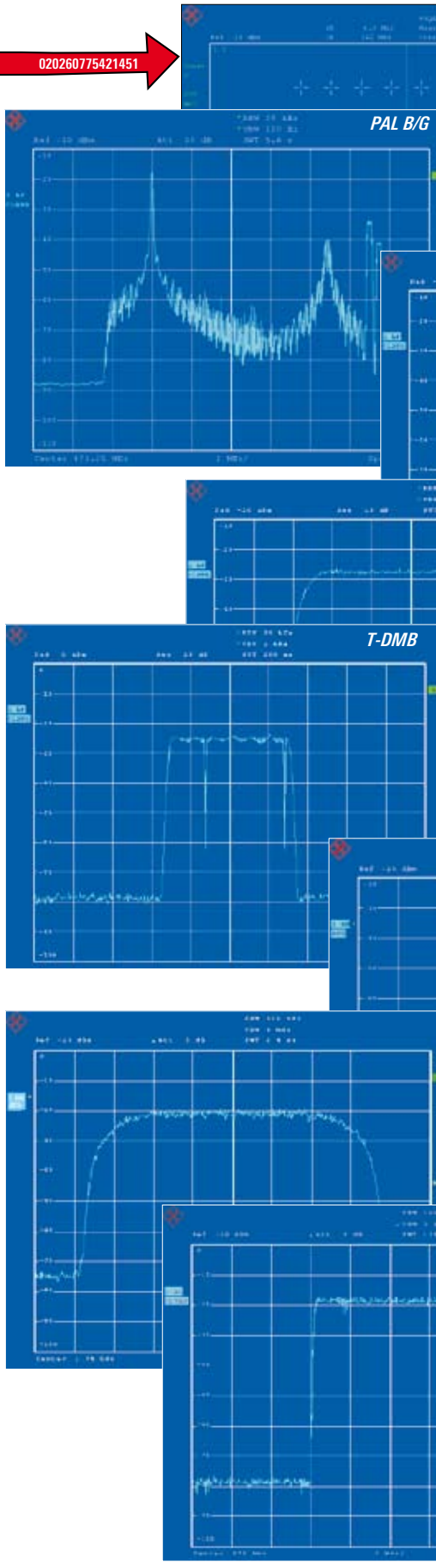
High output power
High output levels and signal amplifiers are usually required in production. The R&S®SFU provides this high output power with its high power option.

I/Q interface
The digital I/Q interface provides the high-quality I/Q signals that are required in development as input and output signals. The instrument also features an analog I/Q interface and an I/Q wideband input that allows I/Q signals to be fed directly to the modulator.

Coders

All realtime coders are software-based; you can activate them immediately by means of an enabling code (see right). It is thus not necessary to open the instrument.





Cable standards

DVB-C
The DVB-C coder supports all QAM modulations defined in the EN 300429 standard. The powerful coder hardware is also able to cover high-order QAM modulations that have not yet been standardized.

ISDB-C
ISDB-C is a Japanese cable standard based on ITU-T J.83 Annex C. The DVB-C coder in the R&S®SFU supports all QAM modulations defined in this standard.

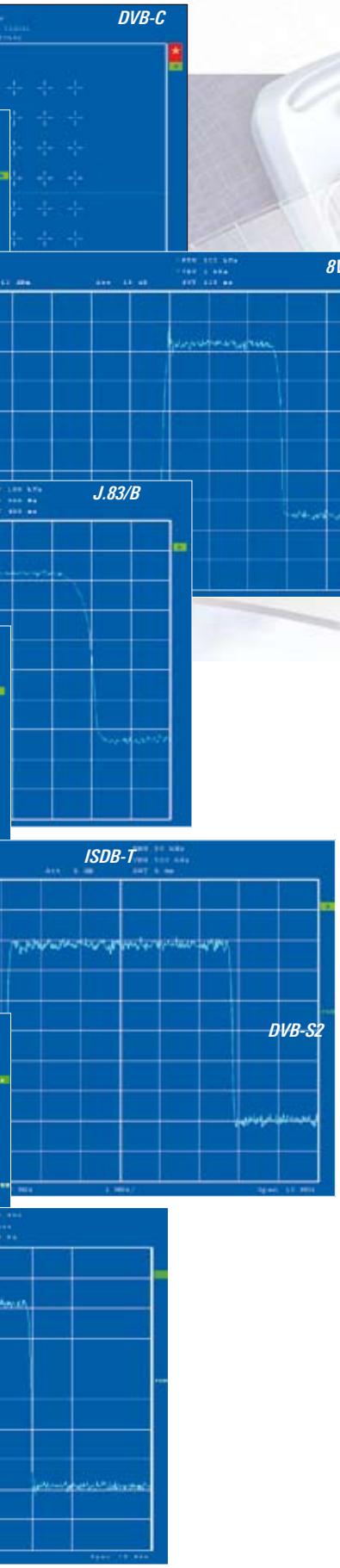
J.83/B
J.83/B is an American cable transmission standard. The coder also supports the standard enhancement with 1024QAM.

Satellite standards

DVB-S, DVB-S/DSNG
DVB-S (EN 300421/EN 301210) was introduced in 1994 as a satellite transmission standard. DVB-S uses QPSK modulation. Since its introduction, DVB-S has established itself as the world's most widely used satellite transmission standard. DVB-S/DSNG also uses 8PSK and 16QAM.

DVB-S2
DVB-S2 is an innovative and efficient channel coding method that is used in combination with high-order modulation modes. The method is very robust, offers safe reception and provides up to 30 % higher data transmission rates than DVB-S. The R&S®SFU supports the broadcast service mode for non-backwards-compatible broadcast services.

DIRECTV
DIRECTV (and DIRECTV legacy mode) is a proprietary standard with conditional access that is widely used in America and in the United States. For transmission, a proprietary transport stream protocol with 130-byte packets is generated. After conversion to 188 bytes, DIRECTV transport streams can be replayed with the R&S®SFU-K22 TRP player option.



Digital terrestrial TV standards

DVB-T
DVB-T permits high-quality transmission of digital broadcast signals. Its success will continue with the conversion from analog to digital TV.

ISDB-T
ISDB-T is a Japanese digital standard for terrestrial transmission of video, audio, and data signals by means of 13 segments. ISDB-T with partial reception is for mobile operation.

ISDTV
ISDTV is the Brazilian digital standard for the terrestrial transmission of video, audio, and data signals. It is based on ARIB STD-B31 and thus corresponds to ISDB-T as regards RF transmission.

DMB-T
DMB-T is a non-standardized multicarrier transmission method developed for use in China. It can be regarded as the predecessor of DTMB (GB 20600-2006).

DTMB (GB 20600-2006)
DTMB was developed in China and has meanwhile become known as the GB20600 standard. It offers high-quality digital TV with excellent characteristics, based either on an OFDM or a single-carrier transmission method.

ATSC/8VSB
8VSB is a terrestrial DTV standard from the USA with vestigial sideband modulation. At a bandwidth of 6 MHz, a sideband is suppressed in the spectrum.

ATSC/A-VSB
A-VSB is another terrestrial DTV standard from the USA. It is based on 8VSB and has been especially developed for mobile reception.

Analog terrestrial television standards

B/G, D/K, M/N, L and I
Analog standards with the B/G, D/K, M/N, L, and I transmission systems as well as the PAL, NTSC, and SECAM color systems are also available. Since the baseband signal has already been integrated, an additional signal generator is not required.

Mobile TV standards – video goes mobile

The following standards are terrestrial transmission methods for broadcast applications with mobile receivers such as mobile phones and PDAs.

DVB-H

The DVB-T/H coder provides the following functions: the newly introduced 4k mode, use of the TPS carriers for time slicing signaling, the additional 5 MHz channel bandwidth and corresponding native and in-depth symbol interleavers as well as MPE forward error correction (FEC). Hierarchical coding is also possible.

T-DMB

T-DMB was developed in Korea and is based on the digital audio broadcasting (DAB) standard known in Europe, which was also developed for mobile reception with radios. The T-DMB/DAB coder in the R&S®SFU supports both the Korean and the European transmission standards.

