



TV Test Transmitter R&S®SFM

The multistandard platform for tomorrow's TV

The TV Test Transmitter R&S®SFM supplies vision and sound signals for all presently used TV standards.

All parameters of the vision and sound carriers generated by the R&S®SFM are automatically set according to the selected TV standard.

In addition, all parameters can be varied in a wide range about the specified standard values.

By virtue of its versatile configuration, the R&S®SFM is an ideal solution for a wide variety of applications in:

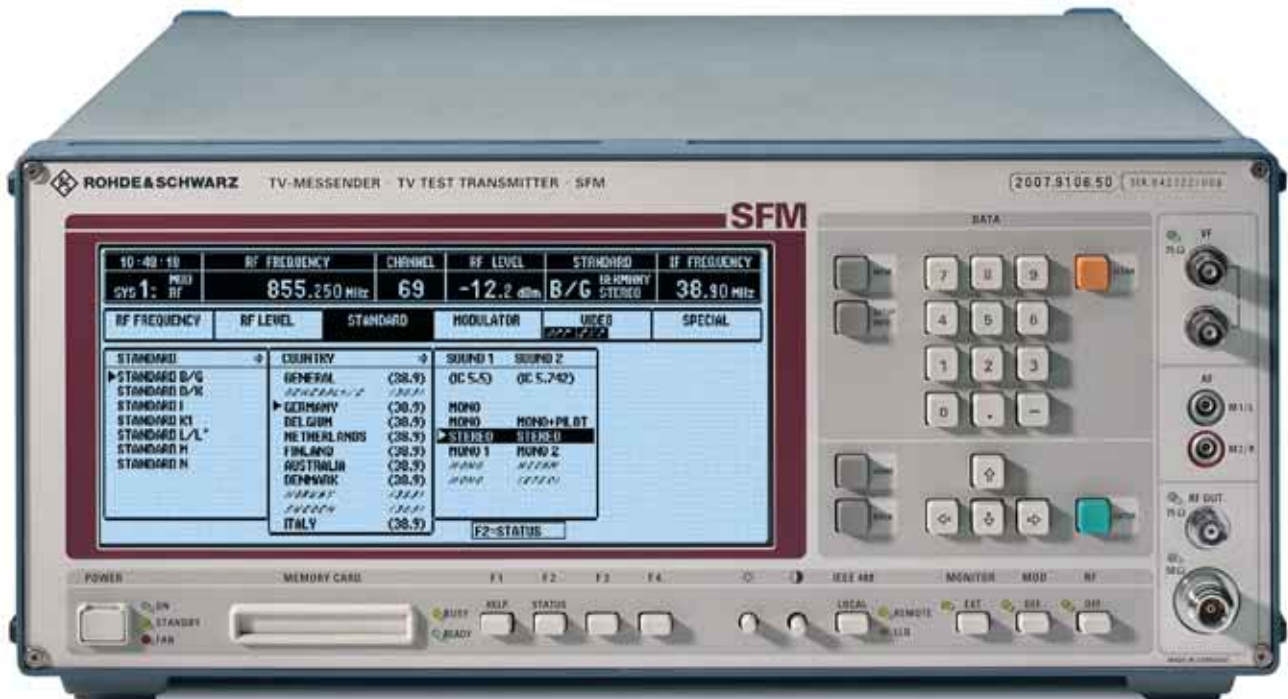
- ◆ Development and service
- ◆ Production and quality assurance of TV sets and modules
- ◆ EMC measurements

Main features of the R&S®SFM:

- ◆ Generation of standard TV signals (standards B/G, D/K, L/L', I, M, N, K1) including stereo/dual sound and NICAM
- ◆ Double-sideband test modulator for all IFs between 32 MHz and 46 MHz
- ◆ RF upconverter, 5 MHz to 1000 MHz, with high frequency resolution (1 Hz)
- ◆ Audio generator, stereo coder and NICAM generator



ROHDE & SCHWARZ



Uses

The flexible modular concept based on plug-ins (freely selectable) makes the R&S®SFM suitable for a wide range of applications.

By virtue of the highly compact design, a great number of different configurations can be implemented in a single R&S®SFM.

Depending on application and configuration, the R&S®SFM may be used as

- **Multistandard signal generator** providing vision and sound modulation signals for up to seven TV standards (B/G, D/K, L/L', I, M, N, K1) including sound as is required by the dual-carrier method or NICAM-728 as well as an RF upconverter used as a tunable test signal source

- **IF modulator** comprising several vision/sound modulators to various standards equipped for use in multi-channel and multistandard systems

Characteristics

The most important features of the R&S®SFM are:

- ◆ Generation of TV RF/IF signals (vestigial sideband amplitude modulation) to specified standards
- ◆ All vision and sound modulation parameters variable in wide ranges about standard values (see page 5)
- ◆ Vestigial sideband filter (SAW) and group-delay precorrection can be separately switched on/off
- ◆ Double-sideband test modulator for all IFs between 32 MHz and 46 MHz

- ◆ RF upconverter from 5 MHz to 1000 MHz; suitable for back-channel operation in analog and digital modulation modes
- ◆ Switchover between upper and lower sideband at RF
- ◆ Maximum RF output level from +10 dBm to 0 dBm depending on operating mode (optimum signal-to-noise and signal-to-intermodulation ratio)
- ◆ Non-interrupting level reduction down to -14 dB
- ◆ RF frequency resolution 1 kHz or 1 Hz for precision offset
- ◆ Frequency locking for all oscillators via internal 10 MHz reference frequency or external precision reference frequency
- ◆ RF output impedance 50 Ω (female N) or optional 75 Ω (female BNC)
- ◆ AF generator, 30 Hz to 15 kHz, and stereo/dual-sound coder (IRT/Korea)

- ◆ Wideband audio input for BTSC signals up to 120 kHz (standard M)
- ◆ NICAM QPSK modulator with generator for frequencies from 0 Hz to 15 kHz, adjustable BER, PRBS and I/Q test sequences
- ◆ NICAM intercarrier output adjustable between 5 MHz and 9 MHz, digital data/clock inputs/outputs for 728 kbit/s
- ◆ Instrument settings storable in internal memory or on memory card (PCMCIA)
- ◆ System-compatible due to IEC/IEEE-bus and RS-232-C interface
- ◆ Connectors for external keyboard and external monitor

Description

Each R&S®SFM frame can accommodate up to ten plug-ins so that the standards B/G, D/K, I, L/L', M, N and K1 can be implemented in a single R&S®SFM (see Fig. on right).

