



ABN 43 064 478 842

231 Osborne Avenue Clayton South, VIC 3169
PO Box 1548, Clayton South, VIC 3169
t 03 9265 7400 f 03 9558 0875
freecall 1800 680 680
www.tmgtestequipment.com.au

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Version
03.00December
2004

CCVS + Component Generator R&S® SAF/ CCVS Generator R&S® SFF

Multistandard generators for all TV applications

- ◆ Several hundred test signals to suit every application
- ◆ Easy definition of additional signals via front panel, storage in built-in RAM or memory card
- ◆ Setting of amplitude, H/V and color subcarrier frequency as well as of other signal parameters
- ◆ Genlock operation: selection of phase between input signal and generator signal
- ◆ Insertion of internally generated test, data and teletext lines as well as of signals from a maximum of two external sources
- ◆ System compatibility owing to IEC 625/IEEE 488 bus



ROHDE & SCHWARZ

Characteristics

The R&S®SAF and R&S®SFF TV generators are two multistandard instruments suitable for all applications in the field of television. They provide signals according to the BG/PAL and M/NTSC standards that are used worldwide and also generate signals to M/PAL and N/PAL standards.

The CCVS + Component Generator R&S®SAF supplies test signals in CCVS, $Y_C C_R$, RGB and S-VHS formats. The user can select an aspect ratio of 4:3 or 16:9 for test patterns for the adjustment of monitors. Where the CCVS format is required only, the attractively priced CCVS Generator R&S®SFF can be used. The digital signal format to ITU-R 601 can optionally be implemented in parallel and serial form in both generators.

Both generators allow complex signal variations via menus:

AMPLITUDE

- ◆ CCVS, CVS, chroma, sync, burst, setup and $Y_C C_R$ can be varied continuously
- ◆ The RGB channels can be switched off individually; a sync pulse can be added to each of these components



The different setting menus can be called up at a keystroke

PHASE/TIME

- ◆ Setting of SC/H phase
- ◆ The synchronized mode enables the user to select the timing of the generator signal with respect to the program signal as well as the phase of the generator color subcarrier relative to the program color subcarrier
- ◆ Variation of horizontal frequency by $\pm 5\%$
- ◆ User-selectable color subcarrier frequency in range 100 Hz to 6 MHz
- ◆ Selection of burst duration, position and rise time as well as of sync duration and rise time

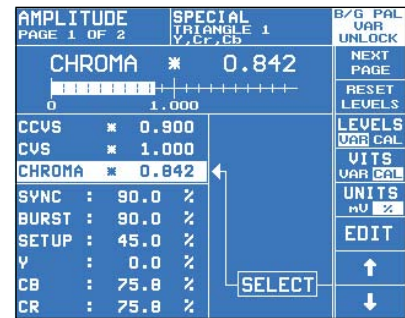
SIGNAL EDIT

- ◆ Definition of signals via front panel, and storage in built-in, battery-backed RAM or externally on memory card

A signal line is described as a list of signal elements using a simple language. All parameters of the signal elements can be varied separately by means of the rotary knob or the keyboard. The generator output signal reflects the variation of parameters. For instance, it is thus possible to change the amplitude of the luminance bar to test amplitude control circuits, white-level limiters or video analyzers over the whole range of the device under test. The frequencies of individual sinewave burst elements, phase, timing and rise times can also be varied easily and rapidly.

The full field (pattern) is defined similarly by listing line commands. This can be done using user-defined or factory-stored test lines.

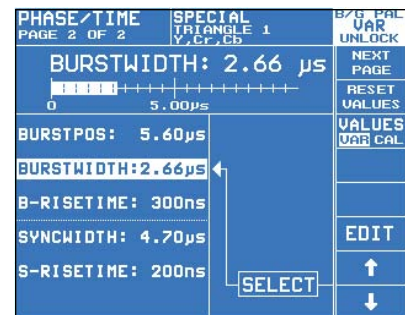
Another way of editing signals is by forming sequences of predefined patterns. Test signals made up of moving elements can thus be defined.



The large-size EL display and softkeys make complex signal variations, e.g. of amplitude, easy ...



... and enable time-related settings such as phase and reference clock ...