ISDB-T (partial reception)

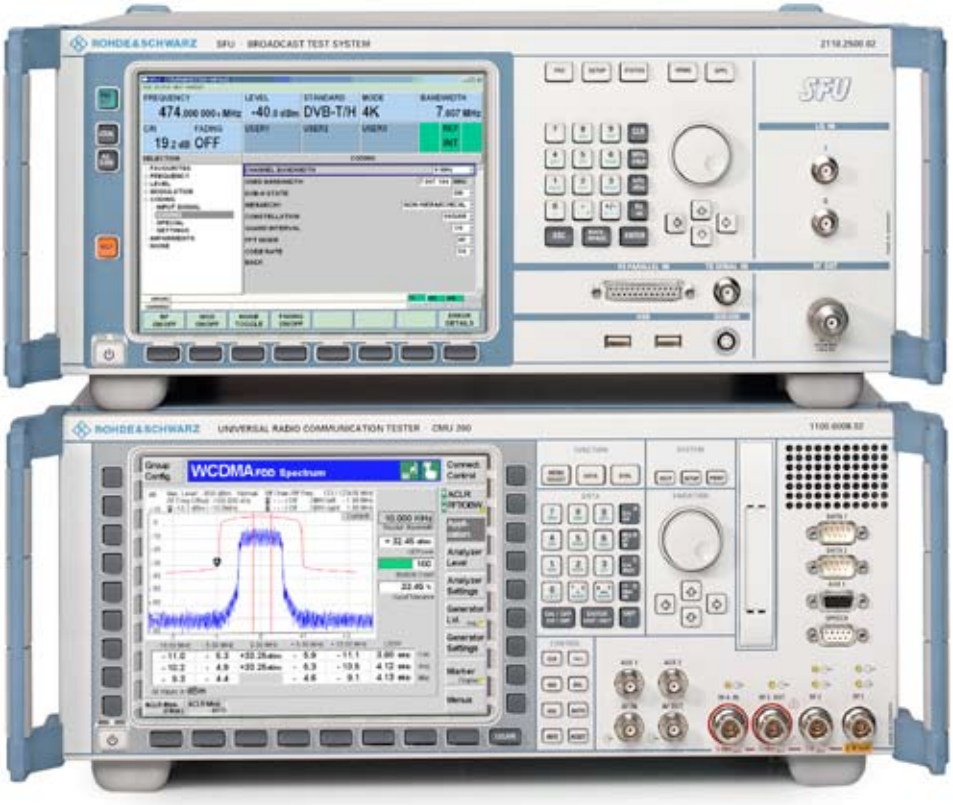
With mobile ISDB-T in accordance with ARIB 1.5, only one of altogether 13 available segments is used for transmission. The remaining 12 segments can transmit TV programs for stationary reception.

MediaFLO™

MediaFLO™ was developed and standardized by the American company QUALCOMM. The baseband signal in this proprietary standard is based on a transport stream with 188 bytes. MediaFLO™ is currently used in a nationwide network in the USA. QPSK and 16QAM methods are used as OFDM modulation at a bandwidth of 5 MHz and 6 MHz. The data rates transmitted to the mobile receiver range between 50 kbit/s and 1 Mbit/s.

DMB-TH

DMB-TH is a modification and enhancement of the DMB-T standard initially developed. The DMB-H mode makes it possible to use this modulation also for handheld reception.



Testing mobile broadcast applications with the R&S®SFU and the R&S®CMU200

Terrestrial sound broadcasting standards

DAB

Based on a COFDM transmission method, DAB was developed for digital and high-quality audio transmission to mobile receivers.

ISDB-T_{SB}

ISDB-T_{SB} is a Japanese narrowband digital sound broadcasting standard for the terrestrial transmission of audio and data signals by means of one segment. ISDB-T_{SB} is mostly used for mobile applications.

TS generator (R&S®SFU-K20)

A transport stream generator in the baseband internally provides test streams for the realtime coder. For external equipment, the test streams are made available at an ASI output. An external MPEG-2 generator is therefore no longer necessary. Furthermore, the number of instruments needed for testing set-top boxes is reduced and the costs are minimized.

The transport stream generator allows you to generate endless and seamless high-bit-rate MPEG-2 transport streams for the broadcast range. The SDTV transport stream library included as standard contains ATSC and DVB test streams. The numerous transport streams from Rohde & Schwarz cover a wide range of applications and test scenarios.

R&S®SFU transport stream generator

Transport stream/video libraries

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
- ATV-Video – analog video test patterns

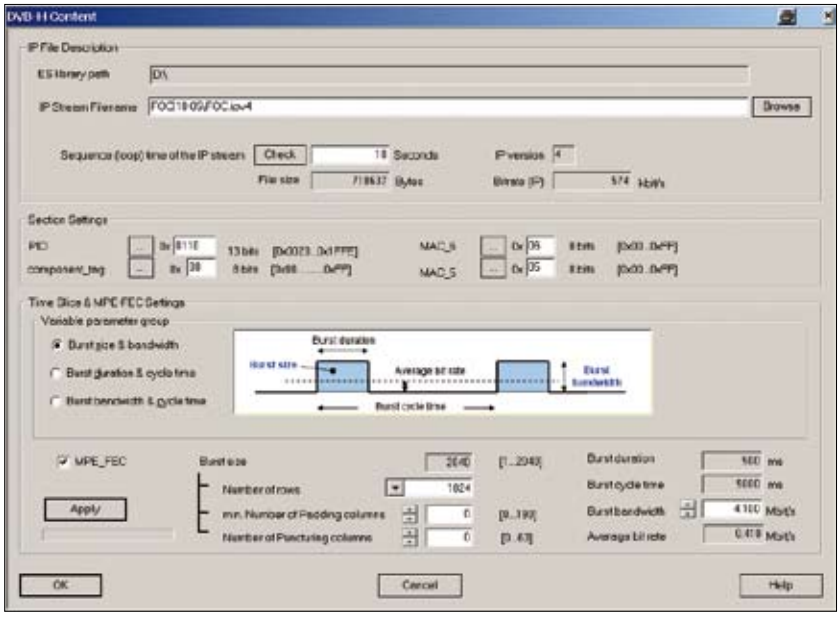
The libraries are continuously being expanded and adapted to technical requirements.

	1	2	3	4	5	6	7	8	9
Name	DVBH-01	DVBH-02	DVBH-03	DVBH-04	DVBH-05	DVBH-06	DVBH-07	DVBH-08	DVBH-09
DVB-H content	video, CIF, H264 coded, 128 kbit/s, IPv6	video, CIF, H264 coded, 128 kbit/s, IPv6	video, CIF, H264 coded, 128 kbit/s, IPv6	video, CIF, H264 coded, 128 kbit/s, IPv6	video, CIF, H264 coded, 128 kbit/s, IPv6	video, CIF, H264 coded, 128 kbit/s, IPv6	video, CIF, H264 coded, 128 kbit/s, IPv6	video, CIF, H264 coded, 128 kbit/s, IPv6	video, CIF, H264 coded, 128 kbit/s, IPv6
PID (dec)	0x012F (303)	0x012F (303)	0x012F (303)	0x012F (303)	0x012F (303)	0x012F (303)	0x012F (303)	0x012F (303)	0x012F (303)
MAC address byte 6; byte 5	0x06; 0x05	0x06; 0x05	0x06; 0x05	0x06; 0x05	0x06; 0x05	0x06; 0x05	0x06; 0x05	0x06; 0x05	0x06; 0x05
MPE-FEC	yes	yes	yes	yes	yes	yes	yes	yes	yes
Burst bandwidth	3000 kbit/s	1500 kbit/s	1000 kbit/s	500 kbit/s	256 kbit/s	1500 kbit/s	1500 kbit/s	750 kbit/s	750 kbit/s
Constant bandwidth	250 kbit/s	250 kbit/s	250 kbit/s	250 kbit/s	250 kbit/s	250 kbit/s	250 kbit/s	250 kbit/s	250 kbit/s
Burst cycle time	7698 ms	7697 ms	7698 ms	7697 ms	7696 ms	1955 ms	3911 ms	1955 ms	3910 ms
Burst duration	641 ms	1281 ms	1922 ms	3844 ms	7508 ms	329 ms	652 ms	650 ms	1303 ms
Receiver off-time	7057 ms	6416 ms	5776 ms	3853 ms	188 ms	1626 ms	3259 ms	1297ms	2607 ms
Ratio of burst duration to burst cycle time	1:12	1:6	1:4	1:2	1:1	1:6	1:6	1:3	1:3
Burst size	1.816 kbit	1.816 kbit	1.816 kbit	1.816 kbit	1.816 kbit	480 kbit	920 kbit	480 kbit	920 kbit
Number of rows	1024	1024	1024	1024	1024	256	512	256	512
Number of padding columns	28	28	28	28	28	25	25	25	25
Puncturing columns	0	0	0	0	0	0	0	0	0
Broadcast content	video PID 0x100 (256) 4 Mbit/s; audio PID 0x120 (272) 0.384 Mbit/s					video PID 0x100 (256) 4 Mbit/s; audio PID 0x120 (272) 0.384 Mbit/s		video PID 0x100 (256) 4 Mbit/s; audio PID 0x120 (272) 0.384 Mbit/s	

Example from the DVB-H transport stream library

Stream generation tools

Stream generation tools provide full flexibility when generating your own streams, which can be used with the R&S®SFU-K20 TS generator. The R&S®DV-ASC advanced stream combiner allows you to generate your own transport streams, also for DVB-H.



