# Test Equipment Solutions Datasheet

Test Equipment Solutions Ltd specialise in the second user sale, rental and distribution of quality test & measurement (T&M) equipment. We stock all major equipment types such as spectrum analyzers, signal generators, oscilloscopes, power meters, logic analysers etc from all the major suppliers such as Agilent, Tektronix, Anritsu and Rohde & Schwarz.

We are focused at the professional end of the marketplace, primarily working with customers for whom high performance, quality and service are key, whilst realising the cost savings that second user equipment offers. As such, we fully test & refurbish equipment in our in-house, traceable Lab. Items are supplied with manuals, accessories and typically a full no-quibble 2 year warranty. Our staff have extensive backgrounds in T&M, totalling over 150 years of combined experience, which enables us to deliver industry-leading service and support. We endeavour to be customer focused in every way right down to the detail, such as offering free delivery on sales, covering the cost of warranty returns BOTH ways (plus supplying a loan unit, if available) and supplying a free business tool with every order.

As well as the headline benefit of cost saving, second user offers shorter lead times, higher reliability and multivendor solutions. Rental, of course, is ideal for shorter term needs and offers fast delivery, flexibility, try-before-you-buy, zero capital expenditure, lower risk and off balance sheet accounting. Both second user and rental improve the key business measure of Return On Capital Employed.

We are based near Heathrow Airport in the UK from where we supply test equipment worldwide. Our facility incorporates Sales, Support, Admin, Logistics and our own in-house Lab.

All products supplied by Test Equipment Solutions include:

- No-quibble parts & labour warranty (we provide transport for UK mainland addresses).
- Free loan equipment during warranty repair, if available.
- Full electrical, mechanical and safety refurbishment in our in-house Lab.
- Certificate of Conformance (calibration available on request).
- Manuals and accessories required for normal operation.
- Free insured delivery to your UK mainland address (sales).
- Support from our team of seasoned Test & Measurement engineers.
- ISO9001 quality assurance.

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# 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 multichannel 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

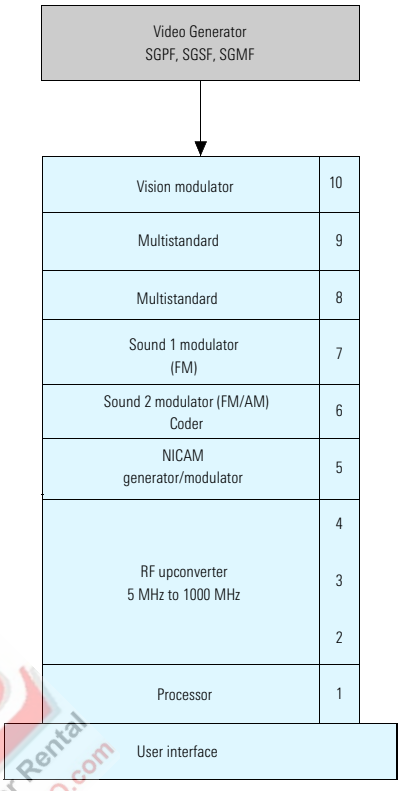
The IF of the vision modulator (Fig. below) is set automatically when the standard is selected. The vision carrier is modulated with the residual-carrier setting stipulated by the standard. Hard and soft video clamping can be selected. If soft clamping is used, hum is not suppressed for example.

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 precorrections are also implemented in this module.

