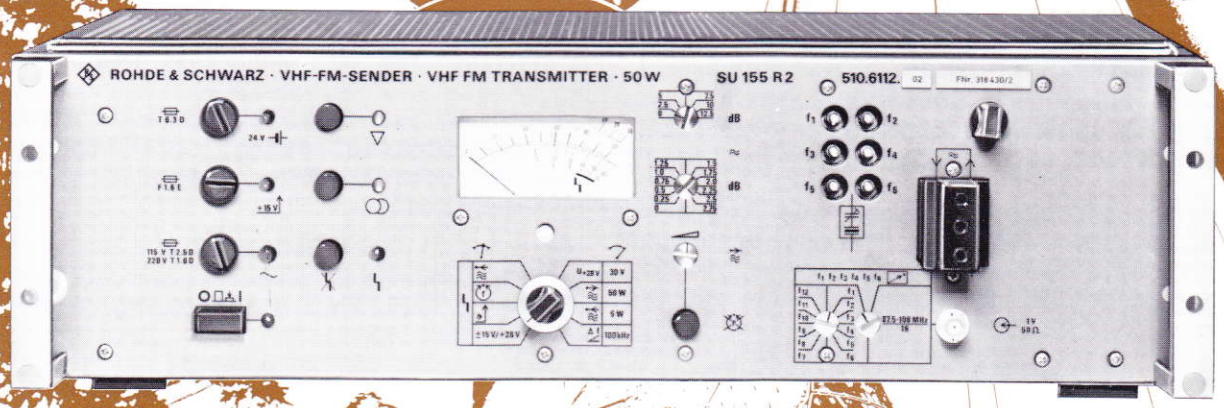
ROHDE&SCHWARZ

SU 155 R2

VHF-FM TRANSMITTER

for mono and stereo broadcasts
87.5 to 108 MHz, 50 W

- Particularly suitable for outside broadcasting
- Selection of any of twelve operating frequencies by switchover of crystals without retuning
- Operation from battery and/or AC supply



Data sheet
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VHF-FM TRANSMITTER SU 155 R2

- Automatic reduction of output power in case of mismatch
- Constant output power thanks to efficient ALC
- High spectral purity due to frequency generation and modulation at transmitter frequency
- Fault-signal memory proof against erasure by AC-supply failure

Characteristics and Uses

High reliability, ease of servicing and the favourable price are the most noteworthy features of the VHF-FM Transmitter SU 155 R2. It may be used as an **independent unit, e.g. for outside broadcasts,** or as **exciter** for the R&S transmitters with 0.3 to 10 kW output.

The SU 155 R2 is suitable for the transmission of mono or stereo programs in accordance with CCIR Recommendation 450, section 2 ("pilot-tone system") and of supplementary information, such as traffic-radio or SCA signals. The SU 155 R2 complies with the standard specifications of the Federal German association of broadcasters ARD and of the Deutsche Bundespost.

In conjunction with an automatic switchover facility, two transmitters SU 155 R2 can be combined to form a transmitting system with passive standby facility, or up to six transmitters may be interconnected in an n + 1-reserve configuration.

The SU 155 R2 is a 19″ rackmount; its front panel can be easily converted to DIN dimensions with accessory parts. For use as an independent unit, the transmitter can also be accommodated in a cabinet.

SU 155 R2
as 19″ rackmount

Description

The SU 155 R2 consists of the following modules: FM oscillator, AFC circuit, 50-W amplifier, monitoring circuit and stabilized power supply (see block diagram). All these circuits are mounted on a common motherboard.

All electrical connections are of the plug-and-socket type. Although the transmitter does not require any routine maintenance, all modules can be swung out or removed completely in order to facilitate servicing. Replacement of complete modules is possible without any adjustments being required.

Generously dimensioned heatsinks and the arrangement of the main sources of heat along the periphery of the transmitter ensure optimum cooling with a minimum temperature gradient inside. Junction temperatures of the transistors well below the permissible maxima and advanced technology ensure high operational reliability and availability, which is of particular importance for use in unmanned stations.