R&S®DV-ASC advanced stream combiner

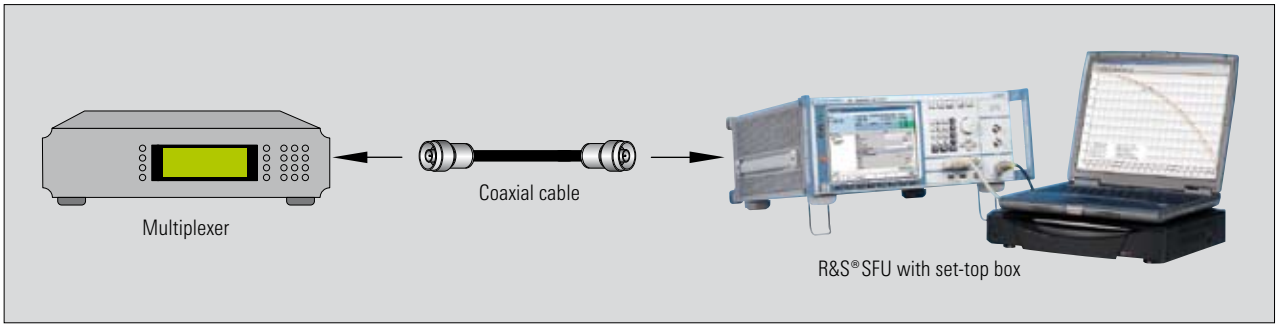
TS recorder (R&S®SFU-K21)

A transport stream recorder and player as an expansion of the data source is available for the R&S®SFU. It allows you to record any externally applied transport streams and ETI data streams at data rates between 100 kbit/s and up to 90 Mbit/s.

The available recording formats are TRP with eight bits (8-bit data), T10 (10-bit data, 1-bit data valid, 1-bit packet sync), and ETI. With the 8-bit and T10 formats, the parallel SPI (LVDS) interface is used. The R&S®SFU-B11 ETI interface (optional) is required for the ETI format.

The amount of data that can be recorded is limited only by the size of the hard disk. The recorded transport streams can be transferred to other storage media via the USB or LAN interface. Using the TS recorder, the streams can be replayed endlessly and seamlessly with packet-exact cutting at the end-of-file/start-of-file transition.

To enable R&S®SFU-K21, you require the R&S®SFU-B6 additional hard disk, the R&S®SFU-B4 memory extension 2, and the R&S®SFU-K22 TRP player.



Recording of an external transport stream with the R&S®SFU recorder function

TRP player (R&S®SFU-K22)

The TRP player 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®SFU file system and be replayed from there.

In addition, this TRP player is used to replay T-DMB and DAB ETI streams. For this purpose, the TRP player can replay predefined ETI test streams for T-DMB and DAB from an optional T-DMB/DAB library (R&S®SFU-K221).

To enable the R&S®SFU-K22 TRP player option, the R&S®SFU-B6 additional hard disk and the R&S®SFU-B4 memory extension 2 are required.

Video/audio generator (R&S®SFU-K23)

Together with the analog realtime coders, the video/audio generator offers a complete solution for modulated analog and interruption-free video test patterns and audio signals. The video/audio generator is generally available with every analog realtime coder.

In addition to the PAL, NTSC, and SECAM test patterns included in the basic configuration, an ATV-Video library with comprehensive analog video test signals can be integrated.

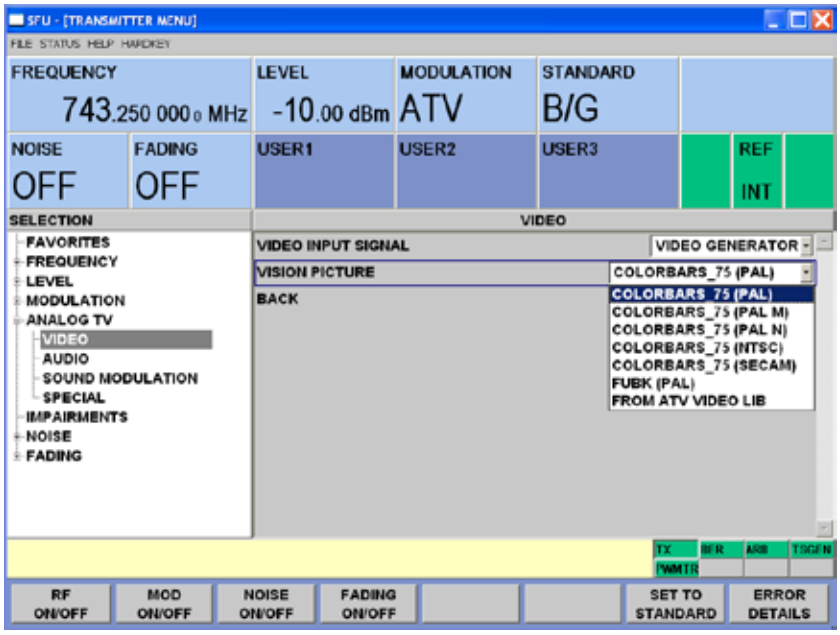
Arbitrary waveform generator

The integrated arbitrary waveform (ARB) generator of the R&S®SFU opens up a wide range of additional applications, such as simulating occupied adjacent channels, adding interferers to the useful signal, and generating user-defined RF signals (e.g. notched noise).

It is thus possible to generate any externally computed complex modulation signals. A hardware resampler and a low oversampling rate significantly reduce the memory space needed to store I/Q waveforms on the hard disk. This allows you to store a large number of I/Q waveforms directly on the hard disk.

Externally generated I/Q waveform files can also be loaded into the instrument and read out via one of the computer interfaces such as USB or LAN, or via the IEC/IEEE bus.

Together with the R&S®SFU-K81 option, which switches off the realtime coder function, the ARB generator can also be used for easy, cost-efficient production solutions. If a wider scope of functions is required, the realtime coders integrated in the R&S®SFU can subsequently be enabled by means of keycode options (see figure on page 12).



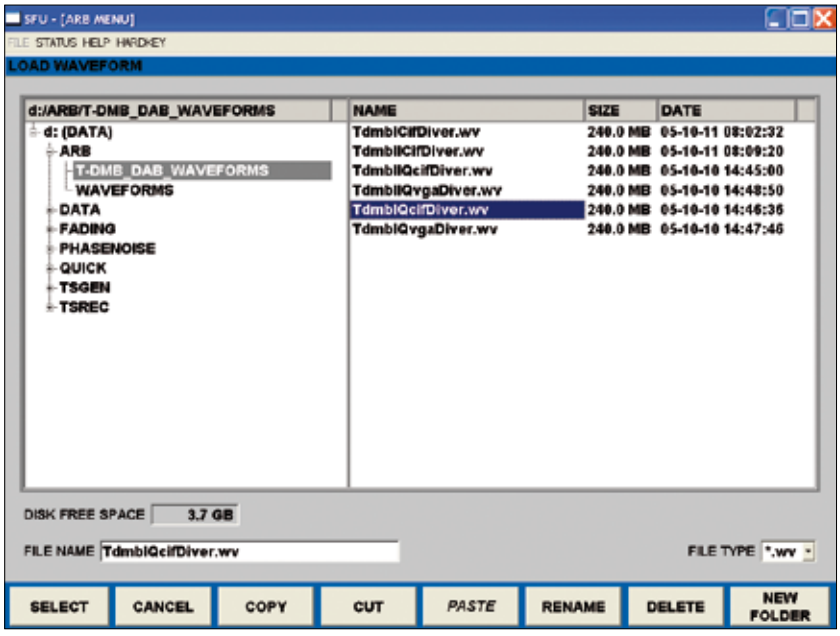
Selection of analog test pattern and audio signals

Waveform libraries

Additional waveform libraries allow quick evaluation of new modulations. 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)
- Digital/MBRAI interferers (R&S®SFU-K354)
- MediaFLO™ (R&S®SFU-K355)
- SCTE40 cable interferer (R&S®SFU-K356)

Further waveform libraries will soon be available.



Selection of T-DMB waveforms in the ARB generator

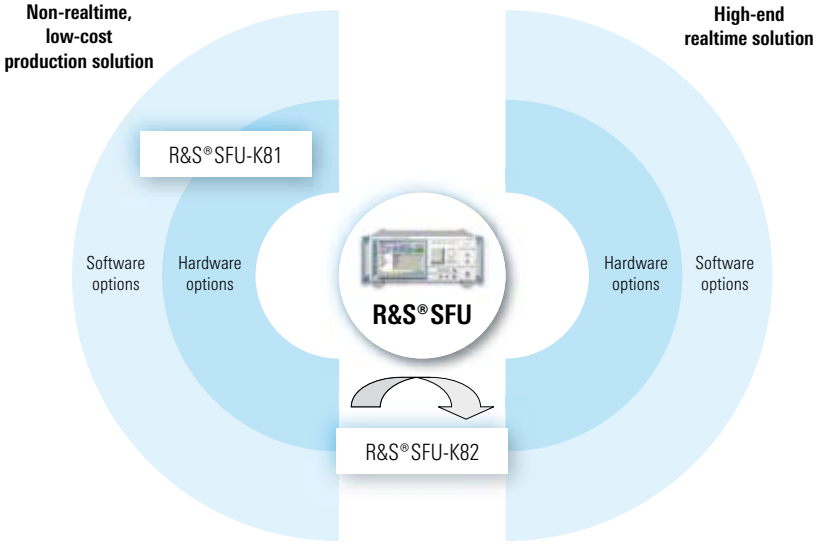
Simulation tools

The R&S®SFU allows full use of R&S®WinIQSIM™ simulation software. All waveforms generated with R&S®WinIQSIM™ can be loaded into the ARB generator of the R&S®SFU. Other software tools that utilize R&S®WinIQSIM™ can also be used.