Vision modulator

The IF of the vision modulator (Fig. below) is set automatically when the standard is selected. The vision carrier is modulated with the residual-carrier setting stipu-

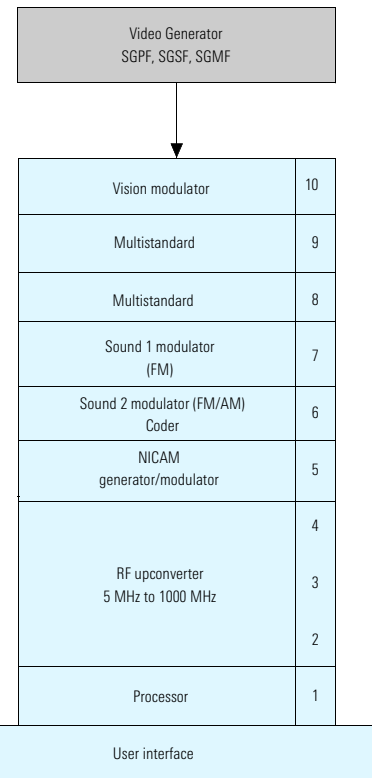
lated by the standard. Hard and soft video clamping can be selected. If soft clamping is used, hum is not suppressed for example.

In the multistandard module, the amplitude modulation spectrum is limited by standard-dependent vestigial sideband filters (high-quality SAW filters). A variety of video group-delay pre-corrections are also implemented in this module.

Sound modulators

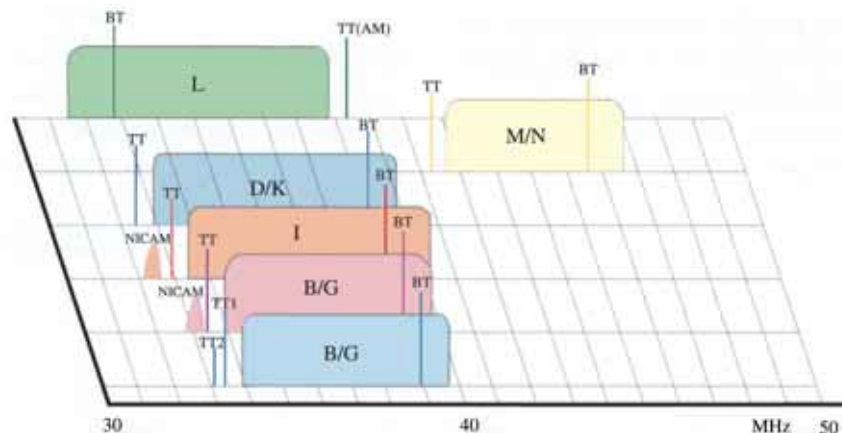
Similar to the vision carrier, the sound carrier IF, the sound-carrier method as well as country-specific features are set automatically when a standard is selected. In addition, the frequency spacing between vision and sound carrier can be varied within ± 7 MHz in 1 Hz steps. The sound-carrier method (mono, stereo, dual sound, mono + NICAM) is selected in the standards menu. AF coding is then carried out automatically. Audio multiplex signals with a frequency of up to 120 kHz can be used for the BTSC method (standard M).

The frequency deviation and the output level of the sound carriers are also set automatically in line with the standard.



Example of R&S®SFM equipped for standards B/G, D/K, I, L/L', M/N and K1

Intermediate frequencies and VSB filtering for various standards



NICAM modulator

The modulator generates a standard QPSK signal with the correct IF (33.05 MHz/32.348 MHz) for standards I and B/G. A NICAM signal at the correct RF is available for standard L/L'. In this case, the VSB characteristic is identical to that of standard B/G, i.e. the IF of the NICAM carrier for standard L/L' is also 33.05 MHz.

Since pulse filtering and the modulator are digital, a signal is obtained with the I and Q signals in quadrature without any phase error.

The NICAM modulator has inputs for an external data stream and a clock signal. When the external NICAM data stream fails, the test transmitter automatically switches over to a pseudo-random bit sequence (PRBS). Modulation can be switched off (continuous wave). A defined bit error rate can be set for the NICAM data stream.

The internal generator delivers a standard NICAM data stream which comprises a frame-alignment word, selectable control and additional data bits plus the digitally coded audio signals. The required signal coding can also be selected. The appropriate intercarrier is available at a separate output.

RF upconverter

The RF upconverter has an internal and an external IF input; the external one can be tuned to any IF vision carrier frequency between 32 MHz and 46 MHz. Thus almost any IF signal can be converted to the RF. At the RF it is possible to select the upper or lower sideband.

By virtue of this selection capability, all L/L' channels can be generated to standard. With the lower sideband selected, TV standards at any IF are possible (e.g. standard M, Japan, 58.75 MHz).

An RF output impedance of 50 Ω or 75 Ω (optional) can be selected.

Special configurations for intermodulation and linearity measurements in the form of programs may be called up. Level combinations for vision, sound 1 and 2 and sideband as specified in the standards are set with the modulation switched off. Linearity measurements are performed by automatic vision-carrier level switching every two seconds.

If parameters for the vision, NICAM and sound modulators are set to non-standard values, the display outputs a warning. However, compliance with the appropriate standard can be restored with a single keystroke.

Remote control

The R&S®SFM is equipped with an IEC/IEEE interface to SCPI and also has an RS-232-C interface for the remote control of all functions.

Settings can be loaded from or to an external memory card via a PCMCIA connector. Software updates can be carried out via the memory-card interface and the serial interface.

