# EQUIPMENT REVIEW
# THE AMERITRON AL-811 HF LINEAR AMPLIFIER

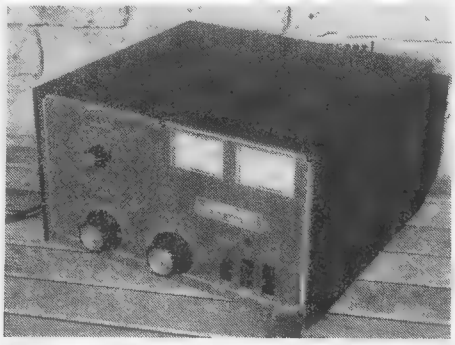
RON FISHER VK3OM.
GAALANUNGAH
24 SUGARLOAF RD, BEACONSFIELD UPPER 3808

IF YOU ARE IN THE MARKET for an HF linear amplifier, you will find a rather limited selection at the present time. Not only that, those that are available tend to be very expensive. If your budget runs to $3000 plus, there are a few nice solid state and valve final units available. But what about a conservative 400 watts for $1449? Sounds good? Well let me tell you all about the AL-811. Firstly, it is imported by that go-ahead firm of Stewart Electronic Components.

But, first let's go back a few years. It was in November 1939 that the RCA Manufacturing Co first announced the arrival of the new 811 power output triode valve at the bargain price of only $3.50 each. Actually, the 811 was designed primarily as a class 'B' audio tube and the companion 812 was the one to use in the transmitter final stage. Both tubes had the same power rating but the 811 had a higher amplification factor making it very suitable for class B operation. Of course in those days, single sideband transmission was all but unknown on the amateur bands, although it was in limited use in commercial radio applications. Probably not initially realised by the RCA Tube Co, the 811 would in time make a very suitable SSB linear amplifier. Well 52 years on,the 811 is still with us, now made in China, and has been chosen by Ameritron for its latest linear amplifier. The AL-811 (you can now see how it gets its name) actually uses three 811A valves in parallel as a grounded grid class AB2 amplifier for both SSB and CW modes. The 811A valve, incidentally, is an upgraded 811 that was introduced in the early post-war years, with the plate dissipation increased from 55-65W but otherwise unchanged. So much for the historical side of things, let's now have a detailed look at the AL-811.

## The AL-811 Technical Details

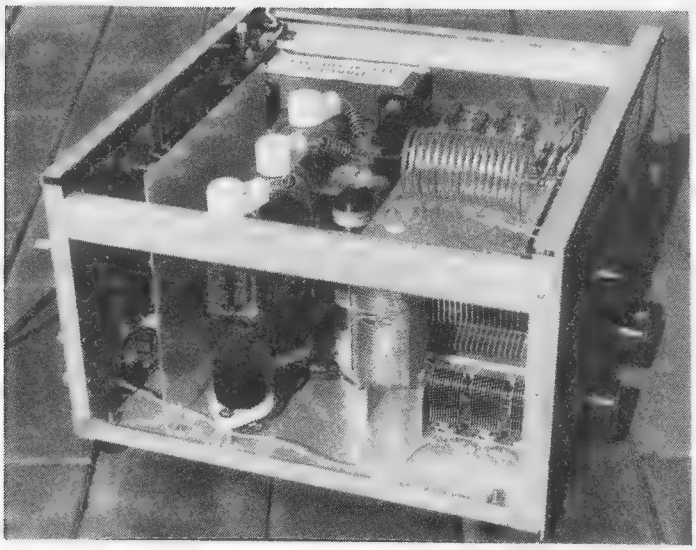
The AL-811 is a large black box. It is actually somewhat higher, narrower and deeper than most contemporary equipment. It measures 20cm high, 35cm wide and 40cm deep and weighs in at 13.6kg. Of course this is an all-up weight that includes the heavy duty power supply, but even so, is some 6.5kg less than the popular Yaesu FL-2100Z amplifier. The three 811As are in a grounded grid circuit with the drive from the exciter going into the valve filaments through a separate pi-network for each of the six bands. These are 160, 80, 40, 20/30, 15/17 and 12/10 metres. One of the interesting features of American made amplifiers or for that matter amplifiers imported into the US, is that they are not permitted to include the 10m band. This is to to stop their use by CB operators on 27MHz. I am not sure this actually stops them being used on the CB band, as in most cases mods to put them on 28MHz (and 27MHz) are quite easy. The AL-811 has been factory 'modified' for 10 and 12m operation but this leaves a strange legacy. The 10m position of the band switch is labelled 'AUX'. Once you get used to this, everything becomes straight-forward. Anyhow, back to the circuit description. The power supply uses one transformer to supply power to all circuits. The primary side is tapped for inputs from 100 volts to 240 volts, and these adjustments are made through a removable panel at the back of the amplifier. A bridge rectifier provides 1700 volts output on no load and 1500 volts on full load. Four series connected 210µF capacitors filter the output. A good picture of the internal construction can be obtained from the illustrations. Most of it is on two very large fibreglass printed circuit boards, the first carrying the tank coil winding, with the power supply components at the other end. The second board, mounted near the rear of the cabinet, contains the input Pi-network circuitry and the AC input wiring. The three 811As are mounted vertically in high grade ceramic sockets. Two excellent panel meters give readings of total grid current on one, and either plate voltage or plate current on the second. Both are brightly illuminated and are very clearly calibrated. Front panel switching, apart from the band switch, is for AC power on/off, standby/operate and the meter switch. A red LED indicates when the amplifier is in the transmit mode. There are two tuning controls, one for plate tuning and the second for loading. The plate tuning has a six-to-one vernier control fitted for easy setting. Finally, there is an ALC output to feed back to the driver transceiver to prevent excessive drive power being applied. As we shall later see, this is a most important feature. Cooling is well taken care of with a 20CFM fan fitted on the rear panel.