Technical details

As an I/Q modulation source, the ARB generator features the following:

- 128 Msample memory for I and Q
- Up to 100 Msample/s

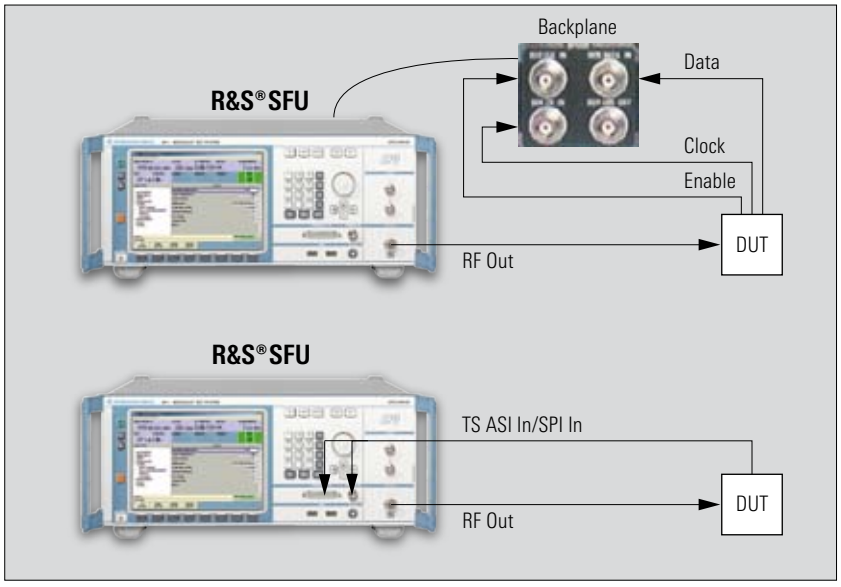


Expansion of a low-cost production solution into a high-end solution

BER measurement

The BER measurement, which operates independently of other applications, is used to check channel conditions. The integrated BER tester allows you to evaluate a signal demodulated and decoded by the DUT by means of the BER measurement. Two general methods are available for this purpose.

A measurement with a pure pseudo-random binary sequence (PRBS) can check the demodulation section of the receiver. A known PRBS-modulated data sequence is sent to the DUT, which decodes the signal and feeds the decoded data and the associated clock back to the R&S®SFU. If the error ratio of the decoding branch must also be measured, the MPEG-2 TS can be returned. In this case, the test signal includes an MPEG-2 TS that contains a PRBS as payload. If path measurements on a live MPEG-2 signal are to be performed, the null packets must contain a PRBS payload. The BER tester of the R&S®SFU synchronizes to the returned, known PRBS and counts the bit errors. The quotient obtained by dividing the number of error bits by the total number of bits is the BER.



Block diagram of BER measurement

Power measurement

To allow you to determine the input power directly on the DUT, the R&S®SFU provides a power measurement function. Software is available for controlling and evaluating the measurement.

Power measurement with the R&S®SFU and R&S®NRP-Z11

Available R&S®NRP power sensors:

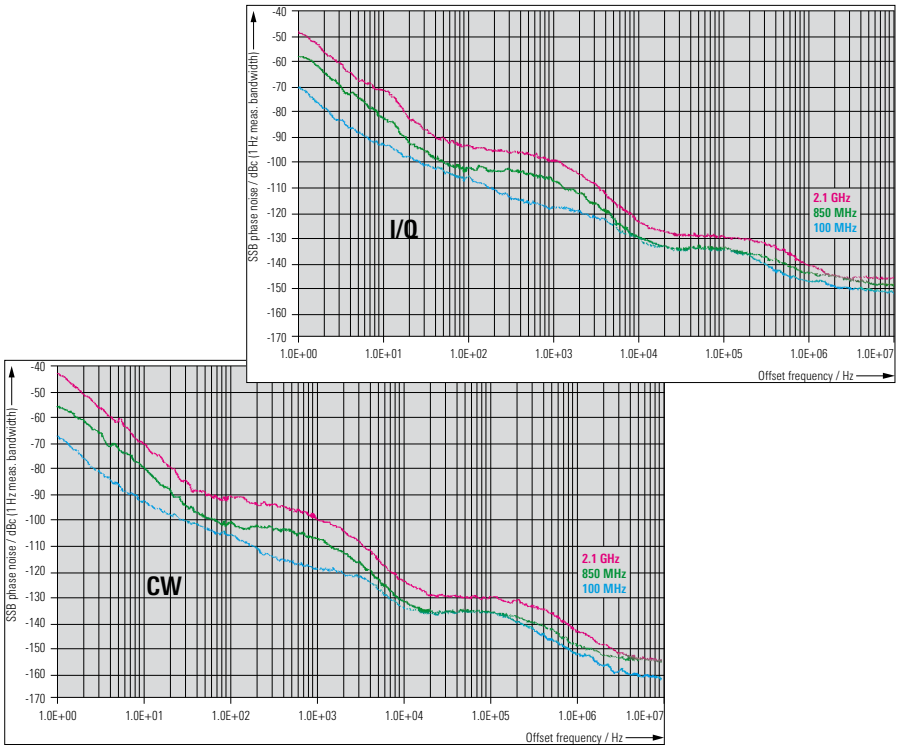
- Average power sensors
  - R&S®NRP-Z11
  - R&S®NRP-Z21
  - R&S®NRP-Z24
  - R&S®NRP-Z33
- Thermal power sensors
  - R&S®NRP-Z51
  - R&S®NRP-Z55

Signal quality

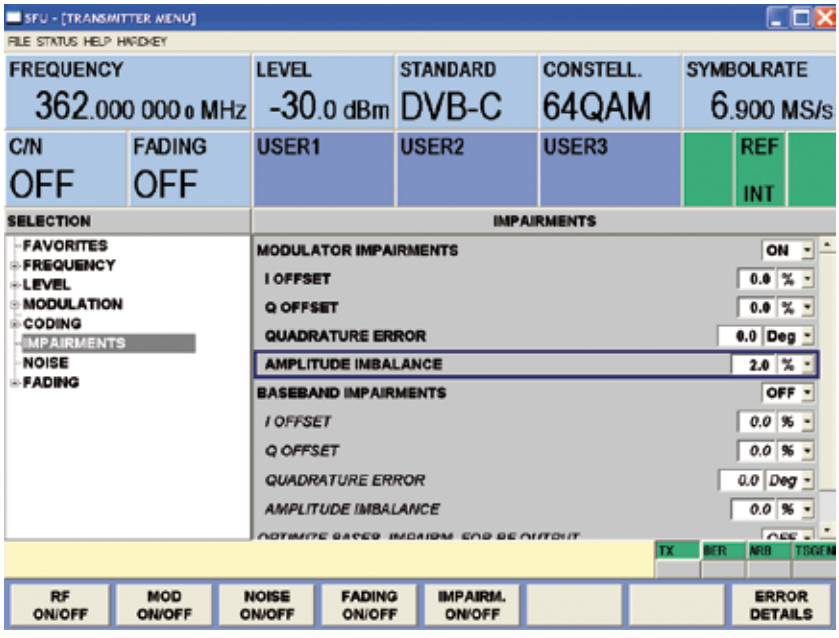
High signal quality and digital signal processing in the baseband make for accurate and reproducible measurements. A new type of digital level control ensures high precision. The overall level accuracy is less than 0.5 dB. The phase noise of the R&S®SFU synthesizer is typically less than –135 dBc/Hz (1 GHz, 20 kHz offset) with minimal modulation errors in the near-carrier range.

Modulation impairments

You can easily switch operating parameters (e.g. roll-off, puncturing rate, QAM mode) and select operating parameters whose values exceed those defined in the standard for lab applications. Non-ideal behavior of the I/Q modulator can be simulated by selectively changing amplitude, phase, and carrier leakage before the signal enters the I/Q modulator.



Typical phase noise characteristic

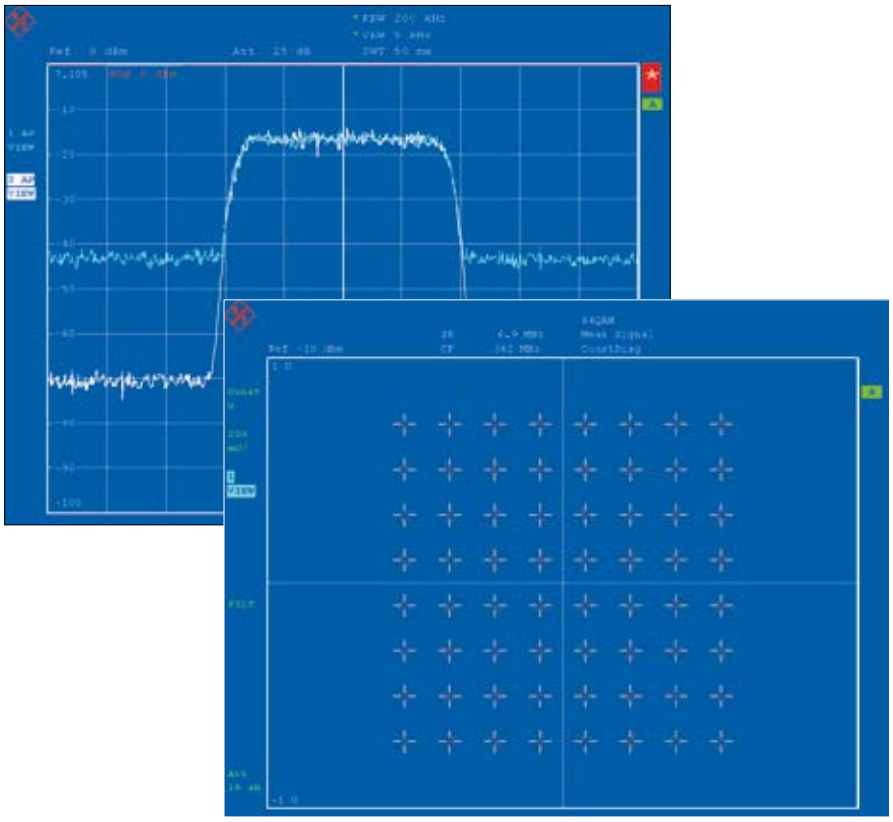


User interface for setting modulator impairments

AWGN generator (R&S®SFU-K40)

The digital additive white Gaussian noise (AWGN) generator is used as a source for generating a pure noise signal modulated onto the carrier and for influencing the actual useful signal. Realistic noise can be simulated in the transmission path – via satellite, cable or antenna – by generating a 96 MHz broadband AWGN signal with a Gaussian amplitude distribution in the digital baseband.