FM oscillator The FM oscillator operates at the output frequency of the transmitter. It is frequency modulated by varactors, the modulation signal being applied via a shorting plug and an AF amplifier. The floating modulation input is provided with a broadband transformer.

Two controls (coarse and fine) are provided for level matching and frequency-deviation adjustment. With mono operation, these are followed by a 15-kHz lowpass filter and a preemphasis RC circuit (both bypassed for stereo operation) and an amplifier.

A DC voltage proportional to the modulation voltage is passed on to the panel meter for indication of the frequency deviation.

A special circuit in the modulator ensures that the frequency deviation for a given modulating voltage remains largely unaffected by the transmitting frequency.

AFC circuit The AFC circuit ensures optimum frequency stability of the transmitter. Towards this end, the oscillator frequency is compared in a discriminator with a reference frequency delivered by a crystal oscillator, and corrected if necessary. In this way, the centre frequency of the oscillator is automatically maintained at the reference frequency over the entire RF range.

If the difference between oscillator and reference frequency is adequately small, the discriminator switches automatically from frequency comparison to phase comparison. Consequently, the accuracy of the transmitter output frequency is identical to that of the reference frequency. The AFC voltage generated in the discriminator is applied to a varactor for correcting the oscillator frequency. In order to minimize the effect of the frequency deviation on the accuracy of the control process, the frequency-modulated oscillator frequency is divided in a high-ratio digital divider prior to the comparison in the discriminator.

If the two frequencies applied to the discriminator are unequal, the signal "capture range exceeded" is given and the carrier blocked by the monitoring circuit to prevent unwanted emissions.

The oven-controlled reference oscillator operates at one sixteenth of the transmitter centre frequency. Up to twelve crystals may be inserted, so that any of twelve frequencies can be selected, six crystals being remotely selectable. In addition, operation with an external reference frequency is also possible.

A trimmer is provided for each crystal to permit accurate adjustment to the desired frequency. The maximum departure of the centre frequency from the nominal frequency is less than 1 kHz/year.

The FM modulator is followed by an amplifier containing an ALC circuit for stabilizing the output power. The RF amplifiers are broadband so that the output frequency can be changed merely by switching over the operating crystal. This can also be done by remote control, which is of particular advantage in unmanned stations.

50-W amplifier The broadband 50-W amplifier is equipped at the output with directional couplers; these deliver the command variable for the ALC and the test voltages for indication of output and reflected power.

The amplifier also incorporates a protective circuit which reduces the output power ot the transmitter to a tolerable level whenever the mismatch at the output is unduly high.

Monitoring circuit The monitoring circuit evaluates the principal operating characteristics and, if necessary, initiates corrective measures and/or delivers fault signals. This circuit monitors the output frequency, output matching and — most important — the temperature of the power transistors. If the maximum permissible temperature is exceeded, the carrier is automatically cut off and the signal "overtemperature" given.

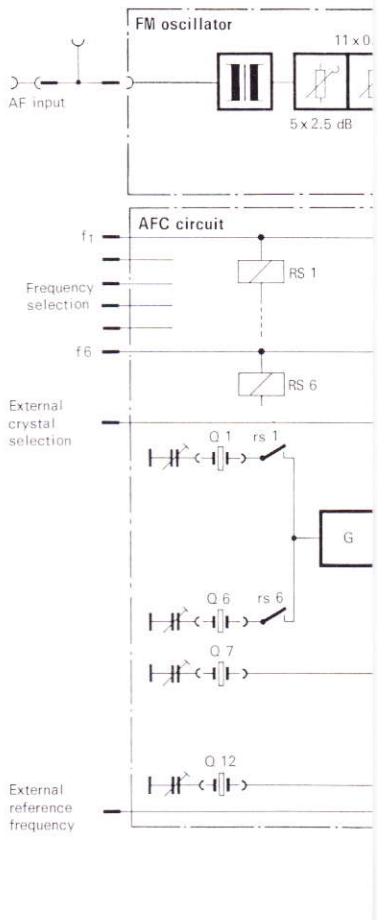
All fault signals applied to the monitoring circuit are stored. If operation is disrupted by a fault, normal operation can be resumed again if the cause of this fault has been eliminated and the transmitter is switched off and then on again. The fault signal, however, remains stored and can be cancelled by actuating a reset button. In unattended stations, this facility permits subsequent determination of any temporary fault that may have occurred.

