



# Expert 1K-FA Linear Amplifier

*Chris Lorek puts this diminutive 1kW linear under the microscope.*



Photo 1: The remarkably compact Expert 1kW linear

**IT'S SMALL AND CUDDLY.** Claimed to be the smallest 1kW PEP amateur band linear amplifier in the world, measuring just 28 cm W x 14 cm H x 32 cm D overall, the Expert 1K-FA also contains an automatic antenna tuner and an AC mains power supply within its case. It's not just an HF band amplifier either, because as well as covering the WARC HF bands it also operates on the 6m band up to 54MHz with an output of 700W PEP. Switched full power (eg. for SSB/CW) and half-power modes (eg. for data modes) are available from the front panel. Designed and built in Italy, it comes from the SPE company which has been headed since 1975 by Dr. Gianfranco Scasciafratti, IOZY. The Expert is distributed in the UK by Vine Antennas Ltd, headed up by keen DX and contest operator Ron Stone, GW3YDX.

**CIRCUITRY.** The amplifier is fully solid state, with six MRF150 linear MOSFET RF power transistors operated in three pairs as push-pull amplifiers through a combiner in the RF amplifier section. There are two separate power supplies, one for the control circuitry and a second for the power amplifier itself. The latter uses a large toroidal transformer, which generates a low magnetic field. It includes an SCR regulator for 'soft start' on switch-on, and supplies 44V DC on full-power mode and 30V on half-power mode. Two central processing units (CPUs) are used for control, and an

RS-232 port is provided to allow remote PC monitoring and control if you wish. A band-switched Pi-L output low pass filter network is used to reduce the level of harmonics.

**AUTOMATIC SWITCHING.** The amplifier offers a 'no tune' approach with fully automatic band change. Two RF inputs, each with a dedicated TX control input, ALC output, and remote port, are available for connecting two transceivers. If you use an Icom, Kenwood or Yaesu transceiver with its remote port connected to the Expert, the amplifier automatically reads the operating frequency and switches accordingly. Otherwise, a built-in frequency counter is used to detect the transmit frequency and switch the amplifier accordingly. Thus all you need do is to connect your rig up using the supplied PTT and ALC leads, and off you go. DB15 connectors are also supplied with the amplifier for you to make up a lead for remote control. The supplied manual gives wiring details for these.

**BUILT IN AUTO ATU.** To help tune out slight antenna mismatches, and of course to help present a good 50 ohm match to the amplifier output and give the best performance in terms of harmonic suppression etc, a built-in high power automatic ATU (Antenna Tuning Unit) is included. Many transceivers already have

this fitted, but of course this only affects the load connected to the transceiver rather than an add-on power amplifier. It's capable of handling coax feed mismatches of up to 3:1 on HF and 2.5:1 on 6m, and after initial tuning the band switching, antenna change and tuning conditions are changed within 10ms (one hundredth of a second). Each band segment has a separate 'memory table', which stores the relevant tuning and antenna settings for repeated use. As well as automatic tuning, manual tuning is also available from the front panel, using the dedicated up/down L' and 'C' buttons.

**PROTECTION AND ALARMS.** The amplifier has a comprehensive protection system built in, which constantly monitors and controls parameters such as the heat sink temperature, maximum/minimum PA voltage, maximum PA current, PA combiner power balance, input power, maximum RF voltage at the tuner, and output forward and reflected power. The reflected power measurement also takes into account the power of the harmonics reflected by the band-pass filter, should any problems arise. Three types of protection systems are included:

- a simple audio 'bleep' to warn you but with the amplifier automatically correcting the matter (like reducing power or increasing fan speed),
- where automatic system recovery isn't possible (like when there's an obstruction over the fan intake and the temperature climbs too high), when the amplifier goes into 'standby' (straight-through) mode so you can continue operation
- a 'fatal' error where something can't operate and the amplifier is turned off, here you'll usually just need to switch the amplifier off and then back on again to restore operation.

No fewer than seven three-speed fans are used, including four fitted to the rear panel, and internal temperature measurement is used to control the speed of these. The fan speed-change thresholds can be switched between 'Contest' (i.e. heavy use) and 'Normal' (i.e. typical shack use) modes. Thanks to the built-in software control, the RF relay switching is handled at zero power to prevent relay damage. Full break-in CW operation is provided using this.