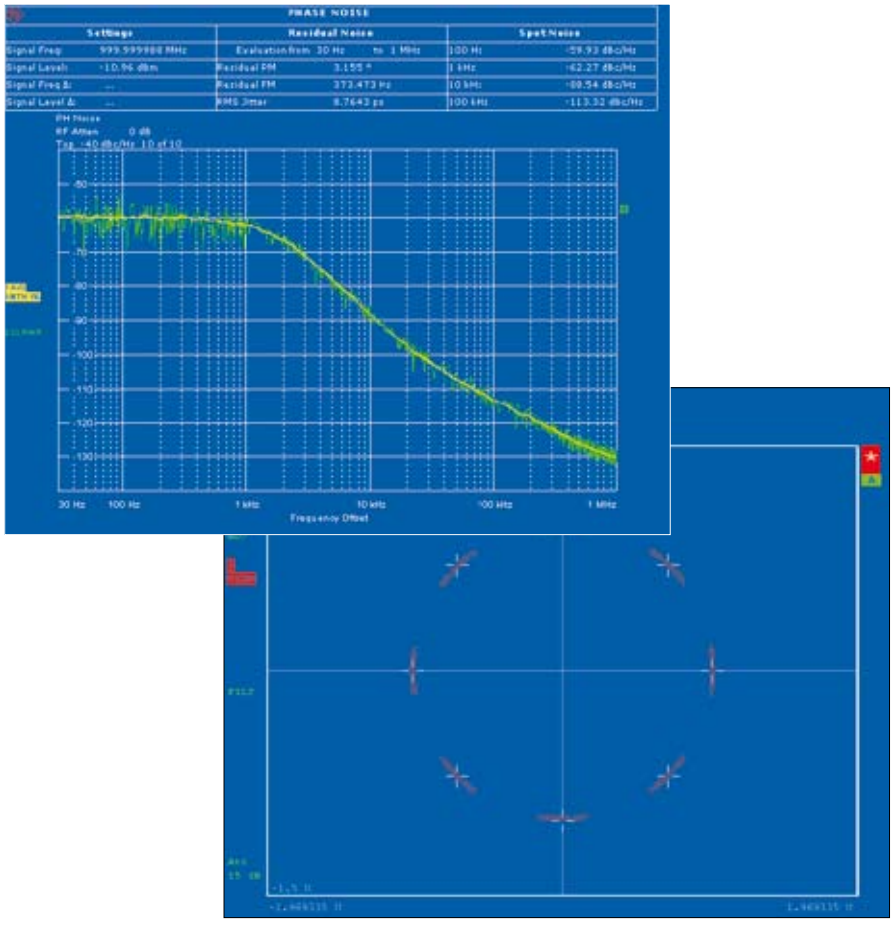
The AWGN generator can be used if the R&S®SFU-K40 software option has been enabled.



Useful signal with AWGN

Phase noise (R&S®SFU-K41)

The phase noise of the R&S®SFU synthesizer is typically less than –135 dBc/Hz (1 GHz, 20 kHz offset). The R&S®SFU is therefore ideal for simulating phase noise. The option allows you to simulate phase noise in oscillators and phase lock loops. In the setting range from –10 dBc/Hz to –110 dBc/Hz, the wanted phase noise can be loaded as a profile. User-defined profiles can be generated with conventional simulation programs such as MATLAB®, ported as a file to the R&S®SFU by means of a USB stick, and stored on the hard disk. The phase noise functionality can be used if the R&S®SFU-K41 software option has been enabled.



Phase noise simulation and phase noise with 8PSK

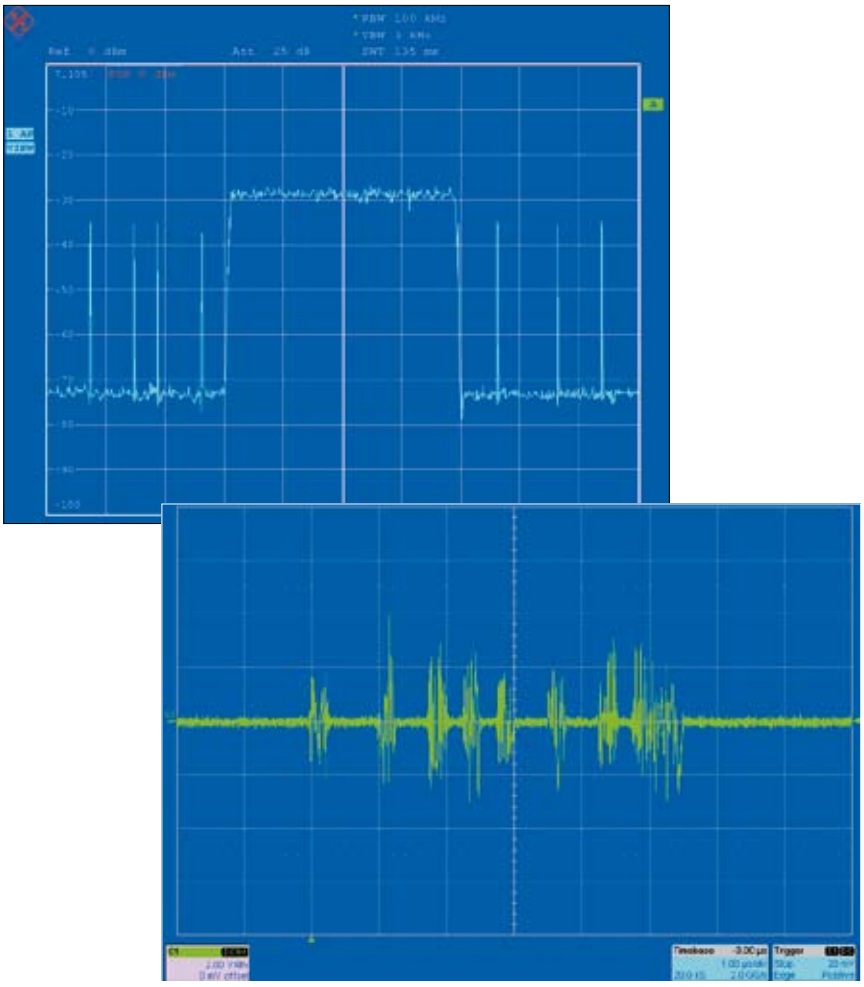
Impulsive noise (R&S®SFU-K42)

Impulsive noise permits the pulsed addition of an AWGN signal to the useful signal with a settable number of pulses.

Implementation is in line with DTG, Dbook, and A/74 with a maximum bandwidth of 96 MHz. In addition, the statistical distribution of the pulse intervals can be selected.

The pulse generator required for the pulses is integrated in the R&S®SFU. An additional external signal generator and the associated cabling are thus no longer necessary. The pulse spacing limits, the number of pulses, and the burst duration can be configured very easily.

The impulsive noise functionality can be used if the R&S®SFU-K42 software option has been enabled.



Impulsive noise with DVB-T

Multinoise use (R&S®SFU-K43)

The multinoise use functionality can be used if the R&S®SFU-K43 software option has been enabled.

It permits the simultaneous use of multiple noise sources in the form of an additive noise signal which, in turn, can be added to the useful signal.

Fading simulator (R&S®SFU-B30/R&S®SFU-B31)

The channel simulator (fading simulator) of the R&S®SFU is ideal for realtime simulation of multipath and mobile reception. The basic version (R&S®SFU-B30) provides up to 20 paths; with the full version (R&S®SFU-B31), up to 40 paths are available.

