

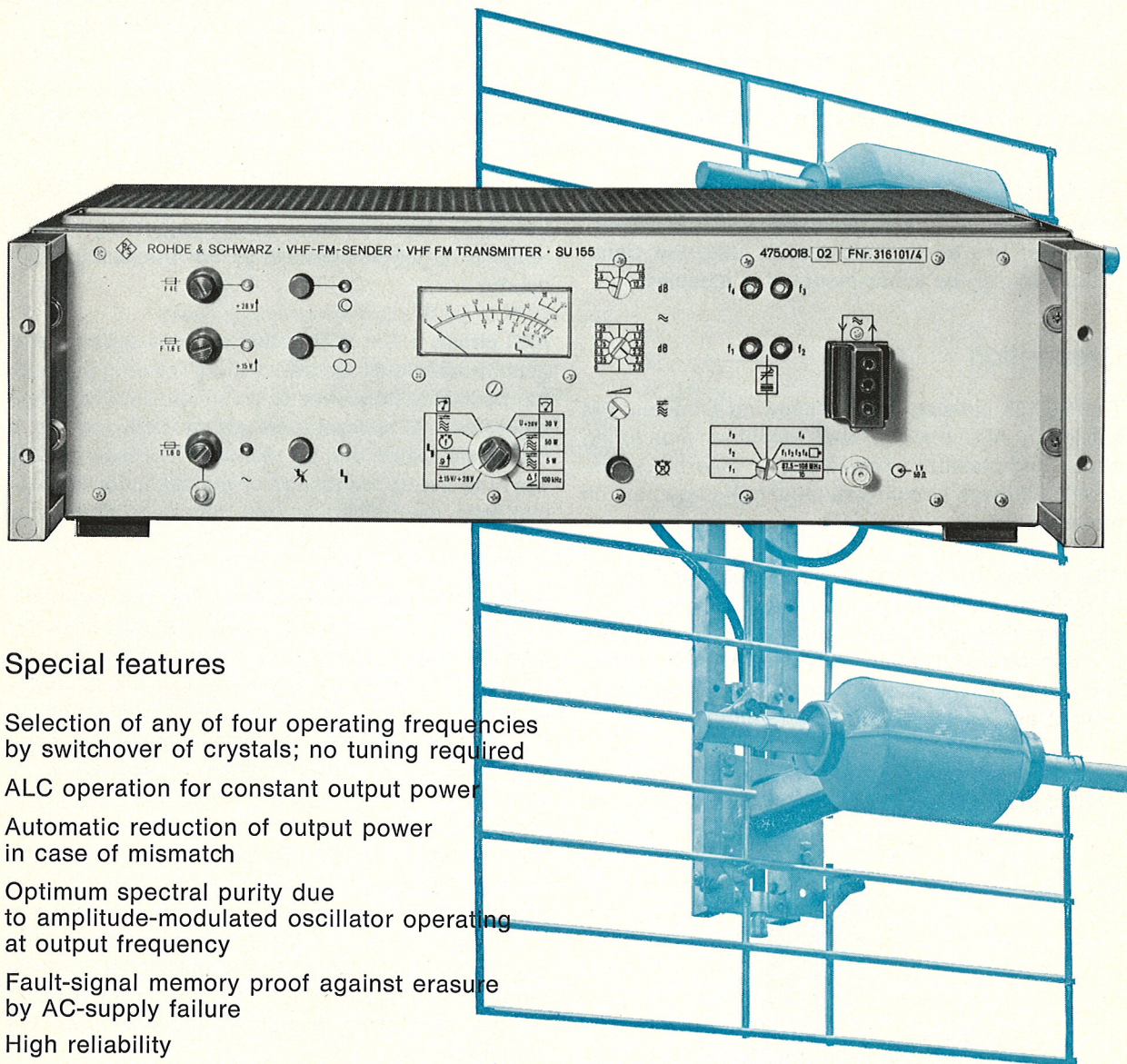


ROHDE & SCHWARZ
MÜNCHEN

SU 155

VHF-FM TRANSMITTER

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



Special features

Selection of any of four operating frequencies by switchover of crystals; no tuning required

ALC operation for constant output power

Automatic reduction of output power in case of mismatch

Optimum spectral purity due to amplitude-modulated oscillator operating at output frequency

Fault-signal memory proof against erasure by AC-supply failure

High reliability

Characteristics and Uses

High reliability, ease of servicing and the favourable price are the most noteworthy features of the VHF-FM transmitter SU 155. It may be used as an independent unit (e.g. for outside broadcasts) delivering an output power of 50 W, or as a driver for the R&S transmitters with 0.3 kW, 1 kW, 3 kW, 5 kW or 10 kW output.

