Using the ADP 200 Amplifier on 3400MHz

The ADP 200 is a solid state microwave amplifier designed for scientific/industrial use, and is specified for an output of 17 watts at a frequency of 3700MHz.

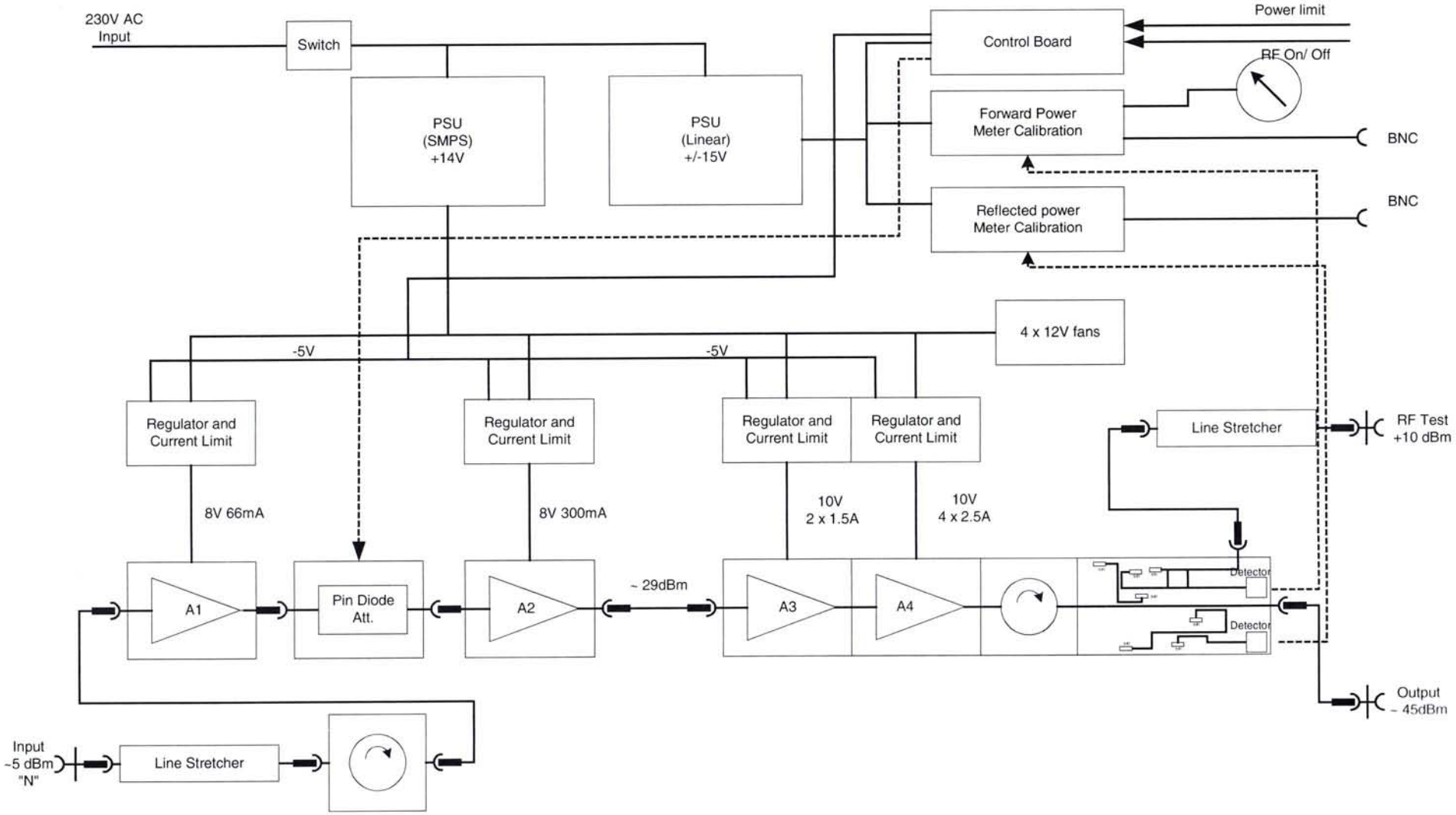
It is self contained, incorporating mains power supplies for the amplifier and auxiliaries which include monitoring and control, power meter and heat sinks with forced air cooling. Input power level is a few milliwatts and the equipment is designed for prolonged operation at its rated power with the power supplies and heat sinking being appropriately rated for this.