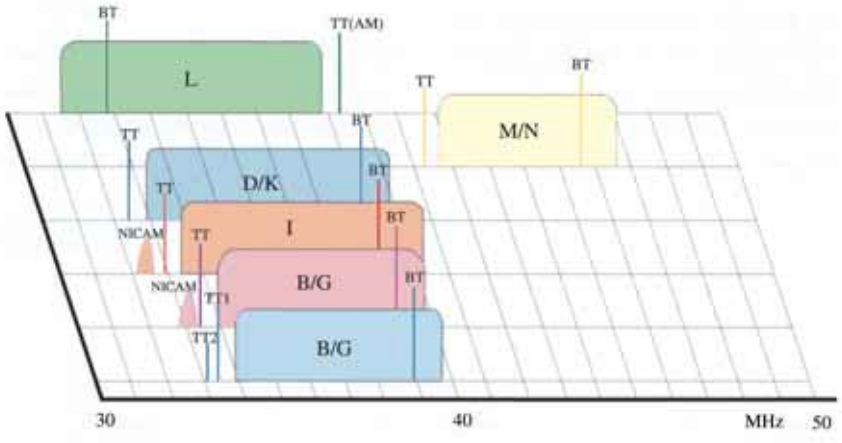
### Sound modulators

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 |
|---|---|---|
| **RF upconverter** | | |
| Output frequency range | 5 MHz to 1000 MHz | 1 kHz or 1 Hz |
| RF level (absolute level), ref. to 50 W | | |
| Low noise mode | +10 dBm to –99 dBm | 0.1 dB |
| | 117 dBmV to 8 dBmV | 0.1 dB |
| | 707.1 mV to 0 mV | 0.1 dB |
| Normal mode | +6 dBm to –99 dBm | 0.1 dB |
| | 113 dBmV to 8 dBmV | 0.1 dB |
| | 446.2 mV to 0 mV | 0.1 dB |
| Low distortion mode | 0 dBm to –99 dBm | 0.1 dB |
| | 107 dBmV to 8 dBmV | 0.1 dB |
| | 223.6 mV to 0 mV | 0.1 dB |
| RF level (non-interrupting), referred to absolute level | 0 dB to –14 dB | 0.1 dB |
| IF input frequency range | 32 MHz to 46 MHz | 1 kHz or 1 Hz |
| IF input level (for external modulator) | 0 dBm to –7 dBm | 0.1 dB |
| **Vision modulator** | | |
| Vision carrier (double-sideband modulation) | 32 MHz to 46 MHz | 10 kHz |
| Residual carrier (negative modulation) | 0% to 30% | 0.1% |
| Modulator balance | –50% to +50 | 1 |
| Average level (offset) | –50% to +50% | 1% |
| **Sound 1 modulator** | | |
| Internal AF | 0.03 kHz to 15 kHz | 10 Hz |
| Deviation (15 kHz) | 0 kHz to 100 kHz | 10 Hz |
| Carrier frequency | $\|f_{vc}-f_s\| \leq 7$ MHz | 1 kHz or 1 Hz |
| Carrier level | –6 dB to –34 dB | 0.1 dB |
| Preemphasis | 50 ms/75 ms/off | – |
| **Sound 2 modulator** (FM) | | |
| Internal AF | 0.03 kHz to 15 kHz | 10 Hz |
| Deviation (15 kHz) | 0 kHz to 100 kHz | 10 Hz |
| Carrier frequency | $\|f_{vc}-f_s\| \leq 7$ MHz | 1 kHz or 1 Hz |
| Carrier level | –10 to –38 dB | 0.1 dB |
| Preemphasis | 50 ms/75 ms/off | – |