The SU 155 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 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 can be combined in a common cabinet to form a transmitting system with passive standby facility, or up to four transmitters may be interconnected in an n+1-reserve configuration.

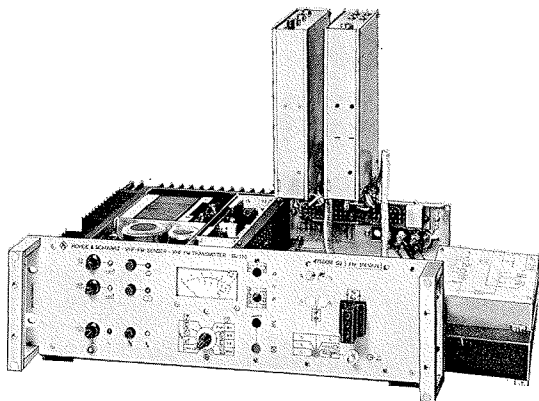
The SU 155 is a 19" rackmount; its front panel can be easily converted to DIN dimensions with accessory parts. For use as an independent unit, the transmitter can also be accommodated in a cabinet.

Description

The SU 155 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



Serviceable design: SU 155 with swing-out modules

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 crystal oscillator for the reference signal operates at one sixteenth of the centre frequency of the transmitter. Up to four crystals can be housed in an oven so that one external or any of four internal frequencies can be selected. 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 or 500 Hz/year, depending on the type of crystal used.

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.

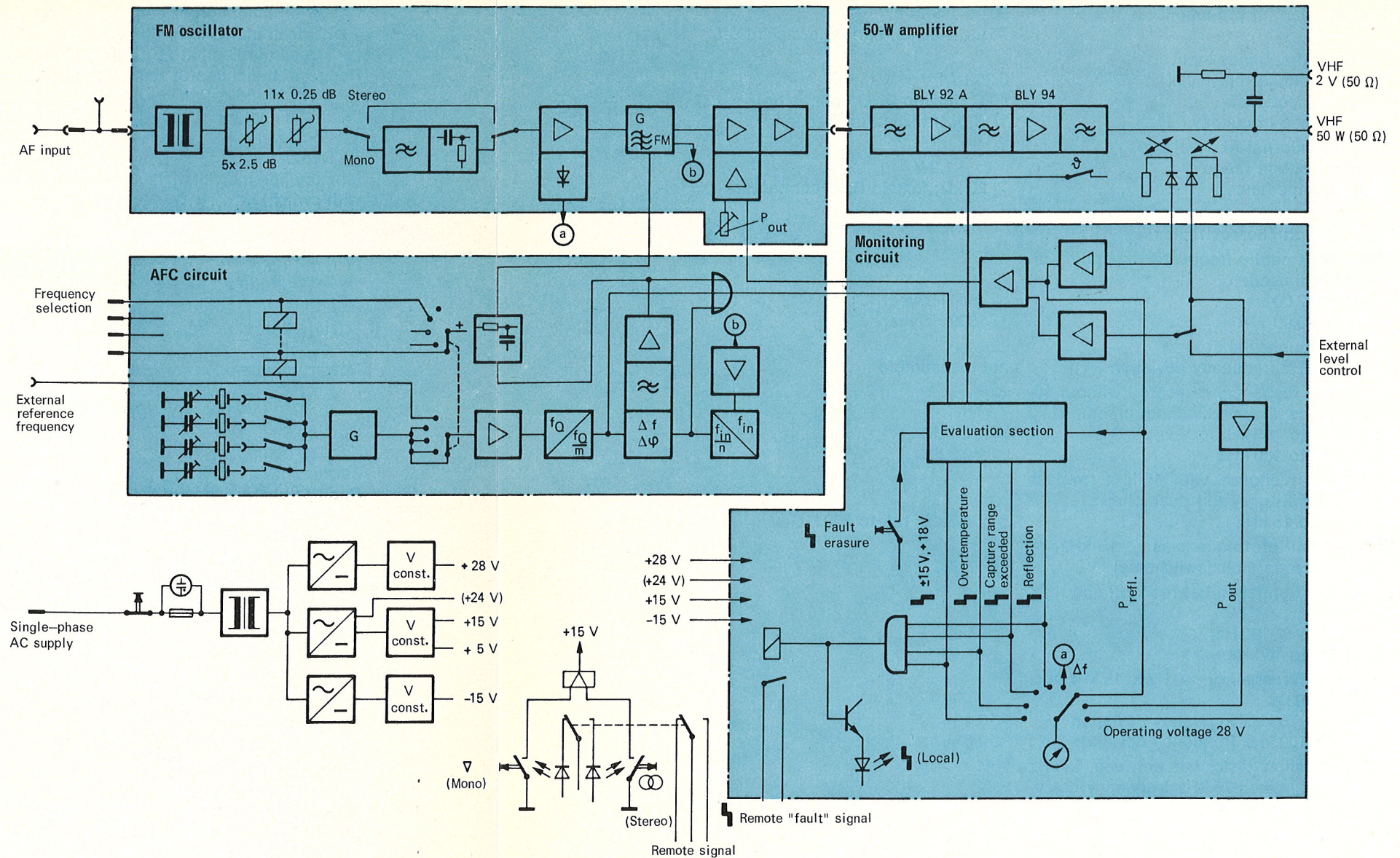
50-W amplifier The broadband 50-W amplifier is equipped at the output with directional couplers; these deliver the command variable for the ALC and the test voltages for indication of output and reflected power. The amplifier also incorporates a protective circuit which reduces the output power of the 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 “over-temperature” 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 is also equipped with a separate input for an external control voltage so that the output