In consequence the package is 410 x 110 mm front panel by 750mm deep and weighs over 10kg.

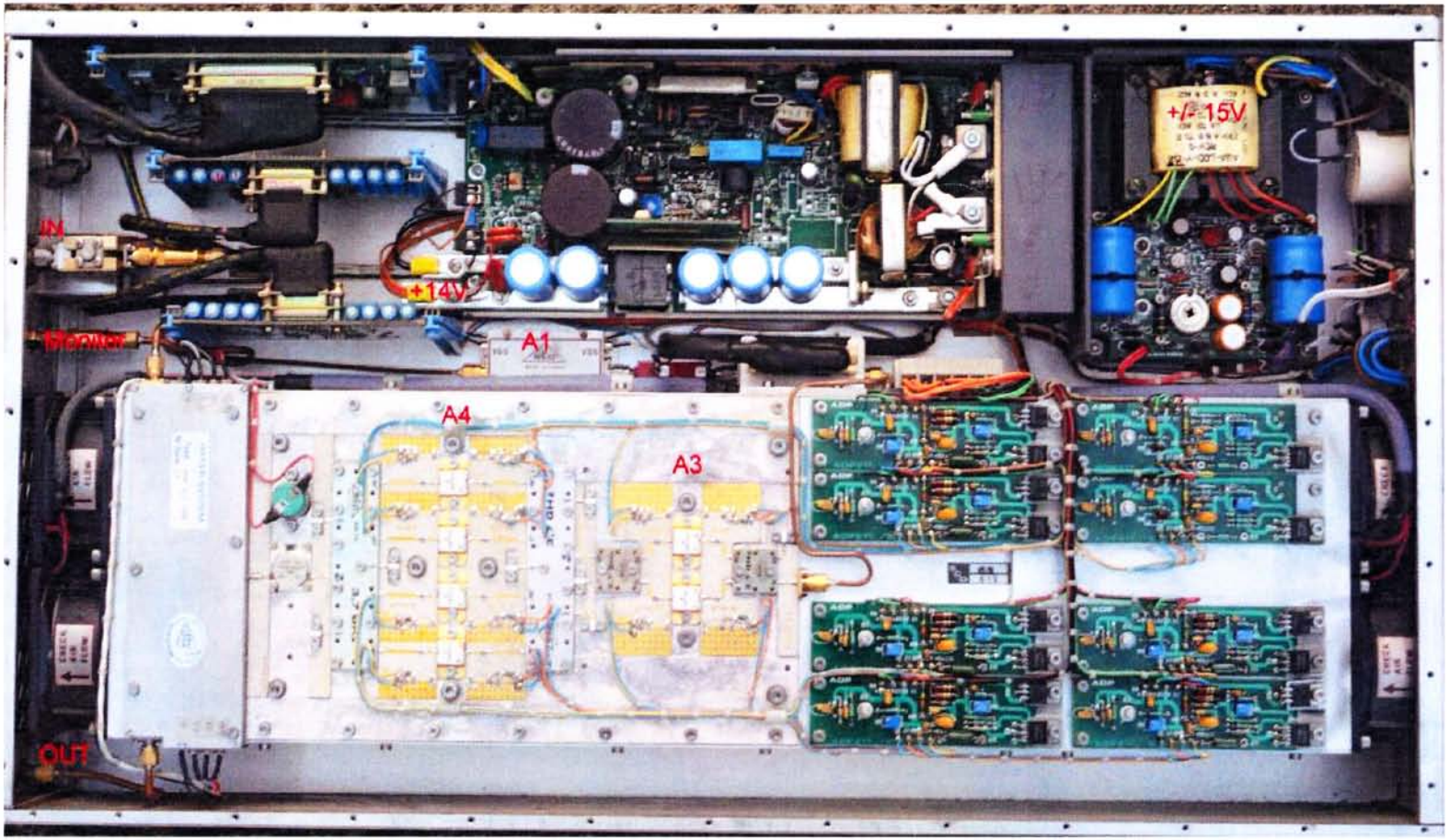
A limited number of units have become available on the surplus market.
There is no detailed documentation but examination reveals the contents to be very straightforward.

