

# Yaesu 'Quadra System' VL-1000 HF / 6m Linear Amplifier

The UK's first review of this new top-of-the-range HF / VHF amp, by Don Beattie, G3OZF (*HRT, September 1998*)

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This review is written to give some user impressions of the 'Quadra System' VL-1000 amplifier, recently released by Yaesu Musen. The amplifier was used very effectively during the February 1998 Spratly Island (9M0C) DXpedition [see *Ham Radio Today* April 1998 - *Ed*], where four of these units operated round the clock for 12 days without any problems. This review is not written with the help of any sophisticated test equipment, but is simply one operator's view of the performance and functionality of the equipment.

## Overview

The amplifier is designed to provide a full 1kW PEP SSB output on all HF bands, with 500 watts PEP on 50MHz. The Quadra comes in two cases, the amplifier itself, the VL-1000, and a separate power supply unit, the VP-1000. The amplifier and power supply weigh together some 21kg with, surprisingly, the power supply being the lighter unit. This is explained by it being a switched mode design, with no adjustments being needed for mains voltages from 117 to 240 volts. However, when the amplifier is run from 117 volts, the amplifier power output is limited to some 500 watts PEP. The final stage of the amplifier uses eight rugged MRF-150 MOSFETs with a 48 volt DC power rail. An automatic ATU is built in with 250 memories to memorise settings for each band and frequency, together with antenna selection.

The amplifier is designed to operate with any modern transceiver, but is best with the current Yaesu range of transceivers, in particular the FT-1000MP. This transceiver has become a favourite with DX operators since it was released a few years ago. Connecting the VL-1000 to the FT-1000MP requires four cables. The RF drive cable, the band data cable, the ALC cable and a line to the FT-1000MP 'Remote' socket for control of the transceiver during tune-up. The linear is connected to the power supply by a heavy duty power cable and by a multi-core control cable.

The appearance of the amplifier is unusual. It bears more resemblance to a hi-fi power amplifier than to a piece of Amateur Radio equipment. There are no knobs. All the controls (used only for setting up the amplifier initially) are behind a drop-down panel along the bottom of the amplifier front panel. When this panel is closed, the only control visible is the on / off push button. The front panel of the amplifier is then dominated by a large orange-glow LCD screen, whose function changes during the use of the amplifier, as described later. The power supply is equally straightforward, with a front panel on / off switch and a rear panel circuit breaker. The power supply can be located a few feet from the amplifier, for operating convenience.

## Operating Aids

The amplifier is provided with some useful aids for the DX operator. It is possible to connect two transceivers to drive the amplifier (using only one at a time!) through two RF input sockets. The amplifier automatically selects the input which is providing RF drive. There are also four antenna outputs from the amplifier, which are pre-selected during the installation and set-up phase. This allows differing antennas to be selected automatically for the various bands. For exciters that are not

of the Yaesu range, the amplifier 'sniffs' the RF exciter frequency and then sets the band accordingly, controlling the exciter drive power through the ALC line.

Use of the amplifier is straightforward, but reading the instruction book (which only runs to 16 pages) is a necessary preliminary. After connecting the various leads, and setting a back panel switch to allow the FT-1000MP to control the power on / off to the amplifier, it is time to set the ALC level. This is simply done by feeding RF to the amplifier whilst it is running into a dummy load, and holding two of the push buttons until the desired level of RF output is obtained. This pre-sets the ALC for the future and is a useful feature when the amplifier is capable of significantly more output power than licence regulations permit.

Then, band by band, the antenna tuning unit in the amplifier is engaged, and allowed to match the antennas, and the appropriate antenna output notified to the amplifier. With the FT-1000MP as an exciter, the procedure is particularly simple, and just pressing the 'tune' button on the linear causes the FT-1000MP to switch to a continuous carrier mode, providing the tune-up power for the linear. As soon as tune up is complete, the FT-1000MP returns to receive in the originally selected mode. If the antenna feedline SWR is less than 2:1, the ATU can be left out of circuit, but for SWRs of between 2:1 and 3:1, the ATU must be used. This choice is made on a band by band basis, and memorised by the amplifier's microprocessor. Should the wrong antenna be selected, resulting in high SWR, the amplifier immediately beeps, the protection circuit shuts the RF power down, and the LCD screen flashes a big warning message. Where the antenna SWR exceeds 3:1, an external ATU will be necessary.