Block diagram of VHF-FM transmitter SU 155

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 can be maintained at a constant level by pressing a button on the front panel. Operation with ALC is, however, also possible for maintenance purposes.

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 four crystals or of an external reference frequency

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
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Inputs

Modulation input	
Impedance	2000 Ω or 600 Ω, balanced or unbalanced
Connector	30-pin connector strip acc. to DIN 41622 at rear panel plus 3-pole socket 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 × 2.5 dB
Fine	11 × 0.25 dB

Time constant of pre-emphasis	50 μ s \pm 5 μ s or 75 μ s \pm 7.5 μ s; 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	\geq 20 k Ω ; female BNC connector

Transmission characteristics

Variation of centre frequency depending on R&S crystal used:

090.5607.00	\leq 500 Hz/year
090.4600.00	\leq 1000 Hz/year

Centre-frequency shift

with \pm 75 kHz frequency deviation not measurable

Frequency response, measured **without** 15-kHz lowpass filter and **without** preemphasis

40 Hz to 43 kHz	\leq \pm 0.1 dB	} ref. to 500 Hz
43 kHz to 100 kHz	\leq \pm 0.3 dB	

Frequency response with 15-kHz lowpass filter and with pre- and deemphasis

40 Hz to 15 kHz \leq \pm 0.5 dB, ref. to 500 Hz

Suppression of frequencies \geq 19 kHz by 15-kHz lowpass filter (switchable)

\geq 40 dB

Crosstalk attenuation between left and right channel

40 Hz to < 100 Hz	\geq 37 dB
100 Hz to 15 kHz	\geq 40 dB

Distortion in range from 40 Hz to 15 kHz acc. to DIN 45 403

with \pm 75 kHz frequency deviation	< 0.4%
with \pm 100 kHz frequency deviation	< 0.6%

Intermodulation distortion between 15 kHz and 53 kHz with \pm 75 kHz frequency deviation acc. to DIN 45 403

2nd order products d_2	\leq 0.2% *)
3rd order products d_3	\leq 0.3%

Unweighted FM S/N ratio acc. to DIN 45 405, ref. to \pm 40 kHz frequency deviation and with $f_{mod} = 500$ Hz