RF path is described in the attached schematic. A1 and A2 are are connectorised amplifiers using a single transistor in milled boxes. Amplifiers A3 and A4 are integrated into a unit along with the output circulator and monitoring and mounted on the heat sink. A3 comprising 2 FETs (Toshiba S8814A) combined with 3dB couplers and A4 comprising 4 FETs (Toshiba S8815A) combined with 3 dB couplers. (Some units have different transistors)
Each transistor has a separate small PCB for biasing comprising a L200 current limiting voltage regulator (with additional pass transistor for the high power stages) and adjustable gate bias. All stages are biased in "Class A" for linear amplification.
A monitoring unit houses forward and reverse directional couplers each driving diode detectors and in the case of the forward coupler, an RF output as well. A front panel meter indicate the power output on a scale of 0-20W.

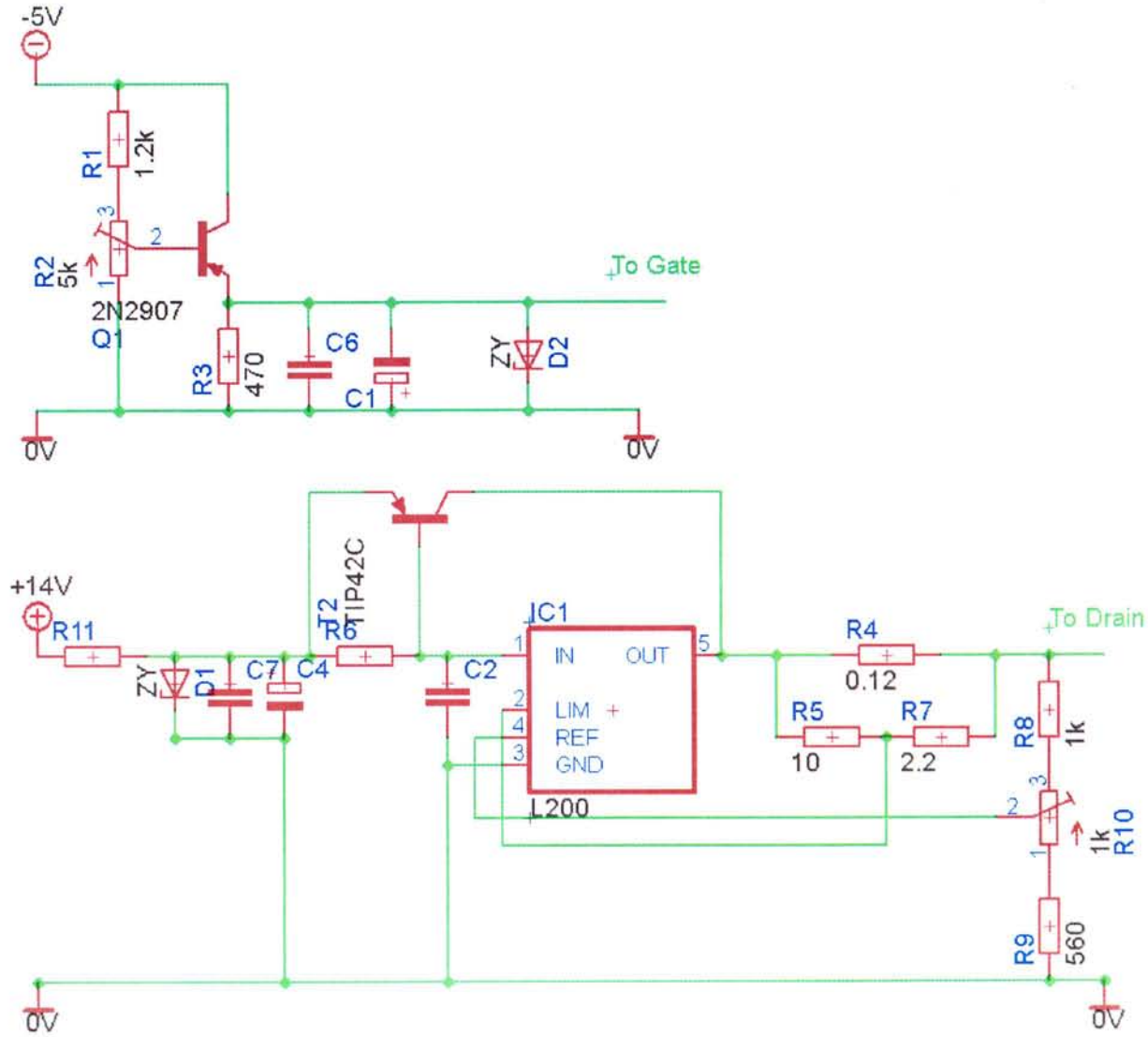
The obvious potential use for radio amateurs for the amplifiers is the 3400MHz band. Hence I assessed the performance at this frequency. Initially it appeared that the power dropped significantly in changing the frequency from 3.7 to 3.4 GHz. However this is largely due to the selectivity of the power meter. On an external power meter the drop was only ~2dB (from 18 watts to about 12). Measuring the low power and high power stages separately showed that (on this example) the gain of the low power stages peaked at 3.4 GHz but the High power staged showed a drop of 4.6dB.
Access to the input and output lines of the A3 and A4 stage transistors is easy. Adding some tabs to A4 improved the 3.4GHz gain and power output, which was finally estimated to be ~45 dBm (32watts) saturated at the SMA output connector. This was considered to be the maximum that can be expected, corresponding to 100W DC input to the final stages, 40% efficiency and allowing something like 1dB losses in the internal circulator, monitoring couplers and semi-rigid cable.
A stub in the monitoring unit was adjusted to optimise the internal power meter for the new frequency, however there seems to be plenty of adjustment range in the electronics driving the meter, which modifies the detector output to suit a linear power scale. The forward and reflected power indications are also available on BNC connectors on the back panel (~0 to 10V).
I have not investigated whether VSWR protection is implemented, but all the necessary facilities for it are there.