Profiles

The fading simulator supports profiles in accordance with DVB, ATTC, and MediaFLO™. Several fading profiles per path can be selected and simulated. You may choose from the following profiles:

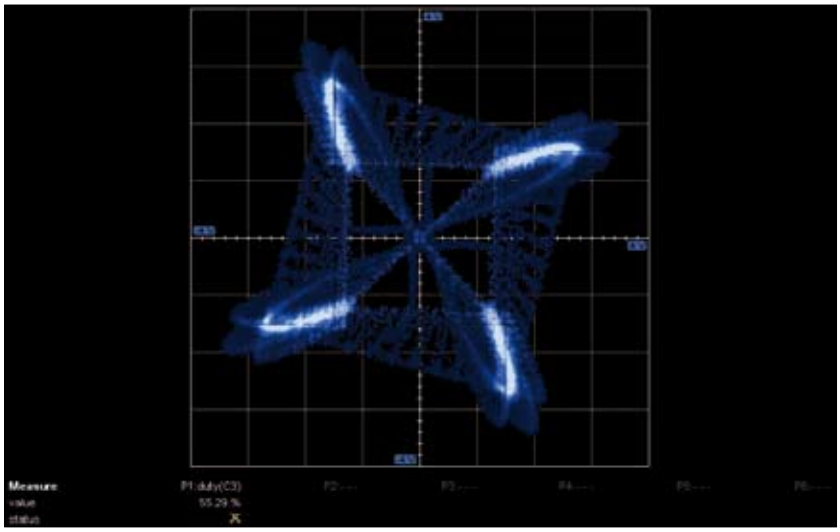
- Pure Doppler
- Rice
- Rayleigh
- Constant phase
- Static phase
- Lognormal
- Suzuki
- Gaussian (with PI and PO)

Dynamic fading profiles can be used with the R&S®SFU-K30 enhanced fading option.

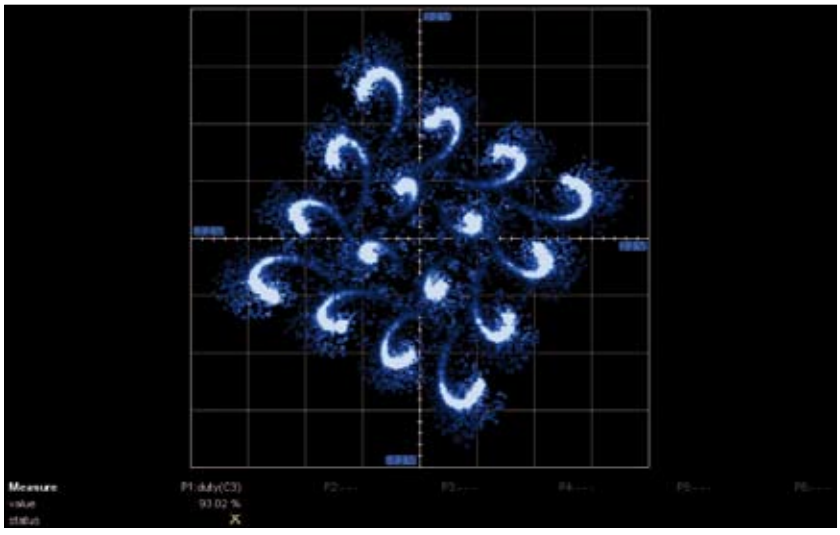
You can vary all fading parameters such as attenuation, phase, delay and Doppler, speed and direction.

DAB with Gaussian fading

The Gaussian fading (R&S®SFU-K32) used for DAB and for the Korean T-DMB mobile standard is included in the realtime T-DMB/DAB coder (R&S®SFU-K11) and in the T-DMB/DAB waveforms option (R&S®SFU-K351), respectively, and permits the corresponding channel simulations.



QPSK with Rayleigh profile



16QAM with Rice profile

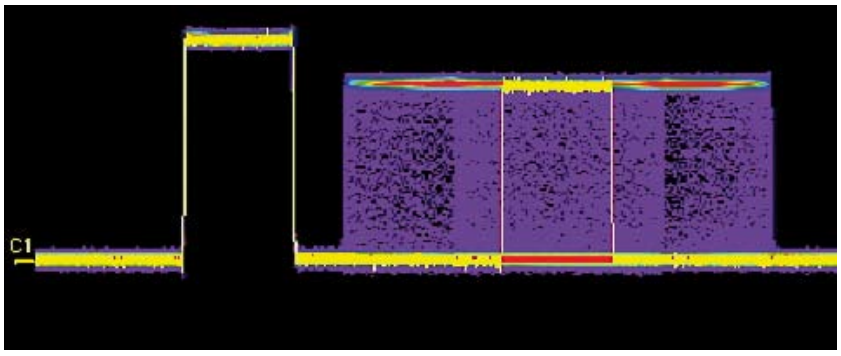
	1 - 1	1 - 2	1 - 3
STATE	ON	ON	
PROFILE	RAYLEIGH	RAYLEIGH	RAYL
PATH LOSS [dB]	3.00	0.00	
BASIC DELAY [us]	0.00	0.00	
ADDIT. DELAY [us]	0.00	0.20	
RESULTING DELAY [us]	0.000	0.200	
POWER RATIO [dB]	0.00	0.00	
CONST PHASE [Deg]	0.0	0.0	
SPEED [m/s]	13.90	13.90	
FREQ RATIO	1.00	1.00	
RES DOPPLER SHIFT [Hz]	46.37	46.37	
CORRELATION PATH	OFF	OFF	
COEFFICIENT [%]	0	0	
PHASE [Deg]			

Fading table of the R&S®SFU with a selection of fading profiles

Enhanced fading (R&S®SFU-K30)

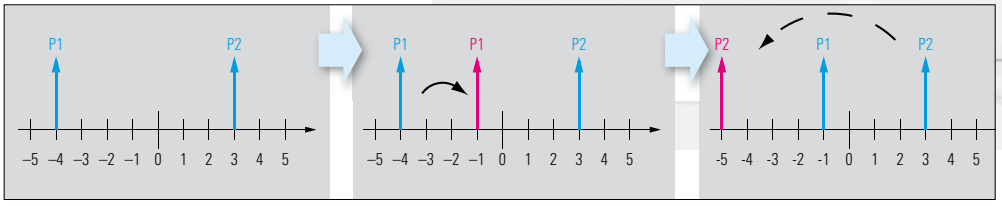
The moving propagation and birth-death dynamic fading configurations can be used to increase the resolution of the fading path delay to simulate dynamic propagation conditions as well as fine delay configurations. These configurations are provided by the enhanced fading option.

The enhanced fading functionality can be used if the R&S®SFU-K30 software option has been enabled. It requires an installed R&S®SFU-B30 option (or R&S®SFU-B30 and R&S®SFU-B31).



Dynamic fading with moving propagation

Dynamic fading with birth-death



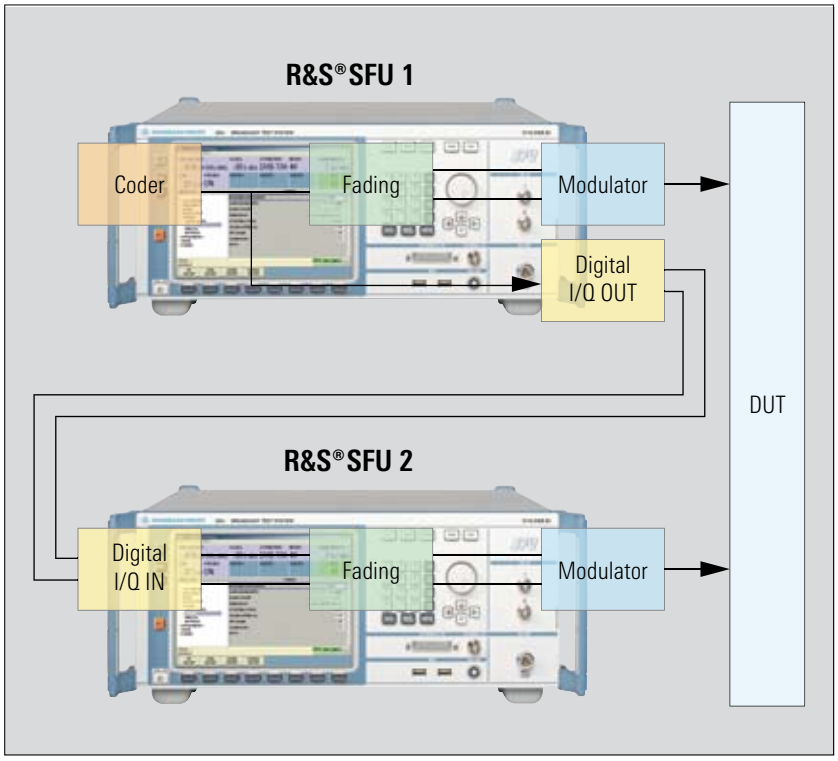
Diversity simulation

When testing diversity receivers, a separate RF receive signal must be provided for each antenna of the receiver. The receive signals must have the same baseband signal and the RF signal must be coupled. The noise and fading signals, however, must show no correlation; this is only possible with one R&S®SFU per antenna.

The RF signals of the two R&S®SFUs are coupled as master/slave by means of the reference frequency.

The digital I/Q baseband signals are interconnected quickly, reliably, and without loss of quality via the extended I/Q interface between the R&S®SFUs.

The functions of the digital I/Q interface can be used after the R&S®SFU-K80 software option has been activated.