| Parameter | Setting range | Step width |
|---|---|---|
| **Sound 2 modulator** (AM) | | |
| Internal AF | 0.03 kHz to 15 kHz | 10 Hz |
| Modulation depth | 0% to 100% | 0.1% |
| Carrier frequency | $\|f_{vc}-f_s\| \leq 7$ MHz | 1 kHz or 1 Hz |
| Carrier level | –10 dB to –38 dB | 0.1 dB |
| **Stereo/dual-sound coder** | | |
| Pilot carrier | 50 kHz to 60 kHz | 10 Hz |
| Pilot deviation | 1 kHz to 4 kHz | 100 Hz |
| Pilot modulation frequency | | |
| IRT | 117.5 Hz/ 274.1 Hz ±20 Hz | 0.1 Hz |
| Korea | 149.9 Hz/ 276 Hz ±20 Hz | 0.1 Hz |
| Pilot modulation depth | 0% to 90% | 0.1% |
| **NICAM generator** | | |
| Internal AF (L) | 0 kHz to 15 kHz | 20 Hz |
| Internal AF (R) | 0 kHz to 15 kHz | 20 Hz |
| Headroom L (400 Hz) | | |
| Preemphasis (J17) | | |
| On | 16.5 dB to 60 dB | 0.1 dB |
| Off | 0 dB to 60 dB | 0.1 dB |
| Headroom R (400 Hz) | | |
| Preemphasis (J17) | | |
| On | 16.5 dB to 60 dB | 0.1 dB |
| Off | 0 dB to 60 dB | 0.1 dB |
| Check bits 3 and 4 | 00 to 11 | binary (2 bits) |
| Additional data | 000 0000 0000 to 111 1111 1111 | binary (11 bits) |
| **NICAM modulator** | | |
| BER | $2 \times 10^{-3}$ to $1.2 \times 10^{-7}$ | – |
| Carrier frequency | 32.348 MHz/ 33.05 MHz ±200 kHz | 1 kHz or 1 Hz |
| Intercarrier frequency | | |
| Standard B/G, I | 5.0 MHz to 9.0 MHz | 1 kHz or 1 Hz |
| Standard L/L' | 5.85 MHz ±200 kHz | 1 kHz or 1 Hz |
| 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.

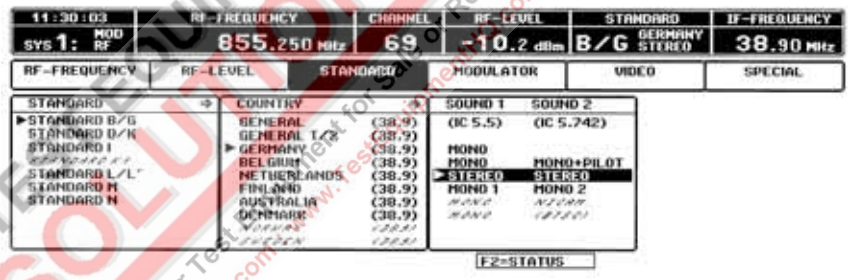
**Status line**
At the top of the large LCD, a clearly arranged status line is displayed where the current operating status of the R&S®SFM can always be seen at a glance.


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


**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.

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



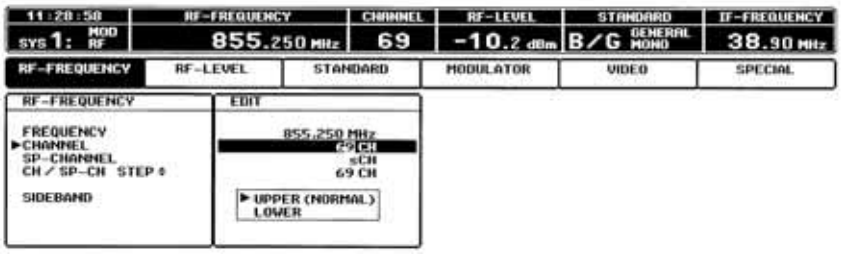

Possible settings for the chosen menu item are displayed in pull-down menus.

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:

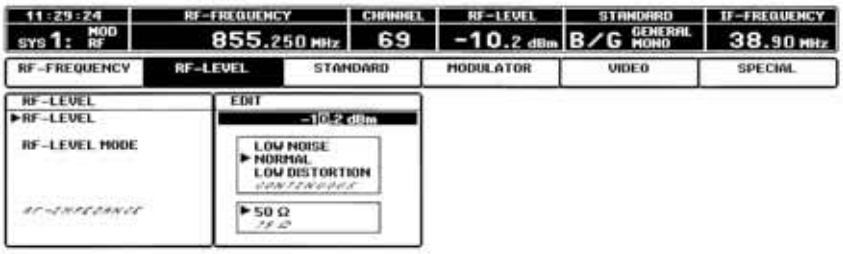
RF FREQUENCY

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.