A powerful processor system controls all R&S®SFM modules via the serial SERBUS developed by Rohde&Schwarz. The SERBUS allows modules to be plugged into any slot.

Setting range for R&S®SFM parameters

| Parameter | Setting range | Step width | Parameter | Setting range | Step width |
|---------------------------------------------------------|-----------------------------|---------------|--------------------------------|--------------------------------------------|------------------|
| RF upconverter | | | Sound 2 modulator (AM) | | |
| Output frequency range | 5 MHz to 1000 MHz | 1 kHz or 1 Hz | Internal AF | 0.03 kHz to 15 kHz | 10 Hz |
| RF level (absolute level), ref. to 50 W | | | Modulation depth | 0% to 100% | 0.1% |
| Low noise mode | +10 dBm to -99 dBm | 0.1 dB | Carrier frequency | $ f_{vc} - f_s \leq 7$ MHz | 1 kHz or 1 Hz |
| | 117 dBmV to 8 dBmV | 0.1 dB | Carrier level | -10 dB to -38 dB | 0.1 dB |
| | 707.1 mV to 0 mV | 0.1 dB | Stereo/dual-sound coder | | |
| Normal mode | +6 dBm to -99 dBm | 0.1 dB | Pilot carrier | 50 kHz to 60 kHz | 10 Hz |
| | 113 dBmV to 8 dBmV | 0.1 dB | Pilot deviation | 1 kHz to 4 kHz | 100 Hz |
| | 446.2 mV to 0 mV | 0.1 dB | Pilot modulation frequency | | |
| Low distortion mode | 0 dBm to -99 dBm | 0.1 dB | IRT | 117.5 Hz/ | 0.1 Hz |
| | 107 dBmV to 8 dBmV | 0.1 dB | | 274.1 Hz | |
| | 223.6 mV to 0 mV | 0.1 dB | | ± 20 Hz | |
| RF level (non-interrupting), referred to absolute level | 0 dB to -14 dB | 0.1 dB | Korea | 149.9 Hz/ | 0.1 Hz |
| IF input frequency range | 32 MHz to 46 MHz | 1 kHz or 1 Hz | | 276 Hz | |
| | | | | ± 20 Hz | |
| IF input level (for external modulator) | 0 dBm to -7 dBm | 0.1 dB | Pilot modulation depth | 0% to 90% | 0.1% |
| Vision modulator | | | NICAM generator | | |
| Vision carrier (double-sideband modulation) | 32 MHz to 46 MHz | 10 kHz | Internal AF (L) | 0 kHz to 15 kHz | 20 Hz |
| Residual carrier (negative modulation) | 0% to 30% | 0.1% | Internal AF (R) | 0 kHz to 15 kHz | 20 Hz |
| Modulator balance | -50% to +50 | 1 | Headroom L (400 Hz) | | |
| Average level (offset) | -50% to +50% | 1% | Preemphasis (J17) | | |
| Sound 1 modulator | | | On | 16.5 dB to 60 dB | 0.1 dB |
| Internal AF | 0.03 kHz to 15 kHz | 10 Hz | Off | 0 dB to 60 dB | 0.1 dB |
| Deviation (15 kHz) | 0 kHz to 100 kHz | 10 Hz | Headroom R (400 Hz) | | |
| Carrier frequency | $ f_{vc} - f_s \leq 7$ MHz | 1 kHz or 1 Hz | Preemphasis (J17) | | |
| Carrier level | -6 dB to -34 dB | 0.1 dB | On | 16.5 dB to 60 dB | 0.1 dB |
| Preemphasis | 50 ms/75 ms/off | - | Off | 0 dB to 60 dB | 0.1 dB |
| Sound 2 modulator (FM) | | | Check bits 3 and 4 | 00 to 11 | binary (2 bits) |
| Internal AF | 0.03 kHz to 15 kHz | 10 Hz | Additional data | 000 0000 0000 to 111 1111 1111 | binary (11 bits) |
| Deviation (15 kHz) | 0 kHz to 100 kHz | 10 Hz | NICAM modulator | | |
| Carrier frequency | $ f_{vc} - f_s \leq 7$ MHz | 1 kHz or 1 Hz | BER | 2×10^{-3} to 1.2×10^{-7} | - |
| Carrier level | -10 to -38 dB | 0.1 dB | Carrier frequency | 32.348 MHz/ | 1 kHz or 1 Hz |
| Preemphasis | 50 ms/75 ms/off | - | | 33.05 MHz | |
| | | | | ± 200 kHz | |
| | | | Inter-carrier frequency | | |
| | | | Standard B/G, I | 5.0 MHz to 9.0 MHz | 1 kHz or 1 Hz |
| | | | | | |
| | | | Standard L/L' | 5.85 MHz | 1 kHz or 1 Hz |
| | | | | ± 200 kHz | |
| | | | Carrier level | -13 dB to -40 dB | 0.1 dB |

All vision and sound carriers can be separately switched on and off.

Self-explanatory menu guiding

Easy-to-understand and clearly structured menus allow safe and fast operation of the R&S®SFM at all configuration stages.

Status line

At the top of the large LCD, a clearly arranged status line is displayed where the current operating status of the R&S®SFM can always be seen at a glance.

| | | | | | |
|------------------|--------------|---------|-----------|---------------------|--------------|
| 11:26:26 | RF-FREQUENCY | CHANNEL | RF-LEVEL | STANDARD | IF-FREQUENCY |
| SYS 1: MOD RF | 855.250 MHz | 69 | -10.2 dBm | B/G GENERAL DUAL | 38.90 MHz |

The fields of the main menus to be called up for instrument settings are displayed below.

| | | | | | |
|--------------|----------|-----------------|-----------|-------|---------|
| RF-FREQUENCY | RF-LEVEL | STANDARD | MODULATOR | VIDEO | SPECIAL |
|--------------|----------|-----------------|-----------|-------|---------|

Main menus

The R&S®SFM's menu structure permits efficient operation even without any knowledge of the hardware configuration.