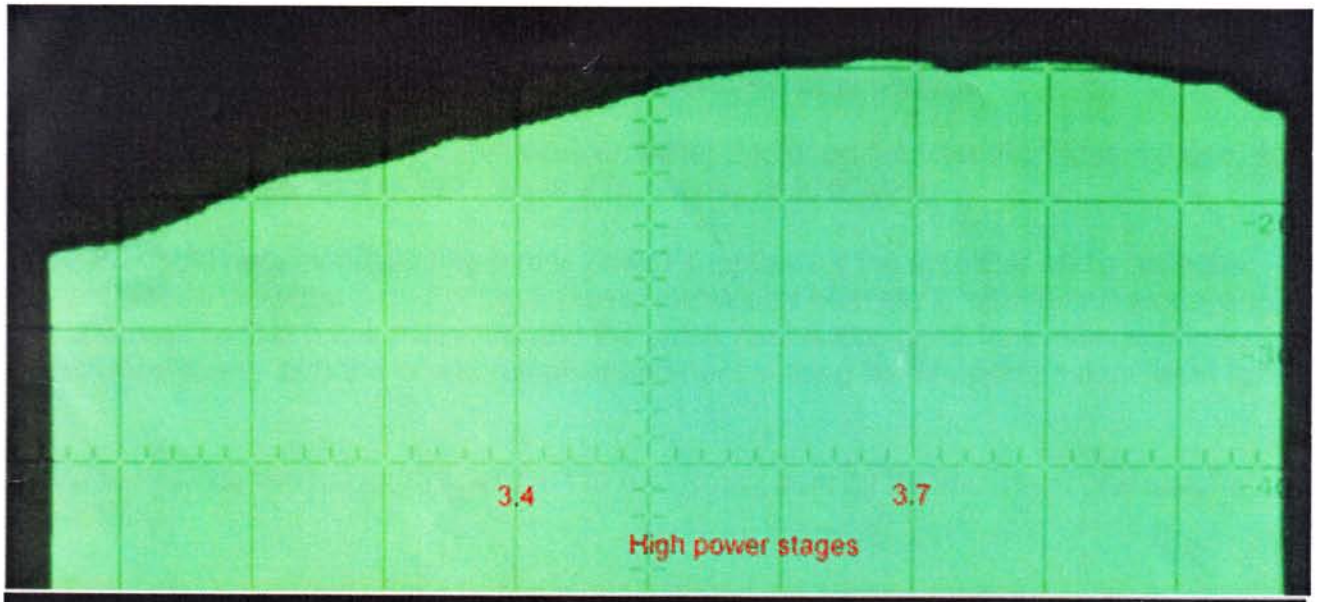

230V AC
Input
Switch
PSU
(SMPS)
+14V
PSU
(Linear)
+/-15V
Control Board
Power limit
RF On/ Off
Forward Power
Meter Calibration
BNC
Reflected power
Meter Calibration
BNC
4 x 12V fans
-5V
-5V
Regulator and
Current Limit
Regulator and
Current Limit
Regulator and
Current Limit
Regulator and
Current Limit
8V 66mA
8V 300mA
10V
2 x 1.5A
10V
4 x 2.5A
Line Stretcher
RF Test
+10 dBm
A1
Pin Diode
Att.
A2
~ 29dBm
A3
A4
Detector
Detector
Output
~ 45dBm
Input
~5 dBm
"N"
Line Stretcher