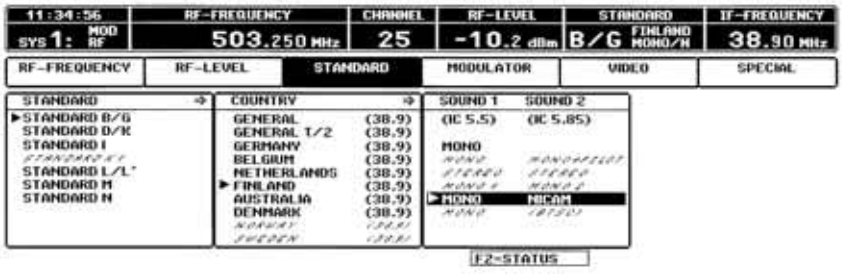
RF LEVEL

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.



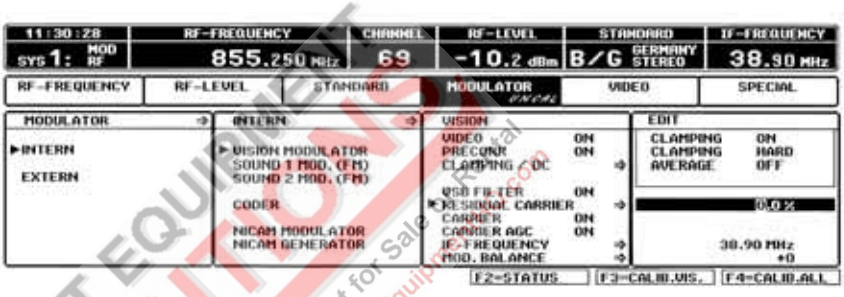

STANDARD

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.




MODULATOR

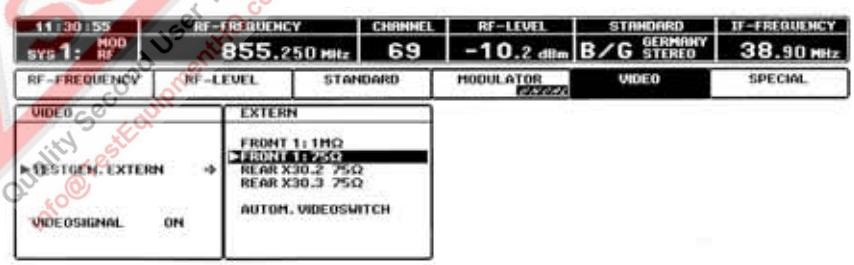
In this menu, all vision and sound modulation parameters can be varied over a wide range (see page 5) about the values set automatically when a standard is selected. Even non-standard test signals can be generated (e.g. for determining limit values of TV modules). Parameters to standard can be restored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




VIDEO

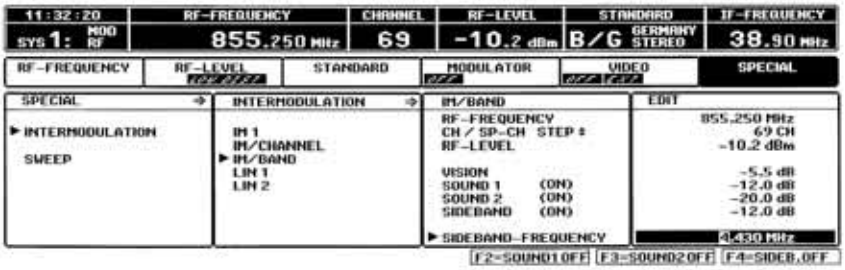
In this menu, one of the three available video inputs can be selected. An input with loop-through filter (high-impedance) or terminated into 75 Ω may be selected on the front panel.

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).



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.