Settings disabled in the selected operating mode or menu items not provided for the present instrument configuration are written in italics.

| | | | | | |
|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------------------|--------------|
| 11:30:03 | RF-FREQUENCY | CHANNEL | RF-LEVEL | STANDARD | IF-FREQUENCY |
| SYS 1: MOD RF | 855.250 MHz | 69 | -10.2 dBm | B/G GENERAL STEREO | 38.90 MHz |
| RF-FREQUENCY | RF-LEVEL | STANDARD | MODULATOR | VIDEO | SPECIAL |
| STANDARD B/G STANDARD D/K STANDARD I <i>STANDARD L/L*</i> STANDARD H STANDARD N | COUNTRY GENERAL (38.9) GENERAL T/2 (38.9) GERMANY (38.9) BELGIUM (38.9) NETHERLANDS (38.9) FINLAND (38.9) AUSTRALIA (38.9) DENMARK (38.9) <i>INDIA (38.9)</i> <i>SWEDEN (38.9)</i> | SOUND 1 SOUND 2 (IC 5.5) (IC 5.742) MONO MONO+PILOT STEREO STEREO MONO 1 MONO 2 <i>MONO 1 MONO 2</i> <i>MONO MONO</i> | | | |
| F2=STATUS | | | | | |

Selecting one of the main menus by means of the cursor key opens up a sub-menu where further selections can be made.

Possible settings for the chosen menu item are displayed in pull-down menus.

Within a particular main menu, the complete menu tree together with all pull-down menus and current parameter settings is shown on the LCD.

The main menus are:

RF FREQUENCY

In this menu, the RF output frequency is set by a numerical entry of frequency and channel or special channel number. In addition, the upper and lower sideband at the RF can alternatively be selected.

| | | | | | |
|------------------|---------------------------|----------|-----------|---------------------|--------------|
| 11:30:50 | RF-FREQUENCY | CHANNEL | RF-LEVEL | STANDARD | IF-FREQUENCY |
| SYS 1: MOD RF | 855.250 MHz | 69 | -10.2 dBm | B/G GENERAL MONO | 38.90 MHz |
| RF-FREQUENCY | RF-LEVEL | STANDARD | MODULATOR | VIDEO | SPECIAL |
| RF-FREQUENCY | EDIT | | | | |
| FREQUENCY | 855.250 MHz | | | | |
| ► CHANNEL | 69 CH | | | | |
| SP-CHANNEL | sCH | | | | |
| CH / SP-CH STEP | 69 CH | | | | |
| SIDEBAND | ► UPPER (NORMAL) LOWER | | | | |

RF LEVEL

In this menu, the RF output level and the RF level mode (low distortion, normal, low noise or continuous) can be set. The RF signal may also be switched to the optional 75 Ω BNC output.

| | | | | | |
|---------------|-----------------------------------------------------|----------|-----------|------------------|--------------|
| 11:29:24 | RF-FREQUENCY | CHANNEL | RF-LEVEL | STANDARD | IF-FREQUENCY |
| SYS 1: | 855.250 MHz | 69 | -10.2 dBm | B/G GENERAL MONO | 38.90 MHz |
| RF-FREQUENCY | RF-LEVEL | STANDARD | MODULATOR | VIDEO | SPECIAL |
| RF-LEVEL | EDIT -10.2 dBm | | | | |
| RF-LEVEL MODE | LOW NOISE NORMAL LOW DISTORTION CONTINUOUS | | | | |
| RF-IMPEDANCE | 50 Ω | | | | |

STANDARD

The TV standard, associated country-specific characteristics (e.g. channel allocation) and the type of sound-carrier modulation can be selected in this menu (see Fig. at center of left page). All standard-specific parameters are automatically set.

| | | | | | |
|---------------|--------------------|----------|-----------|--------------------|--------------|
| 11:34:56 | RF-FREQUENCY | CHANNEL | RF-LEVEL | STANDARD | IF-FREQUENCY |
| SYS 1: | 503.250 MHz | 25 | -10.2 dBm | B/G FINLAND MONO/N | 38.90 MHz |
| RF-FREQUENCY | RF-LEVEL | STANDARD | MODULATOR | VIDEO | SPECIAL |
| STANDARD | COUNTRY | SOUND 1 | SOUND 2 | | |
| STANDARD B/G | GENERAL (38.9) | (IC 5.5) | (IC 5.85) | | |
| STANDARD D/K | GENERAL T/2 (38.9) | | | | |
| STANDARD I | GERMANY (38.9) | MONO | | | |
| STANDARD L/L* | BELGIUM (38.9) | MONO | | | |
| STANDARD N | NETHERLANDS (38.9) | MONO | | | |
| | FINLAND (38.9) | MONO | | | |
| | AUSTRALIA (38.9) | MONO | | | |
| | DENMARK (38.9) | MONO | | | |
| | | MONO | | | |
| | | NICAM | | | |

MODULATOR

In this menu, all vision and sound modulation parameters can be varied over a wide range (see page 5) about the values set automatically when a standard is selected. Even non-standard test signals can be generated (e.g. for determining limit values of TV modules). Parameters to standard can be restored by a single key-stroke (F3, F4).

| | | | | | |
|--------------|-------------------|---------------------|-------------------|--------------------|--------------|
| 11:30:28 | RF-FREQUENCY | CHANNEL | RF-LEVEL | STANDARD | IF-FREQUENCY |
| SYS 1: | 855.250 MHz | 69 | -10.2 dBm | B/G GERMANY STEREO | 38.90 MHz |
| RF-FREQUENCY | RF-LEVEL | STANDARD | MODULATOR | VIDEO | SPECIAL |
| MODULATOR | INTERN | VISION | EDIT | | |
| INTERN | VISION MODULATOR | VIDEO | CLAMPING ON | | |
| EXTERN | SOUND 1 MOD. (FM) | PRECORR ON | CLAMPING HARD OFF | | |
| | SOUND 2 MOD. (FM) | CLAMPING / DC ON | AVERAGE OFF | | |
| | CODER | USB FILTER ON | 0.0 % | | |
| | NICAM MODULATOR | RESIDUAL CARRIER ON | 38.90 MHz | | |
| | NICAM GENERATOR | CARRIER AGC ON | +0 | | |
| | | IF-FREQUENCY ON | | | |
| | | MOD. BALANCE ON | | | |