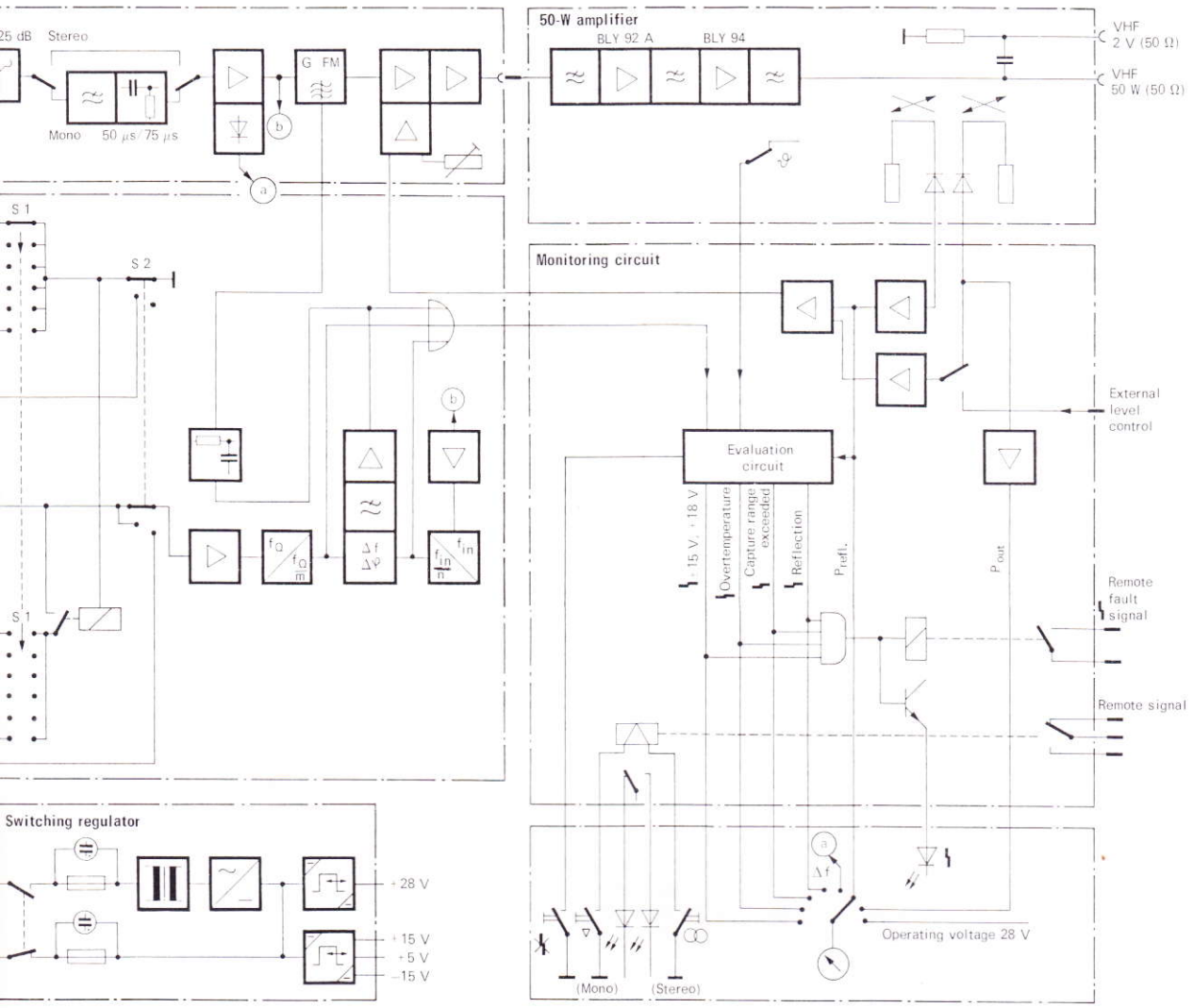
Whenever a fault occurs, indication is made by an LED on the front panel; this "fault" signal can also be transmitted to a remote position via a floating contact. The type of fault can be interrogated manually with a checkpoint selector.