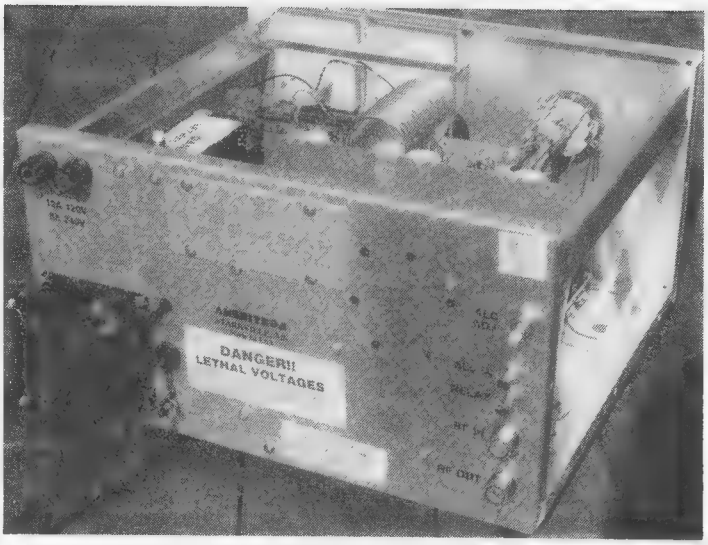
*Front view of Ameritron AL-811*

## The AL-811 On The Air.

Connecting up the amplifier is a straight-forward procedure. Standard SO-239 sockets are provided for both RF input and output. Relay switching and ALC output are via RCA (often called phono sockets) connectors. Setting up with most transceivers should only take a few minutes. All of my tests were done with an ICOM IC-745 transceiver as the driver rig and RCA connectors are provided on it for both relay control and ALC input. To tune up, set the band switch to correspond to the exciter, apply a small amount of drive (exciter in CW or AM mode to give steady carrier) and rapidly