VIDEO

In this menu, one of the three available video inputs can be selected. An input with loop-through filter (high-impedance) or terminated into 75 Ω may be selected on the front panel.

| | | | | | |
|-----------------|------------------------|----------|-----------|--------------------|--------------|
| 11:30:55 | RF-FREQUENCY | CHANNEL | RF-LEVEL | STANDARD | IF-FREQUENCY |
| SYS 1: | 855.250 MHz | 69 | -10.2 dBm | B/G GERMANY STEREO | 38.90 MHz |
| RF-FREQUENCY | RF-LEVEL | STANDARD | MODULATOR | VIDEO | SPECIAL |
| VIDEO | EXTERN | | | | |
| TESTGEN. EXTERN | FRONT 1: 1M Ω | | | | |
| VIDEOSIGNAL ON | FRONT 1: 75 Ω | | | | |
| | REAR X30.2 75 Ω | | | | |
| | REAR X30.3 75 Ω | | | | |
| | AUTOM. VIDEOSWITCH | | | | |

With AUTOM. VIDEO SWITCH selected, the video inputs are assigned to different TV standards (e.g. PAL, SECAM, NTSC) and switched accordingly when a standard is selected.

SPECIAL

This menu offers various programs with defined vision- and sound-carrier settings for intermodulation and linearity measurements (2-, 3- and 4-signal measurements).

| | | | | | |
|-----------------|-----------------|--------------------|-------------|--------------------|--------------|
| 11:32:20 | RF-FREQUENCY | CHANNEL | RF-LEVEL | STANDARD | IF-FREQUENCY |
| SYS 1: | 855.250 MHz | 69 | -10.2 dBm | B/G GERMANY STEREO | 38.90 MHz |
| RF-FREQUENCY | RF-LEVEL | STANDARD | MODULATOR | VIDEO | SPECIAL |
| SPECIAL | INTERMODULATION | IF/BAND | EDIT | | |
| INTERMODULATION | LN 1 | RF-FREQUENCY | 855.250 MHz | | |
| SWEEP | IF/CHANNEL | CH / SP-CH STEP # | 69 CH | | |
| | LN 1 | RF-LEVEL | -10.2 dBm | | |
| | LN 2 | VISION | -5.5 dB | | |
| | | SOUND 1 (ON) | -12.0 dB | | |
| | | SOUND 2 (ON) | -20.0 dB | | |
| | | SIDEBAND (ON) | -12.0 dB | | |
| | | SIDEBAND-FREQUENCY | 0.430 MHz | | |

In the sweep mode, the modulation is switched off and the vision carrier may be used for measuring the frequency response, for example.

Keys

The R&S®SFM is operated with a minimum of keys. In addition to the cursor keys and ENTER, only the keys BACK for returning to the previous menu and HOME for returning to the main menu bar are required.



Numerals can be entered via the keypad or with the aid of the cursor keys.

With MONITOR EXT, the display on the R&S®SFM can be transferred to an external monitor.



When fast tests are to be carried out, the IF modulation can directly be switched off and on with MOD OFF and the RF carrier with RF OFF without the associated sub-menu being opened.

With the aid of the MEM key, instrument settings can be stored internally or on a memory card and called up again.



Information on the hardware and firmware configuration of the R&S®SFM is called up with the SETUP INFO key. Via this key, the parameters for the RS-232-C and IEC/IEEE-bus interfaces can be set, and the RF frequency resolution, level unit and type of 10 MHz synchronization can be selected.

A detailed overview on the current status of all functional groups of the R&S®SFM is displayed when the STATUS key is pressed.

| 11:33:13 | RF-FREQUENCY | CHANNEL | RF-LEVEL | STANDARD | IF-FREQUENCY |
|----------------------------|------------------|---------------------|------------------|--------------------|--------------|
| STATUS | 855.250 MHz | 69 | -10.2 dBm | B/G GERMANY STEREO | 38.90 MHz |
| VIDEO | MODULATOR VISION | MODULATOR SOUND 1/2 | MODULATOR CODER | MODULATOR NCAM | |
| SYSTEM 1: SOUNDMODULATOR 1 | | | SOUNDMODULATOR 2 | | |
| AF | INTERN | AF | INTERN | AF | INTERN |
| AF INTERN | 1.00 kHz | AF INTERN | 0.40 kHz | AF | INTERN |
| DEVIATION | 15.0 kHz | DEVIATION | 30.00 kHz | PREEMPHASIS | ON |
| PREEMPHASIS | ON | PREEMPHASIS | ON | PREEMPHASIS | 50 µs |
| CARRIER | ON | CARRIER | ON | CARRIER | ON |
| CARRIER FREQUENCY | 33.400 MHz | CARRIER FREQUENCY | 33.150 MHz | CARRIER LEVEL | -20.0 dB |
| CARRIER LEVEL | -13.0 dB | | | | |
| [F2=EXIT] | | | | | |