... or burst and sync pulse

SETUP

- ◆ Switchover between BG/PAL, M/NTSC, M/PAL and N/PAL standards
- ◆ User-programming of test-line coding and monitoring
- ◆ Teletext and data line insertion
- ◆ Dataline coder
- ◆ Superimposed hum (selectable frequency, amplitude and waveform)
- ◆ Superposition of external signal
- ◆ Entry of customer-specific texts as source identification or scrolling text
- ◆ Program monitoring + substitution pattern
- ◆ General device setups

STO/RCL

- ◆ Storage of device setups and signals in built-in, battery-backed RAM or externally on memory card
- ◆ Recall of device setups or signals from built-in RAM or memory card
- ◆ Copying from and to RAM and memory card

STATUS

- ◆ Indication of current device setup
- ◆ Four keys with definable functions for fast callup of frequently used functions

Use in digital TV studios

The optional digital video interface to ITU-R 601 makes the R&S®SAF and R&S®SFF suitable for use in digital TV studios. In addition to the analog video signals, a parallel and two serial digital video signals are thus simultaneously available. The generators furthermore produce all test signals to ITU-R Rec. 801, a variety of common pathological test signals as well as shallow ramps with 10-bit resolution. The timing of the reference clock at the parallel digital output can be shifted relative to the video data. All amplitude variations (except sync and burst) also influence the data contents of the digital video signals.

Description

The generator section of the R&S®SAF and R&S®SFF TV generators is of digital design. A transputer – a high-speed RISC processor – calculates the three components Y , C_B and C_R of all test signals which in the CCVS + Component Generator R&S®SAF are applied to three D/A converters. An analog matrix converts the three components into the RGB format. Therefore, the RGB signals are always made available simultaneously with the $Y C_B C_R$ components. The digital CCVS in the R&S®SAF and R&S®SFF is determined from the $Y C_B C_R$ components in realtime with the aid of two LSI gate arrays.

The first array ensures accurate digital coupling of line and color subcarrier frequency, while the second array acts as a digital color subcarrier modulator. This always ensures strict compliance with the SC/H phase for the BG/PAL, M/NTSC, M/PAL and N/PAL standards.

For the S-VHS format, the Y component of the CCVS is digitally switched off. The resulting chroma signal together with the Y component of the $Y C_B C_R$ signal yields the S-VHS format.

The test signals defined in accordance with ITU-R and FCC/NTSC as well as all other test signals including user-defined signals can be inserted into the blanking intervals of the internal generator signal or of any program signal.

Synchronization of the generator signal with the program signal takes account of the correct allocation of the 8(4)-field sequence in BG/PAL (M/NTSC). If the program signal is not to standard, it is thus always ensured that the generator signal complies with the standard.

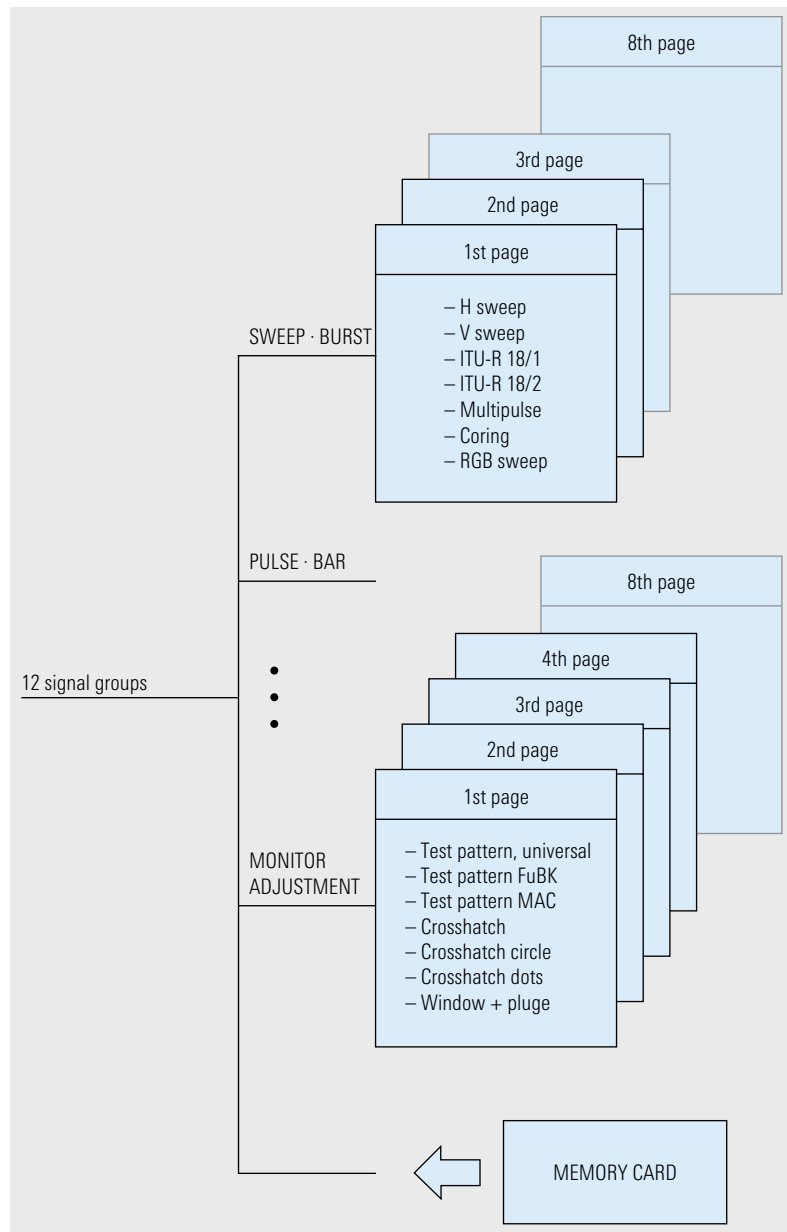
Twelve signal groups can be selected via the front-panel keys:

- ◆ ITS: All test signals to ITU-R, FCC or national standards
- ◆ APL: Average picture level: 3/4 lines monochrome, one selectable signal line; bounce
- ◆ SPECIAL: Split level, coring, sin x/x, bowtie and many other special signals, optional PALplus test pattern
- ◆ SWEEP BURST: H and V sweep, multiburst, V sweep with adjustable marker, sinewave signal with selectable frequency (line-coupled phase)
- ◆ PULSE BAR: Squarewave and \cos^2 pulses
- ◆ LINEARITY: Sawtooth and staircase signals
- ◆ MONITOR ADJUSTMENT: Test patterns 4:3 and 16:9, color bars, pluge, crosshatch
- ◆ ZONE PLATE: Linear, circular and hyperbolic zone plates, variable zone plate signal with user-selectable coefficients $k_x, k_{x^2}, k_{xy}, k_y, k_{y^2}$; coefficients k_ϕ, k_t, k_{t^2} user-adjustable for every zone plate



Twelve different signal groups can be called up via the front panel

- ◆ **ITU-R 601 (option):** Signals to ITU-R Rec. 801, pathological signals, digital shallow ramps
- ◆ **CARD SIGNALS:** All signals stored on plugged-in memory card
- ◆ **USER SIGNALS:** All signals stored in RAM
- ◆ **USER SET:** The last seven signals selected; this set can be "frozen" at any time



Each of the 12 signal groups consists of up to eight signal menu pages; each page may contain seven signals



Rear view of the R&S[®]SAF

Specifications

Inputs/outputs	BNC female connectors, 75 Ω		
Return loss	≥34 dB (up to 6 MHz)		
Sync output	2 V into 75 Ω		
SC (color subcarrier)	2 V (pp) into 75 Ω		
Bounce trigger (input)	TTL levels, Z_{in} approx. 10 kΩ, for external triggering of bounce function		
Bypass	0 V/5 V for controlling the bypass circuit in a junction panel, Z_{out} approx. 20 Ω		
EXT inputs	2 inputs for inserting external signals into test line range or superimposing an external signal on the generator signals		
Connector	BNC, 75 Ω		
Gain	0 dB ±0.1 dB		
Differential gain	≤0.3%		
Differential phase	≤0.3°		
Clamping modes	<ul style="list-style-type: none"> – gated clamping to back porch – clamping to negative signal peak (EXT2 only), – AC-coupled signal (EXT2 only) 		
Superposition (EXT2 only)	<ul style="list-style-type: none"> – anywhere – in active picture range 		
Amplitude adjustment	via front panel or IEC/IEEE bus; the signal components CCVS, CVS, chroma, sync pulse, burst, setup and the components Y , C_b , C_r in the range 0% to 140% ¹⁾ are variable		
Phase/time adjustment			
$H_{EXT} - H_{INT}$	±9 μs		
$SC_{EXT} - SC_{INT}$	0° to 360°		
SC/H phase	–180° to +180°		
Horizontal frequency	±5% (burst switched off from +1.5%)		
Color subcarrier frequency	100 Hz to 6 MHz		
Burst position, duration, rise time, sync duration, rise time	setting range of a parameter always depending on settings of other parameters		
Program path (Genlock)			
Input/output	BNC, 75 Ω		
Amplitude-frequency response	±0.1 dB (up to 6 MHz)		
Group-delay error	≤5 ns (up to 5.5 MHz)		
Differential gain	≤0.2%		
Differential phase	≤0.2°		
S/N ratio (rms, weighted, 0.2 MHz to 5 MHz)	≥78 dB		
Test signal insertion			
Level	same as generator signal – CAL (normal mode) – setting of CVS up to $V_{pp} = 1.2$ V, for testing automatic gain control circuits, video analyzers, etc		
Insertion range	BG/PAL, N/PAL	M/NTSC	M/PAL
in 1st field (lines)	6 to 22	10 to 22	10 to 22
in 2nd field (lines)	319 to 335	10 to 21	273 to 284