Setup for testing diversity receivers

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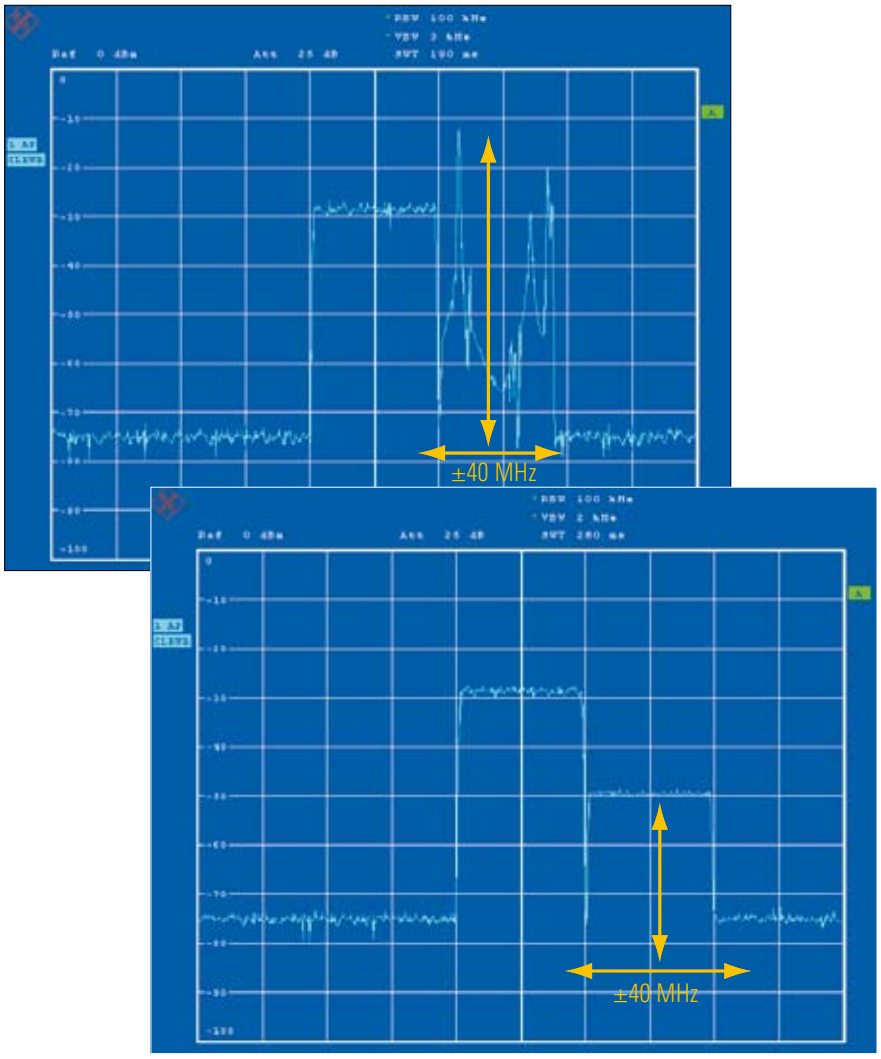
Interferers

Interferers can be added to the useful signals at different points along the transmission path. When adding the interferers, the level can be varied within a wide range. The maximum frequency shift to the useful signal can be ±40 MHz.

Transmission simulations can be used for the mixed signals. The R&S®SFU can simulate the impairment of the useful signal by interferers very compactly and without requiring any external signal sources.

In addition to the signals and signal libraries already available from Rohde & Schwarz (such as the multi ATV predefined option with analog TV signals), you can define other interferers by means of the R&S® WinIQSIM™ software and use them on the R&S®SFU.



Useful signal with analog (top) and digital interferer

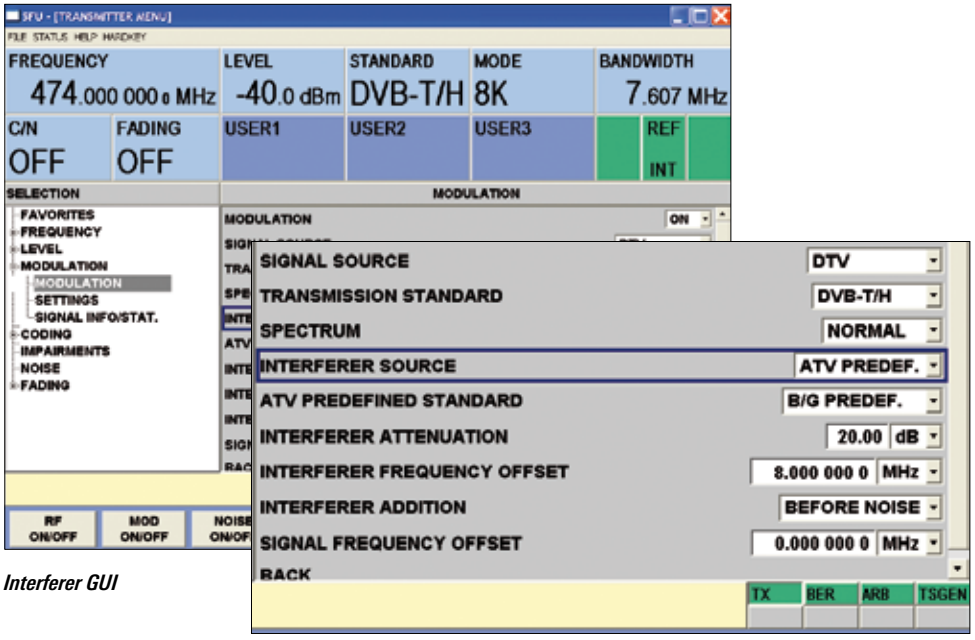
Interferer libraries

The following signal libraries are available as options for analog and digital interferer scenarios in line with IEC 62002 (MBRAI), NORDIG, and A/74:

- R&S®SFU-K199, multi ATV predefined, analog interferers
- R&S®SFU-K354, DTV interferers, digital interferers

For complex cable interferer scenarios, a collection of diverse test functionalities based on SCTE 40 is made available as a library in the following option:

- R&S®SFU-K356, cable interferers



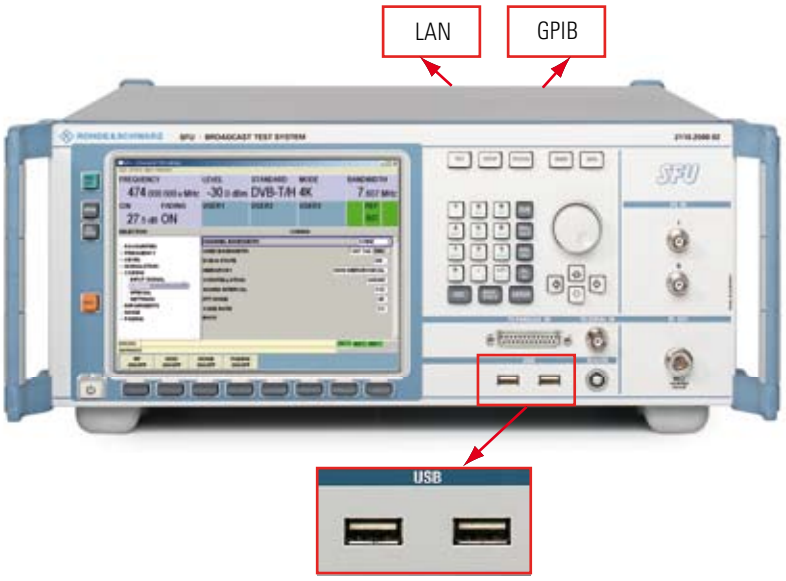
Interferer GUI

Interferer management

The R&S®SFU-K37 option permits easy and straightforward interferer management. Level, frequency, frequency offset, and signal type can be set.

Internal interferers
The R&S®SFU-K199/-K354/-K356 interferer libraries/signals or any other ARB I/Q signal can be used as internal interferers.

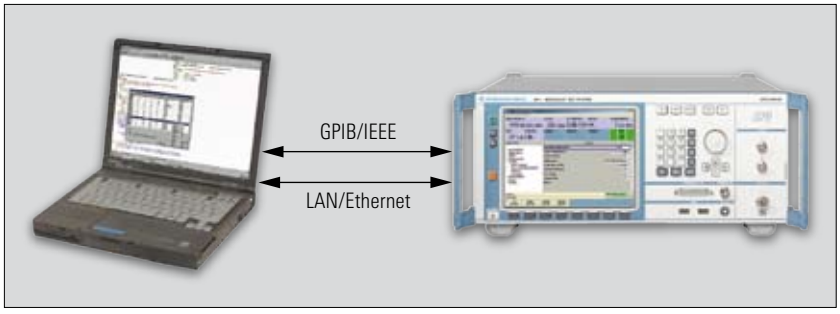
External interferers
External interferers can be applied via the R&S®SFU-K80 analog or digital I/Q interface while ARB sequences or analog TV signals can be provided internally.



USB interfaces on the front panel

Connectivity

LAN (100BaseT), GPIB, and a USB connector are available as interfaces on the instrument's rear panel. Files, firmware updates, and modulation data can be loaded fast and easily via these interfaces.



Possible remote control variants with the R&S®SFU

Remote operation and remote control

The R&S®SFU can be remote-operated via an Ethernet connection or in a LAN network over IP and is preconfigured for DHCP use. The preinstalled Remote Desktop software or the VNC software that comes with the instrument makes this very easy to do.