The SU 155 R2 is also equipped with a separate input for an external control voltage so that the output level of any subsequent power amplifier can be automatically stabilized.

In order to facilitate tuning of the input circuit of such a power amplifier, the output power of the SU 155 R2 can be maintained at a constant level by pressing a button on the front panel. Operation without ALC is, however, also possible for maintenance purposes.

Power supply The power supply operates according to the switching regulator principle, thus providing high efficiency. The transmitter can be fed from the AC supply or from a 24-V battery. AC supply and battery voltage can be connected simultaneously. In case of an AC supply failure the SU 155 R2 switches automatically to battery supply.





Specifications

Frequency range	87.5 to 108 MHz
Type of emission	F3
Stereo emissions	acc. to CCIR Recommendation 450, section 2 on "pilot-tone systems"
Frequency deviation	± 75 kHz, max. ± 100 kHz
Change of operating frequency	by switch-selection of any of twelve crystals or of an external reference frequency, six crystals being remotely selectable
RF output	
Nominal output power	50 W, adjustable between 10 W and 50 W
Nominal output impedance	50 Ω; female BNC connector
VSWR	≦ 2
Harmonics suppression	≧ 70 dB
Suppression of spurious emissions	≧ 100 dB
RF test output	
Output voltage at RF output for 50 W output power	ca. 2 V_{rms} into 50 Ω; female BNC connector
Inputs	
Modulation input	
Impedance	2000 Ω or 600 Ω, balanced or unbalanced
Connector	30-pin strip acc. to DIN 41622 at rear panel plus 3-pole female acc. to DIN 41128 on front panel
AF input level for ± 40 kHz frequency deviation	-6 to +9 dBm (= 0.39 V to 2.18 V)
Steps of input attenuator	
Coarse	5 x 2.5 dB
Fine	11 x 0.25 dB
Time constant of pre-emphasis	50 µs ± 5 µs or 75 µs ± 7.5 µs; can be switched off

Reference-frequency input	
Input-voltage range	0.25 to 1 V
Input impedance	50 Ω; female BNC connector
Reference frequency	1/16 of transmitting frequency
Input for external ALC voltage	
Input-voltage range	0 to -1.2 V
Input impedance	≧ 20 kΩ; female BNC connector

Transmission characteristics

Variation of centre frequency	≦ 1000 Hz/year (with crystal 090.8712.00)
Centre-frequency shift with ± 75 kHz frequency deviation	not measurable
Frequency response, measured **without** 15-kHz lowpass filter and **without** preemphasis	
40 Hz to 43 kHz	≦ ± 0.1 dB } ref. to 500 Hz
43 kHz to 100 kHz	≦ ± 0.3 dB } ref. to 500 Hz
Frequency response with 15-kHz lowpass filter and with pre- and deemphasis	
40 Hz to 15 kHz	≦ ± 0.5 dB, ref. to 500 Hz
Suppression of frequencies ≧ 19 kHz by 15-kHz lowpass filter (switchable)	≧ 40 dB
Crosstalk attenuation between left and right channels	
40 Hz to 15 kHz	≧ 40 dB
Distortion in range from 40 Hz to 15 kHz acc. to DIN 45403	
with ± 75 kHz frequency deviation	< 0.4 %
with ± 100 kHz frequency deviation	< 0.6 %
Intermodulation distortion between 15 kHz and 53 kHz with ± 75 kHz frequency deviation acc. to DIN 45403	
2nd order products d_2	≦ 0.2 % [1]
3rd order products d_3	≦ 0.3 %
Unweighted FM S/N ratio acc. to DIN 45405, ref. to ± 40 kHz frequency deviation and with f_{mod} = 500 Hz	
Mono operation	≧ 70 dB
Stereo operation with coder and decoder	≧ 66 dB
Weighted FM S/N ratio acc. to DIN 45405, ref. to ± 40 kHz frequency deviation and with f_{mod} = 500 Hz	
Mono operation	≧ 70 dB
Stereo operation	≧ 66 dB
Unweighted AM S/N ratio, ref. to 100 % AM	≧ 70 dB
Weighted AM S/N ratio, ref. to 100 % AM	≧ 70 dB
Unweighted AM S/N ratio for FM operation with ± 40 kHz deviation	≧ 54 dB