Whilst the ATU is adjusting the matching to the antenna, the LCD display changes to two rotating tuning capacitors and an SWR bar graph. Once the message 'Complete' appears, the display returns to one of several selectable displays for normal operational use. These range from simple mean and peak power bar graphs to a clever graphical display showing the SWR with and without the ATU across the whole of the band in use.

## In Operation

On turning on the amplifier, one of the fans starts running, and the amplifier goes through a number of self-tests, the results of which are shown on the LCD screen. Once these are complete (which takes about 10 seconds) the amplifier automatically switches to the band selected on the FT-1000MP and is ready for action. Output power is a comfortable 1kW PEP on SSB and 500 watts on RTTY and other continuous modes. The manual says 500 watts for one hour continuous. There is little heat noticeable from the amplifier. When the unit goes to transmit, the main fans start up, but they are quiet, and the air coming out of the vent grills is cool. I have yet to find a way to cause the amplifier to heat up!

Using the amplifier in the RSGB Commonwealth contest, it was a dream to be able to change bands 'instantly' (in less than one second!) and to be ready to transmit on the new frequency instantly. On both SSB and CW, the amplifier is virtually invisible to the operator. The protection circuits seem very comprehensive, so that any operator error is trapped before any damage can be done to the solid state power stages. It really is a 'point and shoot amplifier' with many of the advantages of the legendary Alpha self-tuning valve amplifier, but with a much shorter warm-up time and a lower heat output on standby.

On SSB the quality reports are good, although the specified third order intermodulation is not quite as good as the very best valve amplifiers. The manual quotes -30dB at 1000 watts PEP.

The only drawback which I have found with the amplifier is that when used with the FT-1000MP transceiver, there is a facility to control the mains on / off power to the linear from the FT-1000MP power switch. This is very useful, but there is no

way, when using this feature, to disable the VL-1000 power-up and still maintain the feed-through of the antenna to the transceiver. As one often does not want the linear to be running when monitoring the bands, this means disabling the automatic power-up linkage to the FT-1000MP and controlling the linear mains on / off manually. In this way the antenna is fed through to the transceiver as would normally be expected. Other than this one very minor point, the amplifier must be considered an outstanding piece of equipment, taking the concept of solid state linear HF / VHF power amplifiers to a new level of sophistication and integration.

However, nothing of this quality and technical prowess comes cheap. The recommended retail price for the Quadra in the UK is £4480, but it is available from stock from ML&S (tel: 0181 566 1120) and Nevada (tel: 01705 662145) at £3995. There is an option, the MR-1000 19in mounting rack for the amplifier and power supply, which costs £229.

### **Specifications of the VL-1000 / VP-1000 (adapted from Yaesu specifications)**

#### **General**

Frequency range 160 - 6 metres  
Power output (with 220V AC input) HF 1000 watts (SSB/CW)  
500 watts (FSK-RTTY / FM)  
250 watts (AM carrier)  
50MHz 500 watts (SSB / CW / FSK-RTTY / FM)  
125 watts (AM carrier)  
Power output (with 117V AC input) 500 watts (SSB / CW / FSK-RTTY / AM)  
125 watts (AM carrier)  
Input voltages DC +48V, DC +12V, DC -12V  
Current consumption 48A (DC +48V), 2.8A (DC +12V), 0.1A (DC -12V)  
Dimensions 413W x 151H x 451Dmm (inc feet, switches)  
Weight 21kg (46.3lb)

#### **Linear Amplifier Section**

Input power 2100 watts max  
RF drive power 80 watts (max) for full output  
Spurious emissions Better than -50dB HF  
Better than -60dB (50MHz band)  
3<sup>rd</sup>-order intermodulation products At least -30dB  
Input impedance 50  $\Omega$  unbalanced  
Output impedance 50  $\Omega$  unbalanced

#### **Automatic Antenna Tuner**

Matching range 16.7 - 100  $\Omega$  (1.8MHz band)  
25 - 100  $\Omega$  (50MHz band)  
16.7 - 150  $\Omega$  (all other bands)  
Maximum power 1200 watts  
Insertion loss 1.5dB  
Matched SWR Less than 1.5:1

#### **VP-1000 Power Supply**

Input voltage AC 100 - 234V (automatic switching)  
AC current drain 14A (AC 220V @ 1kW output)  
14A (AC 117V @ 500W output)

Dimensions 413W x 151H x 381Dmm (inc feet, switches)

Weight: 14.6kg (32.2lb)

The VL-1000 in use on the Spratly Islands, Mike, G3SED, operating.