*Internal View*




*Rear view of the AL-811. Note high volume blower at lower left. The six holes at top right allow access to adjust input tuned circuits. Unfortunately they are not identified.*

tune the plate and load controls for maximum output. To do this you will need an external power meter as no output metering is included in the amplifier. Increase the drive from the exciter until maximum output from the amplifier is achieved without exceeding 150mA grid current. And there you have it. Four hundred watts output is obtained in most cases with about 75 to 80mA grid current and about 35 to 40 watts driving power. This should produce a clean signal with most transceivers just loafing along. However now is the time to set up the ALC. Again, it is best to do this with steady carrier feeding the output of the amplifier into a dummy load (you always do don't you?). Increase the drive from the transceiver until you reach maximum output (about 550 watts) then set the ALC adjust on the back of the amplifier for 400 watts output power. In actual fact this was not straight-forward and it was necessary to compromise the output power to an average of 400 watts. I finished up with a maximum output of about 450 watts on the lower frequencies down to about 350 watts on 10 metres. If you settle for 400 watts on the lower bands then the output will be around 300 watts on 10. In operation, the amplifier ran quite cool with just warm air being blown from the cabinet. Plenty of space is required at both the rear and side of the cabinet, so as not to impede the flow of air.

## The AL-811 On Test.

For test purposes, I set up the following: Icom 745 transceiver as the driver, a power/SWR meter in the line to the AL-811 and another power/SWR meter between the amplifier and a 50 ohm dummy load. Table 1 shows the resultant figures.

| Band MHz | Power Output | Power Input | Grid Current | Drive Power | Input SWR Amp On | Through SWR amp Off |
|---|---|---|---|---|---|---|
| 1.8 | 400 | 637w | 75 | 30w | 1.1-1 | 1.1-1 |
| 3.5 | 400 | 712w | 75 | 35 | 1.1-1 | 1.1-1 |
| 7 | 400 | 765w | 75 | 40 | 1.2-1 | 1.1-1 |
| 10 | 400 | 750w | 80 | 50 | 2-1 | 1.1-1 |
| 14 | 400 | 675w | 78 | 30 | 1.2-1 | 1.2-1 |
| 18 | 400 | 840w | 80 | 40 | 2-1 | 1.2-1 |
| 21 | 400 | 875w | 82 | 42 | 3-1 | 1.2-1 |
| 24 | 400 | 820w | 85 | 40 | 2-1 | 1.2-1 |
| 28 | 400 | 805w | 90 | 40 | 1.5-1 | 1.2-1 |

This chart shows the relative performance of the AL-811 on each band. These figures were taken in the CW mode with the power output adjusted to 400 watts. The input SWR on 21MHz at 3:1 is of some concern. It should be noted the input tuned circuits are adjustable but, as the photo shows, these are not identified on the back panel of the amplifier. This makes the adjustment procedure a bit hit and miss.

In each test, the power was set to 400 watts output. On most bands, this was achieved easily, but on ten metres 400 watts was only just reached. The high input SWR on some bands is of concern but, nonetheless, the IC745 was able to drive the amplifier to our power limit. An interesting point is that the SWR looking through the amplifier (amp on standby or actually switched off) was very low. Some linears are not. I do not run to the luxury of a spectrum analyser to check the intermodulation distortion, but the RCA Transmitting Tube Manual quotes a single 811A in class AB2 with 1500 volts HT and a power output of 160 watts PEP giving -25dB for third order and -30dB for fifth order distortion. This is referenced to either of the two tones in a standard two-tone test. For normal PEP speech an extra 6dB needs to be subtracted (ie. -31 and -36dB). This is a satisfactory figure although not up to what can be achieved these days. It is, however, about as good as can be expected from most 12V powered solid-state finals. In other words, the signal should be as clean with or without the amplifier. Running at 400 watts output should produce a somewhat cleaner output from both the exciter and the linear amplifiers, by virtue of the fact that each output is operating below IMD specified power.

## The AL-811 Conclusions

There is no doubt, the AL-811 linear amplifier is in a class of its own. It is possibly the only linear available that suits the Australian power output limitations almost exactly. It is easy to use, stable in operation and attractive in appearance. And last, but by no means least, the price is right. The instruction manual is also well presented and covers both operation and circuit information. A full circuit diagram and parts list is included.

However, the very best I have left until last. Most amateurs know only too well the price of replacement tubes for their linear amplifiers. A full set of tubes for the AL-811 will cost you a total of only $105. I know that's a bit more than the 1939 price, but still only about a third of the price of a pair of 572Bs for instance. Not too bad for these days.

My thanks to Stewart Electronic Components Pty Ltd of Huntingdale, Victoria for the loan of the AL-811 linear amplifier. Stewart is sole agent in Australia for AMERITR0N.

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