



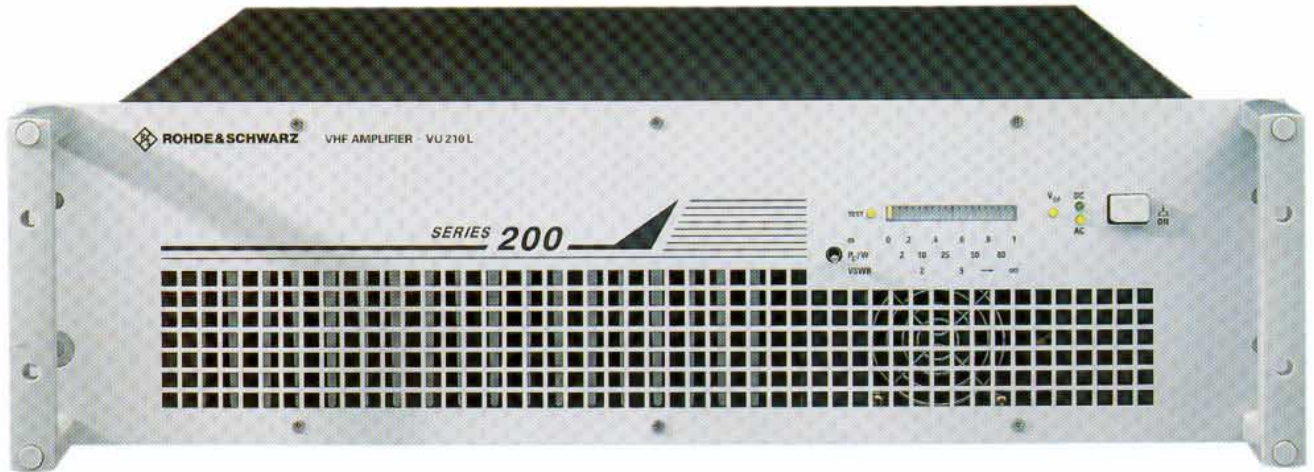
VHF Power Amplifiers

for ground-to-air and naval radio communications

In general high power amplifiers are used in ground-to-air radio stations for improvement of the communication link reliability under extreme natural or operational, planned or unforeseen conditions. They offer:

- Extension of the usable propagation range beyond LOS (making use of the physical bending effect)
- Extension of communication range under adverse technical conditions: compensation of RF power losses of antenna filters, long antenna cables or unforeseen influences like bad coaxial cable, connector or antenna matching (reflection losses) as they can occur under critical circumstances
- Increase of the AJ (anti-jam) margin, i.e. increase of ECM resistance in a jammed communication environment





VHF Amplifier 100 W VU210L

Application

The VHF power amplifiers VU210L and VU220L are designed for following system applications:

- Single and multi-channel (broad-band) application
- Control interfaces for Series 200 or 400U transmitters
- Linear amplifier operation together with other (non-Rohde & Schwarz) exciters
- Amplifiers are with RF bypass relays and enable:
 - operation in standard transceiver mode via the only TX/RX antenna path or
 - power management: normal/high power mode switchable
- Use in 90 to 265 V_{AC} environment
- Use in radio systems with DC backup supply
- Automatic AC/DC switchover
- Use in collocated radio systems
- Continuous operation (100% duty cycle) under normal operating conditions

Design – modularity – functions

The design of both, the VU210L and VU220L, is based on broadband and linear techniques. Integrated test facilities continuously monitor the key functions.

The VU210L (100 W) is designed as a compact 19" 3 HU plug-in for rack installation. Rear installed fans suck the air from the front to the rear through the oversized heat sink the basic VHF Amplifier I is mounted to. The VU210L consists of the following modules:

- 19" Adapter, 3 HU, with central cooling duct
- VHF Amplifier I
- Output Unit
- Control Board
- Power Supply

For details of the modules see below.

The VU220L (200 W) is designed as a compact 19" 5 HU plug-in for rack installation. It consists of:

- 19" Adapter, 5 HU, with central cooling duct from the front to the rear with rectangular cross-section
- VHF Amplifier I: it is mounted atop of the heat sink
- VHF Amplifier II: it is mounted on the lower side of the cooling duct and connected in parallel to VHF Amplifier I
- Output Unit
- Control Board
- Power Supply

For details of the modules see below.