Mono operation	\geq 70 dB
Stereo operation with coder and decoder	\geq 66 dB

Weighted FM S/N ratio acc. to DIN 45 405, ref. to \pm 40 kHz frequency deviation and with $f_{mod} = 500$ Hz

Mono operation	\geq 70 dB
Stereo operation	\geq 66 dB

Unweighted AM S/N ratio, ref. to 100% AM \geq 70 dB

Weighted AM S/N ratio, ref. to 100% AM \geq 70 dB

Unweighted AM S/N ratio for FM operation with \pm 40 kHz deviation \geq 54 dB

Built-in test facilities

Range of indication of frequency deviation 0 to 100 kHz

Error in indication

without pilot tone	\leq 3%, ref. to 40-kHz indication
with pilot tone	\leq 9%, ref. to 40-kHz indication

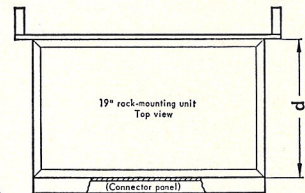
*) $d_2 = \frac{V(f_2 - f_1)}{V_{out} \sqrt{2}}$, $d_3 = \frac{V(2 \cdot f_2 - f_1) + V(2 \cdot f_1 - f_2)}{V_{out} \sqrt{2}}$; V_{out} = rms value of complete output signal

Range of indication of output power	0 to 60 W
Error in indication	$\leq \pm 7.5\%$ of f.s.d.
Error in indication at a fixed frequency	$\leq \pm 2.5\%$
Range of indication of reflected power	0 to 6 W
Error in indication	$\leq \pm 7.5\%$ of f.s.d.
"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)

General data

Nominal temperature range	-5 to +55 °C
Operating temperature range	-20 to +55 °C
Shelf temperature range	-40 to +70 °C
AC supply	115/200/220/240 V +10/-15%, 47 to 63 Hz
Power consumption ($\cos\phi > 0.75$)	
for $P_{out} = 50$ W	ca. 190 VA
for $P_{out} = 0$ W (standby)	ca. 50 VA
Cooling	by convection
Service ceiling	2500 m above sea level
Permissible average humidity	$\leq 80\%$; operational up to 95%
Permissible extraneous field strength	
Electric	≤ 10 V/m
Magnetic	≤ 4 A/m

Overall dimensions (W×H×D) and weight	
19" desk-top model	484 mm × 150 mm × 336 mm, 19.5 kg
19" rackmount	483 mm × 133 mm × 325 mm, seated depth d = 247 mm, 19 kg
Colour	front panel: grey (RAL 7001) cabinet: grey (RAL 7011)
Front-panel engravings	symbols



Order designation	▶ VHF FM Transmitter SU 155
19" desk-top model	475.0018.03
19" rackmount	475.0018.02

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

Accessories supplied

1 crystal	090.4600.00 (drift ≤ 1000 Hz/year)
1 power cable (only for desk-top model)	
Manual	

Recommended extras

Spare crystal 090.4600.00; drift ≤ 1000 Hz/year	} please specify transmit frequency in order
Spare crystal 090.5607.00; drift ≤ 500 Hz/year	
Connector panel 465.6413.02 for installation in racks, including self-engaging mating connector	
Front-panel adapter 034.1074.00 for conversion to DIN dimensions	
Guide rails 043.6875.02 (left) and 043.6969.02 (right) for converting DIN racks (width 520 mm) to 19" standard	
Cabinet 497.7215.02 for rackmounting model	

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

Connector	Mating part	Order No.
Bu1 AF input (front panel)	Free plug	019.0458.00
Bu2 Input for external reference frequency	Free BNC connector (male)	017.6536.00
Bu4 50-W RF output	Free BNC connector (male)	017.6536.00
VHF test output	(not suitable for self-engaging rack connection)	
External ALC voltage	Female connector strip	017.3443.00
St5 Commands / signals	with hand guard	087.7754.00
AF input (rear panel)	and 2 guide sleeves	043.5627.00
St6 Signals	Female connector strip	017.3443.00
AF input (rear panel)	with hand guard	087.7754.00
	and 2 guide sleeves	043.5627.00