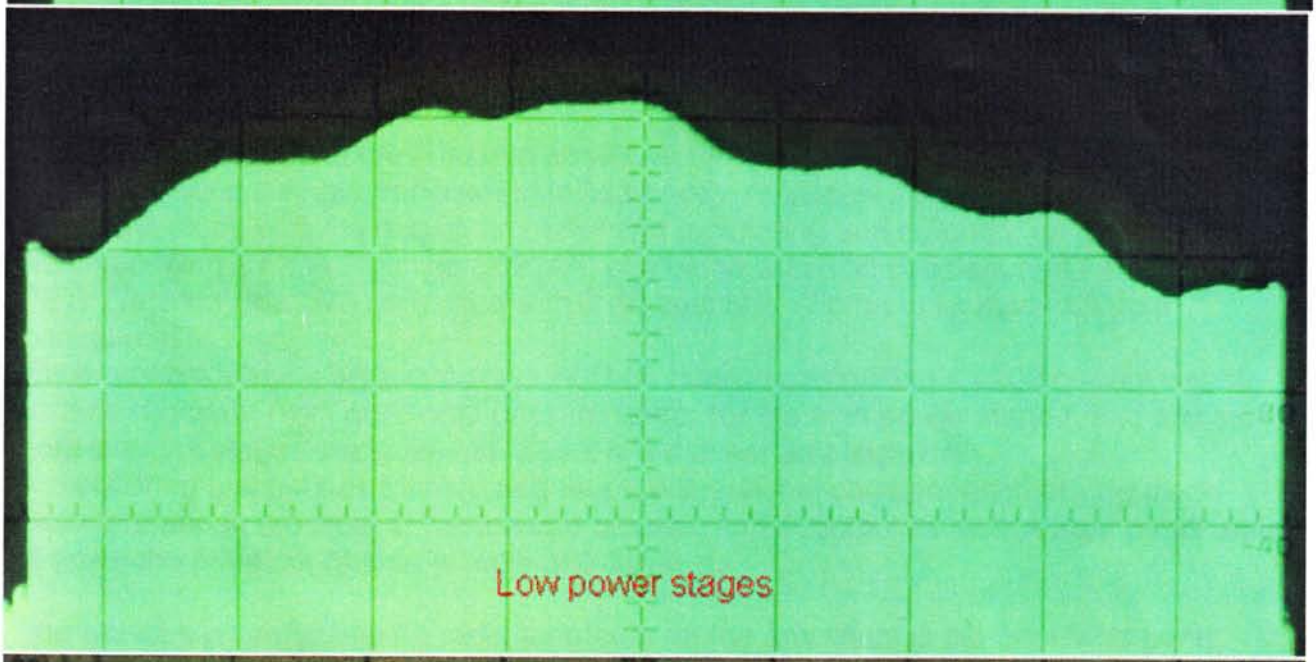

CAUTION
RF O/P POWER
TEMP.
ON/OFF
ON
LIMITATION
MAX
THRESH
3.7 GHz / 17 W AMPLIFIER

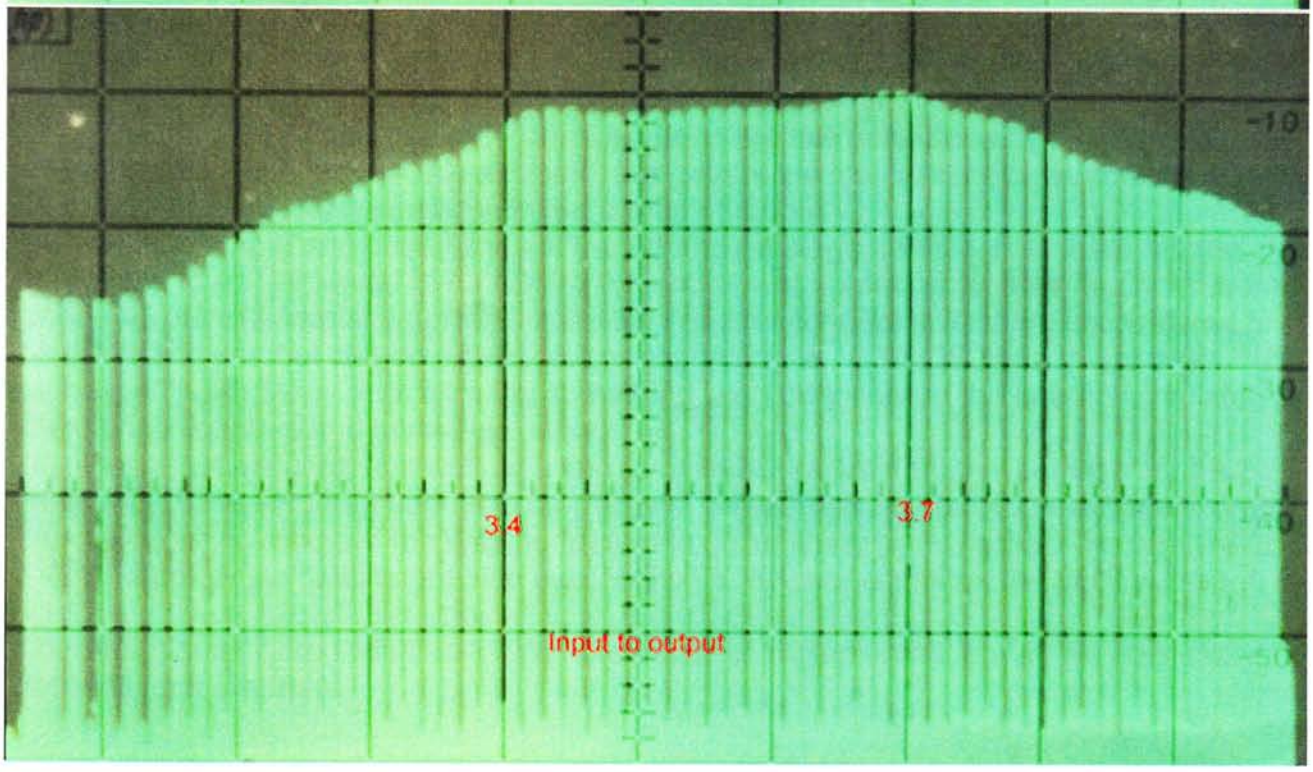

IN
+14V
Monitor
A1
A4
A3
+/- 15V
OUT

ADP211 Gasfet Bias PCB. (Some component values vary for different amplifiers)




3.4
3.7
High power stages


Low power stages


-10
3.4
3.7
Input to output