Built-in test facilities

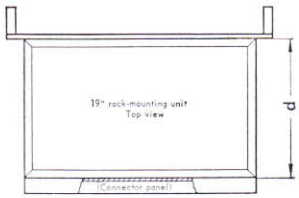
Range of indication of frequency deviation	0 to 100 kHz
Error in indication	
without pilot tone	≦ 3 %, ref. to 40-kHz indication
with pilot tone	≦ 9 %, ref. to 40-kHz indication
Range of indication of output power	0 to 60 W
Error in indication	≦ ± 7.5 % of fsd
Error in indication at a fixed frequency	≦ ± 2.5 %
Range of indication of reflected power	0 to 6 W
Error in indication	≦ 7.5 % of fsd
"Fault" signal	
Local	by LED
Remote	via floating contact
Memory for individual faults (can be interrogated with switch)	reflection, capture range exceeded, overtemperature, operating voltage (± 15 V, 28 V)

[1] $d_2 = \frac{V(f_2-f_1)}{V_{out}\sqrt{2}}$, $d_3 = \frac{V(2\cdot f_2-f_1) + V(2\cdot f_1-f_2)}{V_{out}\sqrt{2}}$; V_{out} = rms value of complete output signal

VHF-FM TRANSMITTER SU 155 R2

General data

Nominal temperature range	-5 to +55 °C
Operating temperature range	-20 to +55 °C
Shelf temperature range	-40 to +70 °C
Power supply	AC supply or battery
AC supply	110/120/220/240 V + 10/-15 %, 47 to 63 Hz, (165 VA for P_{out} = 50 W, 27 VA for standby - power factor ($\cos\varphi$) ≧ 0.75)
Battery operation	21.5 to 40 V (140 W for P_{out} = 50 W, 18 W for standby)
Cooling	by convection
Service ceiling	2500 m above sea level
Permissible average humidity	≦ 80 %; operational up to 95 %
Permissible extraneous field strength	
Electric	≦ 10 V/m
Magnetic	≦ 4 A/m
Overall dimensions (W x H x D) and weight	
19″ bench model	484 mm x 150 mm x 336 mm, 15.5 kg
19″ rackmount	483 mm x 133 mm x 325 mm, seated depth d = 247 mm, 14.8 kg
Colour	front panel: grey RAL 7001 cabinet: grey RAL 7011
Front-panel engravings	symbols



Order designation	► VHF-FM Transmitter SU 155 R2
19″ bench model	510.6112.05
19″ rackmount	510.6112.04

Please specify transmitting frequency, AC-supply voltage and AC-supply frequency in order.

Accessories supplied

1 crystal	090.8712.00
1 power cable (only for bench model)	
Manual	

Recommended extras

Spare crystal (please specify transmit frequency in order)	090.8712.00
Connector panel ZR 155 for installation in racks (including self-engaging mating connector)	465.6413.02
Front-panel adapter for conversion to DIN dimensions	034.1074.00
Guide rails left for converting DIN 41490 racks (width 520 mm)	043.6875.00
Guide rails right for converting DIN 41490 racks (width 520 mm)	043.6969.00
Cabinet for rackmounting model	497.7215.02

The following connectors and accessories are available for the connection of the signal lines:

Connector		Mating part	Order No.
Bu 1	AF input (front panel)	Free plug	019.0458.00
Bu 2	Input for external reference frequency	Free BNC connector (male)	017.6536.00
Bu 4	50-W RF output VHF test output External ALC voltage	Free BNC connector (male) (not suitable for self-engaging rack connection)	017.6536.00
St 5	Commands/signals AF input (rear panel)	Female connector strip with hand guard and 2 guide sleeves	017.3443.00 087.7754.00 043.5627.00
St 6	Signals AF input (rear panel)	Female connector strip with hand guard and 2 guide sleeves	017.3443.00 087.7754.00 043.5627.00

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