**FRONT PANEL.** A large dot-matrix LCD display on the front panel gives an indication of output and reflected PEP power, band, PA voltage and current,



**Photo 2:** The underside of the linear is dominated by the large toroidal transformer



**Photo 3:** The six MOSFETs on the right are arranged as three push-pull pairs. On the left is the auto ATU section.

power gain, PA temperature, selected input, remote type, and so on. A perfectly flat membrane panel with built-in switches is used for front panel control, below this is an air intake filter grille; a spare replacement filter is also supplied.

**CARRY BAG.** A handy carry bag is supplied with the amplifier, which can be useful for field days etc. In view of its compact size and reasonable weight of around 20kg, it is practical to carry the amplifier with you. This is more than can be said of the traditional valve based linear!

**ON THE AIR.** I used the amplifier generally with my FT-990 (for HF) and FT-847 (for HF and 6m) but also with other non-remote controlled radios, together with a variety of antennas ranging from my 160/80/40m trapped dipole, monoband HF dipoles, HF multi-band vertical, and tower-mounted HF and 6m multi-element beam arrays, to hopefully simulate several typical operating situations. On HF, I found the amplifier would, as the specifications indeed stated, provide over a kilowatt output with just less than 20W input. Thus my 100W drivers were not only ample, but I could also reduce the drive of these to keep my SSB signal purity that bit better. This was a refreshing change from my other valve-based HF amplifiers where I do need at least 80W or so to drive them to their full output. This higher sensitivity would also be of benefit to operators using lower power HF drivers, like one of the many transportable types now available with 10 or 20W output. The Expert should then give the facility of a full 400W+ PEP output using one of these rigs. Coupling my 'classic' Yaesu FT-75 20W mobile HF rig up as a quick test in fact gave me just over 500W.

In 'standby' use, ie with the amplifier

switched on but not placed into 'operate' mode, the front panel display still displays relevant parameters such as forward power from my transceiver, the SWR, operational band and so on, and the ATU could be used to present a better match from the coax to the transmitter. By coupling up the remote transceiver inputs, I found that the amplifier could also be automatically switched on and off when the rigs were used, which is handy! Programming the amplifier for remote control is done from the front panel using the 'set' button followed by the various up/down/left/right buttons. At each stage the LCD gives a menu display, firstly for the make of rig, then the actual model, followed by baud rate. I also used the 'set' mode to choose which antenna to use for which band, ie my trapped dipole for the LF bands, HF beam on the higher bands and 6m beam on 50MHz. The ATU could also be manually tuned should you need to do this, although in practice I found I couldn't better the automatic match settings. The amplifier has 126 sub-bands, each of which stores the tuner settings etc. for each central frequency sub-band. So, as I tuned my rig, the amplifier nicely adjusted itself automatically for that band segment.

As one would imagine, the increase in power from a 'barefoot' rig to higher transmitted power did make an appropriate difference to my signal during contacts and DX chasing. But more importantly, on-air reports from local stations showed no signs at all of 'splatter' or a wider signal than from my normal rig at 100W, the only difference being an increase of a couple of S-points!

All in all the amplifier was a delight to use, I could

simply just use my main transceivers as usual and forget all about the amplifier, with it being controlled from whichever rig I was using at the time and the added advantage of it automatically switching in various antennas for me for each rig – no more manual switching needed!

**LAB TESTS.** I gave the amplifier a test using a calibrated power meter and spectrum analyser. Rather than providing a large table of actual values, suffice to say that the amplifier provided in excess of 1000W PEP with a two-tone SSB signal on each HF band, and just over 800W PEP on 6m. With exactly 1000W on 20m, the 3rd order 2-tone intermodulation products were 39dB down relative to PEP level (33dB down relative to each tone), very impressive. Similar results were achieved on other HF band segments, and also on 6m with reduced power. In fact I had to be careful that I wasn't measuring the products of my driver transmitter rather than the amplifier itself. Without the tuner switched in, harmonics were all better than 60dB down on carrier power at 1000W, with 800W on 6m the 2nd harmonic was actually right on the measurement analyser noise level at 80dBc. Switching in the ATU at on each band typically brought the harmonic levels again down to -80dBc or less. Again I had to be careful that I was measuring the actual amplifier performance rather than being limited by the dynamic range of my test equipment.

**CONCLUSIONS.** This is a lovely amplifier; not only is it a superb and compact fully-featured linear, it's also a high power antenna tuning unit, antenna switcher, and power / SWR monitor. If I were in the market for an amplifier right now, I would be very, very tempted to purchase the Expert.

The Expert 1K-FA is currently priced at £2299, and our thanks go to Vine Antennas Ltd. (Tel. 01691 831111) for the loan of the amplifier for review.

**Photo 4:** The clear LCD carries a range of operating and setup information