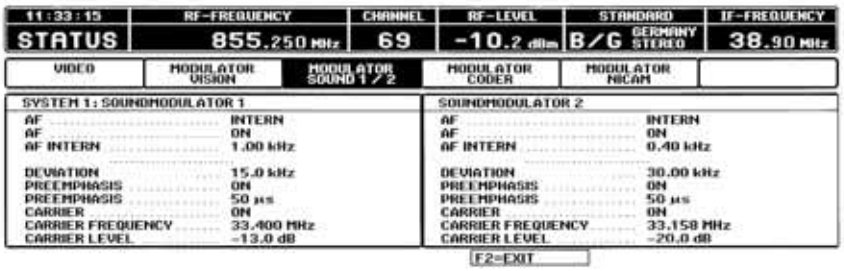
With MONITOR EXT, the display on the R&S®SFM can be transferred to an external monitor.


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 submenu 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.



# 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) $<2 \times 10^{-6}$
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 precorrection** (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 precorrection, South Africa
standard K1
standard M/N, FCC
full precorrection (flat)

**Operating mode** double-sideband modulation with or without group-delay precorrection for IF 32 MHz to 46 MHz
or
vestigial-sideband modulation (SAW filter) with or without group-delay precorrection 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, precorrection off

| | | |
|---|---|---|
| Vision carrier | ±5 MHz | ≤0.15 dB |
| | ±8 MHz | ≤0.3 dB |

Vestigial-sideband modulation

| | | | | |
|---|---|---|---|---|
| B/G | 38.9 MHz IF | with precorrection | ≤0.5 dB | (–0.6 MHz to +4.8 MHz) |
| D/K | 38.9 MHz IF | with precorrection | ≤0.5 dB | (–0.6 MHz to +5.8 MHz) |
| I | 38.9 MHz IF | w/o precorrection | ≤0.5 dB | (–1 MHz to +4.8 MHz) |
| L/L' | 32.7 MHz IF | w/o precorrection | ≤0.5 dB | (–1 MHz to +5.8 MHz) |
| M | 45.75 MHz IF | with precorrection | ≤0.6 dB | (–0.6 MHz to +4 MHz) |

**Group-delay response**
Double-sideband modulation, precorrection off, vision carrier ±5 MHz ≤10 ns
Group-delay precorrection
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

**Intercarrier 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 $|f_{vision\ carrier} - f_{sound}| \leq 7$ MHz
Accuracy $<2 \times 10^{-6}$
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, L ≤±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 | |
| Type of modulation | F3, with preemphasis 50 ms or 75 ms |
| Signal-to-noise ratio | >70 dB (referred to 30 kHz deviation) |
| L/L' | |
| Type of modulation | A3, without preemphasis |
| Signal-to-noise ratio | >70 dB, weighted and unweighted (ref. to 100% modulation) |

**AF generator (DSP)** separately selectable for left and right channel or mono 1 and mono 2

| | |
|---|---|
| Setting range | 30 Hz to 15 kHz |
| Resolution | 10 Hz |
| Frequency error | ≤±0.1% ±3 Hz |
| Distortion (measured via modulator/demodulator) | <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× (L+R) | R + pilot |
| Korean coding | m = 0.5× (L+R) | 0.5× (L-R) + 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) | $2 \times 10^{-3}$ to $1.2 \times 10^{-7}$/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 ±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 | <±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* | ≤2.5% |
| Differential phase error* | ≤2° |
| 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 × H × D) | 435 mm × 192 mm × 460 mm |
| Weight | 20 kg |

## Ordering information

**Basic units**

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

**Accessories supplied**

Audio cable, power cable, spare fuses, operating manual

**Options**

| | | |
|---|---|---|
| Multistandard Plug-in<br>2 VSB SAW filters, 3 group-delay precorrections for further TV standards | R&S®SFM-B7 | 2008.0248.02 |
| Sound 2 Modulator<br>Switchable FM/AM, dual-sound coder (without AF generator) | R&S®SFM-B9 | 2008.0183.02 |
| QPSK Sound Modulator for NICAM 728<br>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 × Lemo Triax/ 1 × 5-way to DIN 41524) | | 2020.6636.00 |
| 19" Adapter (4 height units) for rackmounting | R&S®ZZA-941 | 0396.9471.00 |



Certified Quality System
ISO 9001
DQS REG. NO 1954 QM

Certified Environmental System
ISO 14001
DQS REG. NO 1954 UM

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