Specifications

Vision modulator

| | | | |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------|
| Video input signal (standard level) | 1 V pp into 75 W | | |
| Standards | B/G, D/K, I, K1, L/L', M, N | | |
| Video input | 1 on front panel with loop-through filter (high-impedance), with internal or external 75 W termination 2 on rear panel (75 W) | | |
| Connectors | BNC | | |
| Selection of inputs | automatic or manual | | |
| Return loss (0 to 6 MHz) | >34 dB for all video inputs | | |
| IF output signals | | | |
| Frequency drift (internal 10 MHz reference) | <2 × 10 ⁻⁶ | | |
| Vision-carrier frequency with vestigial-sideband filter (SAW) | 38.9 MHz for B/G, D/K, I | 32.7 MHz for L/L', K1 (sound: mono) | 38.9 MHz for L/L' (sound: mono/NICAM) |
| | | 45.75 MHz for M, N | |
| Vision-carrier frequency with double-sideband modulation | 32 MHz to 46 MHz, selectable in 10 kHz steps over the full range | | |
| IF output level | -3 dBm ± 0.5 dBm into 50 W | | |
| IF output | 1 internal (for RF upconverter) 1 external (for 50 W termination) | | |
| Harmonics suppression | | | |
| Harmonics | >40 dB | | |
| Nonharmonics | >60 dB | | |
| Modulation characteristics | | | |
| Type of modulation | C3F (A5C), negative, for B/G, D/K, I, K1, M, N C3F (A5C), positive, for L/L' | | |
| Group-delay pre-correction (max. 3 settings per multistandard plug-in) | standard B/G, ITU-R standard B/G, ITU-R 1/2 standard B/G, Sweden (A) standard B/G, Australia standard D/K, ITU-R, Report 308 standard D/K, OIRT, TK-III-830 standard I, full pre-correction, South Africa standard K1 standard M/N, FCC full pre-correction (flat) | | |
| Operating mode | double-sideband modulation with or without group-delay pre-correction for IF 32 MHz to 46 MHz or vestigial-sideband modulation (SAW filter) with or without group-delay pre-correction for standards B/G, D/K, I, L/L', M, N, K1 | | |
| Level control | | | |
| Clamping | on (to back porch); hard or soft clamping selectable, off | | |
| Average value for standards with negative modulation (clamping off, AGC off) | ±50% offset | | |
| Hum suppression in hard-clamped mode | ≥57 dB (with 30% superimposed hum) | | |
| Amplitude-frequency response | | | |
| Double-sideband modulation, pre-correction off | | | |
| Vision carrier ±5 MHz | ≤0.15 dB | | |
| ±8 MHz | ≤0.3 dB | | |
| Vestigial-sideband modulation | | | |
| B/G 38.9 MHz IF | with pre-correction | ≤0.5 dB | (-0.6 MHz to +4.8 MHz) |
| D/K 38.9 MHz IF | with pre-correction | ≤0.5 dB | (-0.6 MHz to +5.8 MHz) |
| I 38.9 MHz IF | w/o pre-correction | ≤0.5 dB | (-1 MHz to +4.8 MHz) |
| L/L' 32.7 MHz IF | w/o pre-correction | ≤0.5 dB | (-1 MHz to +5.8 MHz) |
| M 45.75 MHz IF | with pre-correction | ≤0.6 dB | (-0.6 MHz to +4 MHz) |

Group-delay response

| | |
|-----------------------------------------------------------------------|-------------------------------------|
| Double-sideband modulation, pre-correction off, vision carrier ±5 MHz | ≤10 ns |
| Group-delay pre-correction | |
| 0 MHz to 4.43 MHz | ≤10 ns |
| 4.43 MHz to 4.8 MHz | ≤15 ns |
| Vestigial-sideband modulation | additional ripple due to SAW filter |
| B/G | ≤20 ns (-4.8 MHz to +0.5 MHz) |
| D/K | ≤20 ns (-5.5 MHz to +0.5 MHz) |
| I | ≤30 ns (-5.2 MHz to +1 MHz) |
| L/L' | ≤20 ns (-1.25 MHz to +6 MHz) |
| M, N | ≤20 ns (-4 MHz to +0.5 MHz) |

Residual carrier

| | |
|---------------|-----------|
| Setting range | 0% to 30% |
| Resolution | 0.1% |
| Error | <1.5% |

Modulation nonlinearity

| | |
|--------------------------------|------------------------------------------------|
| Modulation in range 8% to 100% | ≤1.5% (for standards with negative modulation) |
|--------------------------------|------------------------------------------------|

Differential gain error

| | |
|-----------------------------------------------------|------------------------------------------------|
| for colour subcarrier modulated in range 10% to 85% | ≤1.5% (for standards with negative modulation) |
|-----------------------------------------------------|------------------------------------------------|

Differential phase error

| | |
|-----------------------------------------------------|----------------------------------------------|
| for colour subcarrier modulated in range 10% to 85% | ≤1° (for standards with negative modulation) |
|-----------------------------------------------------|----------------------------------------------|

Video signal-to-noise ratio

| | |
|-------------------------------------------------------------------------------|--------|
| Double-sideband and vestigial-sideband modulation, measured to ITU-R Rec. 567 | |
| rms, weighted, 0.2 MHz to 5 MHz | ≥70 dB |
| hum, peak-to-peak, 0 kHz to 1 kHz | ≥60 dB |

Inter-carrier signal-to-noise ratio

| | |
|-------------------|--------------------------|
| FuBK test pattern | 56 dB (30 kHz deviation) |
| All-black picture | 58 dB (30 kHz deviation) |

Intermodulation measurement (fixed programs)

| (Level in dB) | Vision carrier | Sound carrier 1 | Sound carrier 2* | Sideband |
|--------------------|----------------|-----------------|------------------|----------|
| Intermodulation IM | 0 | -10 | -20 | off |
| IM/K | -8 | -10 | -20 | -16.5 |
| IM/B | -5.5 | -11.5 | -20 | -12 |
| Linearity LIN1 | -2.5/-8 | -10 | -20 | -32 |
| LIN2 | -2.5/-20 | -10 | -20 | -32 |

*) In connection with NICAM Modulator R&S® SFM-B10 only.