Teletext signals	5 pages and teletext meas. line	eye test pattern and teletext meas. line
Amplitude V_{pp}	462 mV ±5 mV	500 mV ±5 mV
Eye height	≥96%	≥96%
Clock	6.9375 MHz	5.72727 MHz
Data lines	4 sequences programmable via front panel and IEC/IEEE bus	
Amplitude V_{pp}	500 mV ±5 mV	
Coding	biphase coding	
Clock	5 MHz	
Remote-control interface	to IEC 625-2 (IEEE 488), for controlling all generator functions	

CCVS

Level tolerances		
Standard	BG/PAL, N/PAL	M/NTSC, M/PAL
Nominal luminance level (cal.)	700 mV ±4 mV	714 mV ±4 mV
Nominal chrominance level (cal.)	700 mV ±7 mV	714 mV ±7 mV
Departure		
at nominal 500 mV to 700 mV	±1%	±1%
at nominal <500 mV	±5 mV	±5 mV
Squarewave pulses, staircase and sawtooth signals	nominal ±4 mV	nominal ±4 mV
2T pulse	nominal ±5 mV	nominal ±5 mV
10T and 20T pulses	nominal ±7 mV	nominal ±7 mV
12.5T pulses	—	nominal ±7 mV
Amplitude-frequency response		
Multipulse, multiburst, sweep signals up to 5.5 MHz	±0.1 dB	
5.5 MHz to 6 MHz	±0.15 dB	
Group delay		
10T and 20T pulses (modulated with frequencies ≤5 MHz)	≤5 ns	
Rise times (10% to 90%) and half-amplitude duration		
(also for Y , C_b , C_r signals)		
Sync rise time	200 ns ±5 ns (PAL, 625 lines) 140 ns ±5 ns (NTSC, 525 lines)	
Luminance		
Rise times	125 ns to 2000 ns	
Tolerances	125 ns to 249 ns ±5 ns 250 ns to 999 ns ±10 ns 1000 ns to 2000 ns ±30 ns	
Chrominance		
Rise times	150 ns to 2000 ns	
Tolerances	150 ns to 299 ns ±5 ns 300 ns to 999 ns ±10 ns 1000 ns to 2000 ns ±30 ns	

¹⁾ The CCVS must not exceed 1.6 V (pp).

Line-time nonlinearity		
5-step staircase	≤0.8%	
Chrominance phase		
Phase between R-Y and B-Y axes	90° ±1°	
Maximum departure of chrominance phase from nominal	±2°	
S/N ratio		
rms, weighted, 0.2 MHz to 5 MHz		
Measured on all-black picture	≥78 dB	
Measured on sawtooth signal	≥70 dB	
Sync frame	PAL	NTSC
	sync frame and burst phase to ITU-R Rec. 624-3	coupled with stable SC/H phase (to RS-170 A)
SC/H phase (calibrated)	0° ±5°	0° ±5°
V component	can be disabled for special measurements	
The tolerances in S-VHS format correspond to those of the CCVS.		