The most important internal modules of VU210L (and VU220L) and their functions are:

- VHF Amplifier I: it consists of two parallel amplifier stages in A/B mode, two 3 dB/90° devices (splitter and combiner) providing good matching and high load decou-

pling and a circulator: This component offers – together with its absorber – a broadband decoupling of the antenna, i.e. it reduces influence of power reflected from the antenna output caused by mismatch and/or interference from co-sited transmitters. Thus, in conjunction with the circuit design of the basic amplifier modules, the VU210L and VU220L feature a high backward intermodulation, the benefit of which is interference-free operation by suppression of unwanted intermodulation (IM3) product transmissions. Provisions are made that this core technique can easily be used to build-up the 200 W type VU220L: for this case the VHF Amplifier I is supplemented by two 3-dB couplers including their absorbers, inserted behind the RF bypass relay in the input stage and behind the circulator – in front of the (common) output unit. Thus two VHF Amplifiers I and II can be coupled in parallel for high-power application

- VHF Amplifier II (in VU220L only): this board is in principal identical to the amplifier I, complete with own circulator, however without the 3-dB coupling facility
- Output Unit: this module includes the harmonics filter, the directional coupler and the RF bypass. The harmonics filter uses a low loss Tschebyscheff type lowpass filter. The front panel indications for forward power and the antenna matching (VSWR) as well as a power reduction criterium are derived from the directional coupler which is interfaced just in front of the antenna relay. Two RF relays, interfaced at the input and antenna side, are used to form an RF bypass for both, operation with normal exciter power or for transmit/receive mode

- Control Board: this central unit comprises the processor for control and monitoring of the amplifier stages, of the AC and DC supply and of the blower and includes protective circuits. Separate interfaces for the use of Series 200 or 400U are provided for optimum of operation. The status display (detailed BITE-information on 20 element horizontal bargraph LED-display), the switch for selection of modulation depth (m), RF output carrier power (P_{OUT}) or standing-wave ratio (VSWR), the TEST LED (GO/NOGO) and the power switch are further elements of this unit
- Power Supply: this switching type power supply accepts AC and features automatic switchover in case of AC failure to emergency supply (DC). Some supplementary components eg for filtering are mounted directly onto the 19" adapter
- 19" Adapter: this mechanical structure integrates the described modules, incorporates additional components such as the mains filter, DC filter coils and capacitors or reverse polarity protection and includes the electrical interface for RF, AC/DC, control and monitoring

Features and benefits

Features	Benefits for customer
<p>Excellent cooling and monitoring circuitries</p> <ul style="list-style-type: none"> - Oversized heat sink - Forced-air cooling of the power supply (permanent) and of the core amplifier section (sensor-controlled) - Automatic switching to RF bypass mode in the event of malfunction eg high input power or test NOGO, poor VSWR at the output or other adverse operation conditions (eg over or undervoltage or critical heat sink temperature) 	<p>Continuous operation High communication reliability High MTBF</p>
<p>Excellent spectral purity (with Series 200 or 400U exciters) by</p> <ul style="list-style-type: none"> - Multi-stage high-pole harmonics filter and - Circulator(s) most effectively integrated in front of the harmonics filter, both included as standard 	<p>Interference-free operation</p>
<p>Broadband design</p>	<p>Guaranteed specifications over the entire frequency range Full multi-channel capability i.e. no readjustment after change of operating frequency</p>
<p>AC (main) and DC (standby) supply with automatic AC/DC switchover</p>	<p>High system flexibility High communication reliability</p>
<p>RF bypass integrated for normal power or transmit/receive operation</p>	<p>High system flexibility</p>
<p>Integrated test and service facilities</p> <ul style="list-style-type: none"> - P_{OUT}, VSWR and m - TEST (sum GO/NOGO check) - Test Interface integrated 	<p>Quick failure diagnosis and Ease of maintenance</p>
<p>Modular design</p> <ul style="list-style-type: none"> - Defined interfaces/specifications guaranteed 	<p>Low MTTR on LRU basis by change of module only</p>

Specifications

If not otherwise stated, the following specification is valid for both VHF Amplifiers, VU210L and VU220L:

Frequency range	118 to 144 MHz
RF input power	
VU210L	10 W
VU220L	20 W
RF output power VU210L	nominal, valid for the specified AC supply voltage and operating temperature ranges and for VSWR ≤ 2
AM carrier	100 W ± 1.5 dB
FM	150 W ± 1.5 dB
AM PEP (peak envelope power)	400 W
RF output power VU220L	nominal, valid for the specified AC supply voltage and operating temperature ranges and for VSWR ≤ 2
AM carrier	200 W ± 1.5 dB
FM	300 W ± 1.5 dB
AM PEP (peak envelope power)	800 W
Continuous operation	guaranteed through eg – sensor-controlled forced-air cooling – automatic switching to RF bypass mode in case of eg extremely high or low supply voltage (AC or DC), VSWR > 3 typ., heat sink temperature exceeding 80°C or negative TEST result (NOGO)
Unwanted emissions	
Harmonics attenuation	> 80 dBc ¹⁾
Spurious attenuation	> 80 dBc ¹⁾
Backward intermodulation products (with interfering signal 20 dB below the wanted signal)	65 dB below the wanted signal
Modulation characteristics	
Classes of emission	AM, FM, other on request
AF bandwidth	300 Hz to 10 kHz typ.
S/N ratio (AM) with 1 kHz, $m=85\%$ and S/N > 50 dB of exciter	> 45 dB
AF distortion	$< 10\%$ ²⁾
modulation depth (m)	90% AM
TX/RX switching time	10 ms
Power supply VU210L	
AC standard supply	90 to 265 V, 47 to 63 Hz (due to automatic detection any voltage is accepted without damage)
DC backup supply ³⁾	24 to 31 V, operable down to 21.5 V; protected against wrong polarity and reverse feed
AC/DC switchover	automatic
Power consumption (AC, TX mode)	< 800 W
Power supply VU220L	
AC	see above
DC	see above
AC/DC switchover	see above
Power consumption (AC, TX mode)	< 1.6 kW
EMC	IEC801-2, -3 and -4, part 2
Mechanical VU210L	
Dimensions (W x H x D)	483 mm x 133 mm x 471 mm
Weight	19" 3 HU plug-in 25 kg
Mechanical VU220L	
Dimensions (W x H x D)	483 mm x 220 mm x 471 mm
Weight	19" 5 plug-in 45 kg

Environmental

Temperature range	0 to +55°C
operation with full performance	
operation with slightly reduced performance	-10 to +55°C
storage	-40 to +70°C
Relative humidity	IEC 68-2-3
operation	93% +2/-3% at +40°C (without condensation)
storage	93% +2/-3% at +40°C
Permissible altitude	
operation	3000 m above sea level; +35°C
storage/transport	5000 m above sea level
Shock	IEC 68-2-27: 30 g for 11 ms, 18 shocks in 3 positions
Vibration	IEC 68-2-6: 0.3 mm double amplitude, 2 g, 10 to 55 Hz, 1 octave/min, total test period 30 min
Max. altitude (asl)	IEC 68-2-13
operation	3500 m; test conditions: 700 mbar
transport/storage	5000 m; test conditions: 550 mbar, +40°C, 2 hrs
Electrical safety	IEC 950, VDE 0805, VDE 0804

Connectors

AC	Euro plug
DC	2-pin Sub-D male
RF input	N-type female
RF output	N-type female
Series 200 control and monitoring interface	15-pin Sub-D female
Series 400U control and monitoring interface	25-pin Sub-D female
Earth	M6 screw

Front panel control and monitoring

AC power on/off	switch
Modulation depth	quasi analog horizontal LED row
RF output power	see above
VSWR	see above
Selection of above 3 signals	switch
Test	green (GO) LED

Ordering information

Designation	Type	Order No.	Uses, specifications, features and benefits
VHF Power Amplifier 100 W	VU210L	6083.2510.02	19" 3 HU plug-in; delivered with one set of accessories (type N RF cable, Series 200 interface cable, AC mains cable, DC cable socket, fuses etc. ⁴⁾)
VHF Power Amplifier 200 W	VU220L	6083.5317.02	19" 5 HU plug-in; delivered with one set of accessories (see above) ⁴⁾

¹⁾ In addition, the exciter values are applicable

²⁾ Ref. to AM ($m=0.85$; $f_m=1$ kHz) and nominal supply voltage. In addition, the exciter values are applicable

³⁾ Note that the amplifier specifications are not valid in all details for DC backup operation

⁴⁾ Control cable for Series 400U radios on request





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