(Linearity measurement with vision-carrier level switching every 2 s)

Sound 1 modulator, sound 2 modulator

AF signal input

| | |
|-----------------------|---------------------------------------------------------------------------------------------------------------------|
| B/G, D/K, I, M, N, K1 | +6 dBm (1.546 V rms) for 0 kHz to ±100 kHz deviation, floating, Z _{in} >5 kW, switchable internal/external |
| L/L' | +6 dBm (1.546 V rms) for m = 0% to 100% |

Sound-carrier IF

| | |
|---------------------------------------|------------------------------------------------------------|
| Frequency | settable |
| Setting range | f _{vision carrier} - f _{sound} ≤ 7 MHz |
| Accuracy | <2 × 10 ⁻⁶ |
| Level | settable |
| Accuracy at standard level | |
| Sound 1: -13 dB with B/G, D/K, I, M/N | ≤±0.5 dB |
| -10 dB with K1 | |
| Sound 2: -20 dB with B/G, D/K, I | ≤±0.5 dB |
| Accuracy over setting range | |
| Sound 1 referred to -6 dB | |
| -6 dB to -16 dB | ≤±0.3 dB |
| >-16 dB to -34 dB | ≤±0.6 dB |
| Sound 2 referred to -12 dB | |
| -12 dB to -22 dB | ≤±0.3 dB |
| >-22 dB to -38 dB | ≤±0.6 dB |

Modulation characteristics

| | |
|-----------------------|------------------------------------------------------------------------------|
| B/G, D/K, I, M, N, K1 | F3, with preemphasis 50 ms or 75 ms >70 dB (referred to 30 kHz deviation) |
| Type of modulation | |
| Signal-to-noise ratio | |
| L/L' | |
| Type of modulation | A3, without preemphasis |
| Signal-to-noise ratio | >70 dB, weighted and unweighted (ref. to 100% modulation) |

AF generator (DSP)

| | |
|----------------------------------------------------|--------------------------------------------------------------------------|
| Setting range | separately selectable for left and right channel or mono 1 and mono 2 |
| Resolution | 30 Hz to 15 kHz |
| Frequency error | 10 Hz |
| Distortion (measured via modulator/demodulator) | $\leq \pm 0.1\% \pm 3$ Hz <0.3% (60 dB)% |

TV stereo/dual-sound coder

| | |
|------------------|----------------|
| AF input signals | L/R or AF1/AF2 |
|------------------|----------------|

AF output signals (coded)

| | | |
|---------------------|------------------------|-----------------------------------|
| IRT coding | Sound channel 1 | Sound channel 2 |
| Mono | AF | – |
| Mono and pilot | AF | AF + pilot |
| Dual sound | AF1 | AF2 + pilot |
| Stereo | $m = 0.5 \times (L+R)$ | R + pilot |
| Korean coding | $m = 0.5 \times (L+R)$ | $0.5 \times (L-R) + \text{pilot}$ |
| Crosstalk | | |
| Dual sound | >70 dB | |
| Stereo | >46 dB | |
| Pilot carrier | in sound channel 2 | |
| Pilot deviation | 1 kHz to 4 kHz | |
| Pilot frequency IRT | 54.69 kHz = $3.5 f_H$ | |
| Korea | 55.07 kHz | |

NICAM generator

Operating modes

stereo
mono + data
dual sound
data

Audio frequencies

| | |
|-----------------|---------------------------------------------------------------|
| Setting | separately for left and right channel or mono 1 and mono 2 |
| Setting range | 0 kHz to 15 kHz |
| Resolution | 20 Hz |
| Frequency error | <1 Hz |

Audio amplitude (headroom)

| | |
|-------------------------------------------|---------------------------------------------------------------|
| Setting | separately for left and right channel or mono 1 and mono 2 |
| Preemphasis J17 on (ref. to 400 Hz) | |
| Setting range | 16.5 dB to 60 dB |
| Resolution | 0.1 dB |
| Error in range 16.5 dB to 30 dB | <0.3 dB |
| Preemphasis J17 off (ref. to 0 to 15 kHz) | |
| Setting range | 0 dB to 60 dB |
| Resolution | 0.1 dB |
| Error in range 16.5 dB to 30 dB | <0.3 dB |
| Overall setting error | <1 dB |

Data sequence

11 bits, freely selectable, periodic
repetition

Control bits

C3 and C4, freely selectable in all
operating modes

Additional data

AD0 to AD10, freely selectable in all
operating modes

Data output

| | |
|--------------|----------------------------|
| Data rate | 728 kbit/s |
| Output level | TTL into 75 W (AC-coupled) |

Clock output

| | |
|-----------------|----------------------------|
| Clock frequency | 728 kHz |
| Output level | TTL into 75 W (AC-coupled) |

NICAM modulator

Operating modes

| | |
|--------------------------|-------------------------------------------------------|
| Internal | data stream from NICAM generator |
| External | external data stream (with or without clock) |
| PRBS | pseudo-random bit sequence |
| CW | continuous wave (unmodulated carrier) |
| TEST I/Q | 3 fixed 11-bit sequences for direct I/Q modulation |
| Failure of external data | automatic switchover to internal PRBS |

Bit error rate (BER)

| | |
|---------------------------|-------------------------------------------------|
| BER internal (adjustable) | 2×10^{-3} to 1.2×10^{-7} /off |
| external | bit errors added to external data signal |

I/Q signals

interchange of I and Q paths possible

Type of modulation

differential QPSK

Data rate

728 kbit/s to NICAM specifications

Digital pulse filtering

| | |
|-------------|----------------------|
| Resolution | 8 bit |
| Form factor | |
| B/G, L/L' | 40% cosine roll-off |
| I | 100% cosine roll-off |

Spurious emissions

| | |
|----------------------|---------|
| B/G, L/L' (>290 kHz) | <–40 dB |
| I (>390 kHz) | <–40 dB |

Amplitude error (± 182 kHz)

<0.5 dB

Group delay

<50 ns

QPSK phase error

<0.15° (digital modulation)

Level error

| | |
|--------------------|---------|
| from 0 to 15 dB | <0.5 dB |
| in the whole range | <1 dB |

Spurious

<–57 dB

Carrier frequencies (adjustable)

| | |
|--------------|---------------|
| B/G | 33.05 MHz |
| I | 32.348 MHz |
| L/L' | 33.05 MHz |
| Tuning range | ± 200 kHz |
| Resolution | 1 Hz |