Remote control is possible by means of control commands via the IEC/IEEE bus (GPIB) or LAN. The R&S®SFU can thus be integrated into existing test programs and remote-controlled.

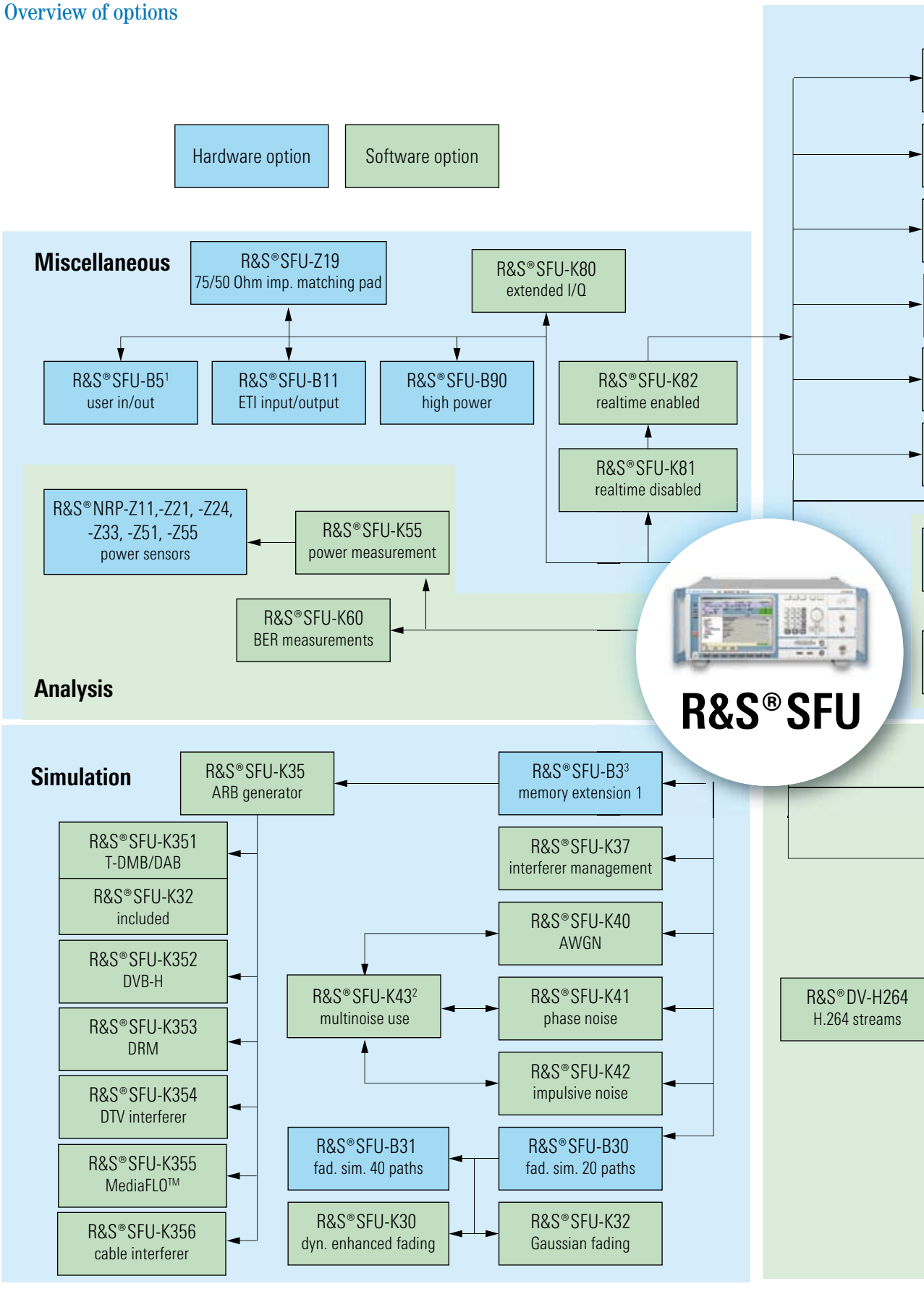
The compatibility of the R&S®SFU remote control commands with the R&S®SFE family ensures easy porting of the remote control programs. Programs generated for the R&S®SFU can thus be used in the lab or in production without any loss of time, since time- and cost-intensive verification tests do not have to be performed.

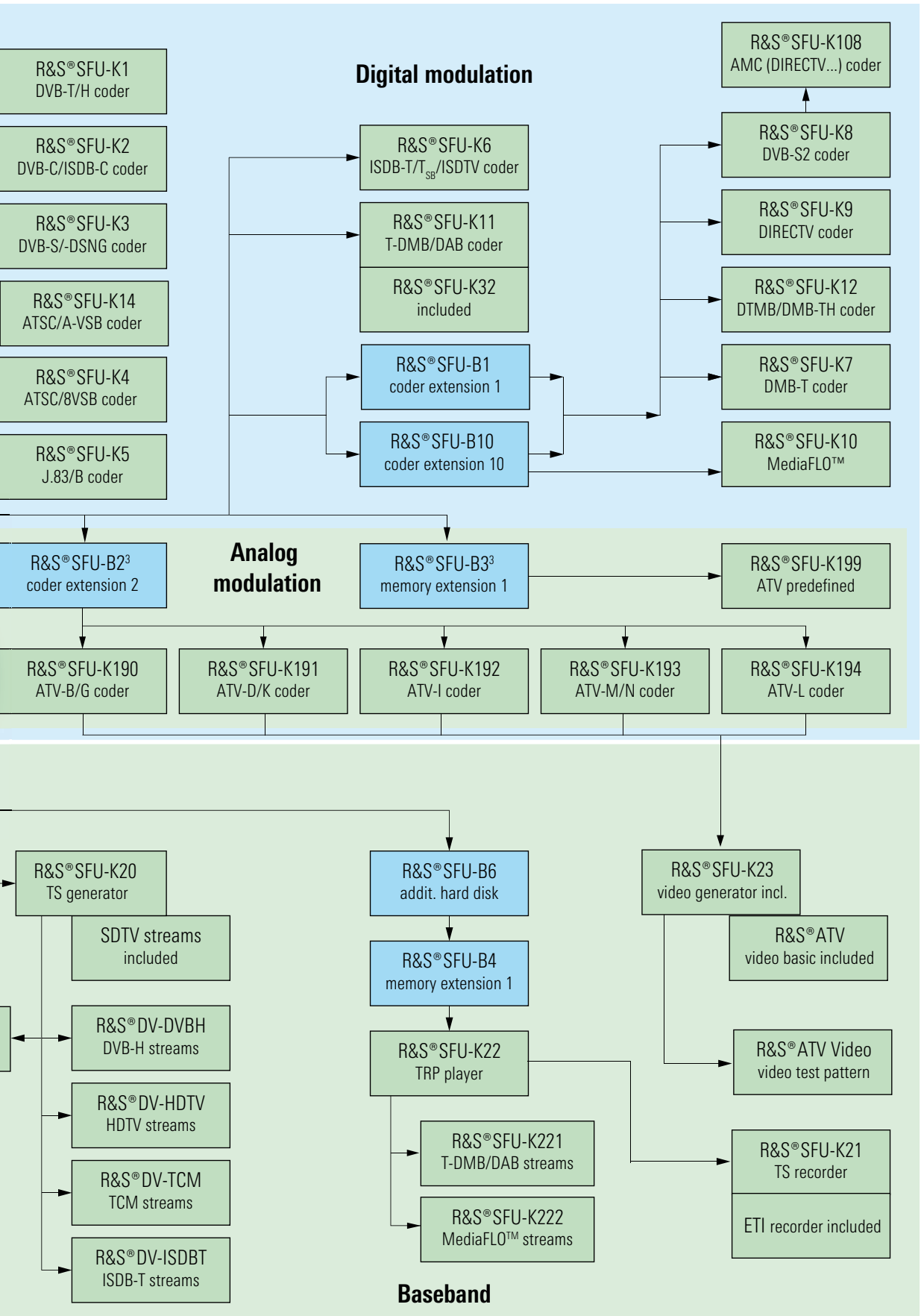
Looking forward

The R&S®SFU's modular design makes it a future-proof investment. Options can usually be activated quickly and conveniently on-site at any time by means of firmware update and license code.

This feature ensures fast and easy availability without time loss and is a big advantage for use in production and development. The R&S®SFU can be adapted to perfectly match current requirements, and its configuration can be tailored to meet customer-specific needs. It thus saves a lot of money yet offers full flexibility and openness for new, evolving fields of application.

Overview of options





[1] R&S®SFU-B2 and R&S®SFU-B3 pre-installed in R&S®SFU base units starting S/N 101000

[2] R&S®SFU-K43 software option for R&S®SFU base units delivered beginning May 2006

[3] R&S®SFU-B5 only supported until R&S®SFU firmware version 1.60

Certified Quality System
ISO 9001
DQS REG. NO 1954 QM

Certified Environmental System
ISO 14001
DQS REG. NO 1954 UM

For data sheet, see PD 0758.1658.22
and www.rohde-schwarz.com
(search term: SFU)

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