Component signals

Y_{C_b}C_r (for 525/625 lines, not for the R&S®SFF)	Y signal	C_b, C_r signal
Squarewave, staircase signals	nominal ±4 mV	nominal ±7 mV
Sawtooth signals	nominal ±7 mV	nominal ±7 mV
2T to 20T pulses	nominal ±7 mV	—
3T to 20T pulses	—	nominal ±7 mV
Sweep, multiburst signals		
0 Hz to 5.5 MHz	nominal ±7 mV	nominal ±7 mV
5.5 MHz to 6 MHz	nominal ±10 mV	nominal ±10 mV
RGB		
Each component can be disabled separately; the rise times are determined by those of the Y _{C_b} C _r signals.		
Amplitude error	same as Y _{C_b} C _r signal components	
Matrixing error	±1%	
Matrixing frequency response	±0.2 dB (up to 6 MHz)	
Sync pulse (can be added to or removed from each component)	300 mV ±7 mV	
Option ITU-R 601		
Standards	625 lines/50 Hz, 525 lines/60 Hz	
Systems	ITU-R Rec. 601/656 (4:2:2) SMPTE 125M/259M	
Signals	<ul style="list-style-type: none"> – to ITU-R Rec. 801 with 10-bit resolution – pathological signals for testing the serial digital interface with 10-bit resolution – digital shallow ramps with 10-bit resolution – all other R&S®SAF/R&S®SFF signals with 9-bit resolution; the 10th bit can be switched to 0, 1 or to alternating 0/1 operation for each Y, C_b and C_r component 	

Outputs	
1 parallel output	27 Msample/s
Amplitude	ECL level
Rise/fall time (20%/80%)	<5 ns
Clock pulse width	18.5 ns ±3 ns
Clock/data delay	18.5 ns ±3 ns
Clock/data setting range	±10 ns
Connector	25-contact D-Sub (ISO 2110)
2 serial outputs	270 Mbit/s (D1 format)
Amplitude	800 mV (V _{pp}) ±10% into 75 Ω
Rise/fall time (20%/80%)	0.75 ns to 1.5 ns
Output impedance	75 Ω
Return loss	≥15 dB from 10 MHz to 270 MHz
Connector	BNC

General data

Operating temperature range	+5 °C to +45 °C
Storage temperature range	–40 °C to +70 °C
Mechanical resistance	
Sinusoidal vibration	5 Hz to 150 Hz, max. 2 g at 55 Hz, 0.5 g from 55 Hz to 150 Hz, to EN 60068-2-6, IEC 1010-1, MIL-T-28800D class 5
Random vibration	10 Hz to 300 Hz, 1.2 g (rms)
Shock	40 g shock spectrum, to MIL-STD-810C and MIL-T-28800D classes 3 and 5
Climatic resistance	+25 °C/+40 °C cyclic at 95% rel. humidity, to EN 60068-2-30
Electromagnetic compatibility	to EMC directive of EU (89/336/EEC) and German EMC law
Electrical safety	to EN 61010-1
Power supply	100 V/120 V/230 V/240 V +10%/–15%, 47 Hz to 63 Hz, 100 VA (R&S®SAF), 80 VA (R&S®SFF)
Dimensions (W × H × D)	435 mm × 147 mm × 460 mm
Weight	
R&S®SAF	16.5 kg
R&S®SFF	15.5 kg

Ordering information

Designation	Type	Order No.
CCVS + Component Generator	R&S®SAF	2007.1005.02
CCVS Generator	R&S®SFF	2007.1057.02
Options		
Digital Video Interface	R&S®SAF-Z1 R&S®SFF-Z1	2007.1063.02 2007.1063.03
PALplus Test Pattern	R&S®SAF-B20	2007.1011.02
Accessories supplied	power cable, fuses	
Recommended extras		
Memory Card 32 Kbyte	R&S®ZM-32	2005.4394.02
Memory Card 512 Kbyte	R&S®ZM-512	2005.4388.02
Service Kit (containing adapter boards, adapter cable and service manual)	R&S®SAF-Z R&S®SFF-Z	2007.1111.00 2007.1105.00
Handles and screws		0396.5153.00

More information at
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www.rohde-schwarz.com

Europe: Tel. +49 1805 12 4242, e-mail: customersupport@rohde-schwarz.com · USA: Tel. +1 410-910-7988, e-mail: customer.support@rsa.rohde-schwarz.com

Asia: Tel. +65 68463710, e-mail: customer-service@rssg.rohde-schwarz.com