Inputs

| | |
|----------------------|------------------------------------|
| Data input | |
| Data rate | 728 kbit/s to NICAM specifications |
| Capture range of PLL | ≤ 10 bit/s |
| Input impedance | 75 W |
| Input level | TTL, into 75 W (DC-coupled) |
| Clock input | |
| Clock frequency | 728 kHz |
| Capture range of PLL | ≤ 40 Hz |
| Input level | TTL, into 75 W (AC-coupled) |

Outputs

| | |
|---------------------------------------|-----------------------------------------|
| Intercarrier output | |
| Output impedance | 50 W |
| Output level | –3 dBm to –25 dBm (manually adjustable) |
| Intercarrier frequencies (adjustable) | |
| B/G | 5.85 MHz (5 MHz to 9 MHz) |
| I | 6.552 MHz (5 MHz to 9 MHz) |
| L/L' | 5.85 MHz (± 200 kHz) |
| Resolution | 1 Hz |
| Spurious with CW | |
| (0 to 20 MHz), 0 dBm output level | |
| Harmonics | <–40 dB |
| Nonharmonics | <–50 dB |

Upconverter

Frequency

| | |
|------------------------|--------------------------------------------------------------------------------------------------|
| IF input 1 | for internal modulator |
| IF input 2 | for external modulator |
| Input frequency range | 32 MHz to 46 MHz ± 8 MHz for double- sideband modulation |
| Output frequency range | 5 MHz to 1000 MHz, 1 Hz steps |
| RF tuning | entry of frequencies via numeric keypad in MHz or entry of TV channels (country- specific) |

| | |
|----------------------------------------------------------------|--------------------------------------------|
| RF sideband (selectable) | upper (standard) or lower sideband |
| Frequency deviation (with internal 10 MHz reference frequency) | $<2 \times 10^{-6}$ |
| Reference frequency | |
| Input/output frequency | 10 MHz |
| Input level (10 MHz, external) | 0.1 V _{rms} to 1 V _{rms} |
| Output level (rms) | 5 dBm \pm 1 dB (corr. to 395 mV/50 W) |

Level

| | |
|---------------------------------------------------------|----------------------------------|
| IF input level range | 0 dBm to -7 dBm into 50 W |
| RF output level (max. level) | |
| Low noise | +10 dBm to -99 dBm |
| Normal | +6 dBm to -99 dBm |
| Low distortion | 0 dBm to -99 dBm |
| Resolution | 0.1 dB |
| Total error | $\leq \pm 1.5$ dB |
| Return loss (level mode: normal, 0 dBm RF output level) | |
| 50 W output | >18 dB |
| 75 W output | >15 dB |
| RF frequency response in TV channel | ≤ 0.5 dB (5 MHz to 950 MHz) |

Overall transmission characteristics

| | |
|-----------------------------------------------------------------------------|---------------------------------|
| (spurious signals with vision/sound ratio of 10:1, * = low-distortion mode) | |
| Nonharmonics* | ≥ 66 dB |
| Intermodulation | |
| Vision (0 dB)/sound 1 (-10 dB) | >56 dB |
| Vision (-8 dB)/sound 1 (-10 dB)/ | |
| Sound 2 (-16 dB) | >76 dB |
| Harmonics | |
| LOW DIST. | ≥ 45 dB |
| NORMAL | ≥ 40 dB |
| Differential gain error* | $\leq 2.5\%$ |
| Differential phase error* | $\leq 2^\circ$ |
| Video S/N ratio, (low-noise mode, referred to black-to-white transition) | |
| 0.2 MHz to 5 MHz (noise) | ≥ 66 dB rms, weighted |
| 10 Hz to 1 kHz (hum) | ≥ 60 dB pp, unweighted |
| Audio S/N ratio up to 15 kHz (with pre- and deemphasis)* | ≥ 66 dB (30 kHz deviation) |

General data

| | |
|-----------------------------|------------------------------------------------------------------------|
| Rated temperature range | +5°C to +45°C |
| Operating temperature range | 0°C to +50°C |
| Storage temperature range | -40°C to +70°C |
| Power supply | 100 V to 120 V/200 V to 240 V +10%/-15%, 47 Hz to 63 Hz (160 VA) |
| Dimensions (W x H x D) | 435 mm x 192 mm x 460 mm |
| Weight | 20 kg |

Ordering information

Basic units

| | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------------|
| TV Test Transmitter | R&S®SFM | 2007.9106.10 |
| Modulator unit with vision modulator, FM sound modulator with AF generator and multistandard plug-in (3 TV standards) (without RF upconverter) | | |
| TV Test Transmitter | R&S®SFM | 2007.9106.50 |
| Modulator unit with vision modulator, FM sound modulator with AF generator and multistandard plug-in (3 TV standards) and RF upconverter, 5 MHz to 1000 MHz, 50 W | | |
| TV Test Transmitter | R&S®SFM | 2007.9106.90 |
| RF upconverter, 5 MHz to 1000 MHz, 50 W (without modulator unit) | | |

Accessories supplied

Audio cable, power cable, spare fuses, operating manual

Options

| | | |
|----------------------------------------------------------------------------------------|-------------|--------------|
| Multistandard Plug-in | R&S®SFM-B7 | 2008.0248.02 |
| 2 VSB SAW filters, 3 group-delay pre-corrections for further TV standards | | |
| Sound 2 Modulator | R&S®SFM-B9 | 2008.0183.02 |
| Switchable FM/AM, dual-sound coder (without AF generator) | | |
| QPSK Sound Modulator for NICAM 728 with NICAM generator, I/Q test signal, BER and PRBS | R&S®SFM-B10 | 2008.0302.02 |
| RF Output, 75 W (selectable) | R&S®SFM-B16 | 2007.9212.02 |

Recommended extras

| | | |
|---------------------------------------------------------|-------------|--------------|
| Memory Card, 4 Mbyte (flash) | | 0008.5499.00 |
| Cable connector, Lemo Triax | | 0231.9182.00 |
| Audio cable (2 x Lemo Triax/ 1 x 5-way to DIN 41524) | | 2020.6636.00 |
| 19" Adapter (4 height units) for rackmounting | R&S®ZZA-941 | 0396.9471.00 |





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