



NATIONAL RADIO ASTRONOMY OBSERVATORY

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TITLE: Tests of a 432 MHz GASFET Amplifier

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The Advanced Receiver Research Model P432VDG is advertised in QST magazine as having < 0.5 dB noise figure at 432 MHz. One unit, priced at \$80, was purchased for evaluation.

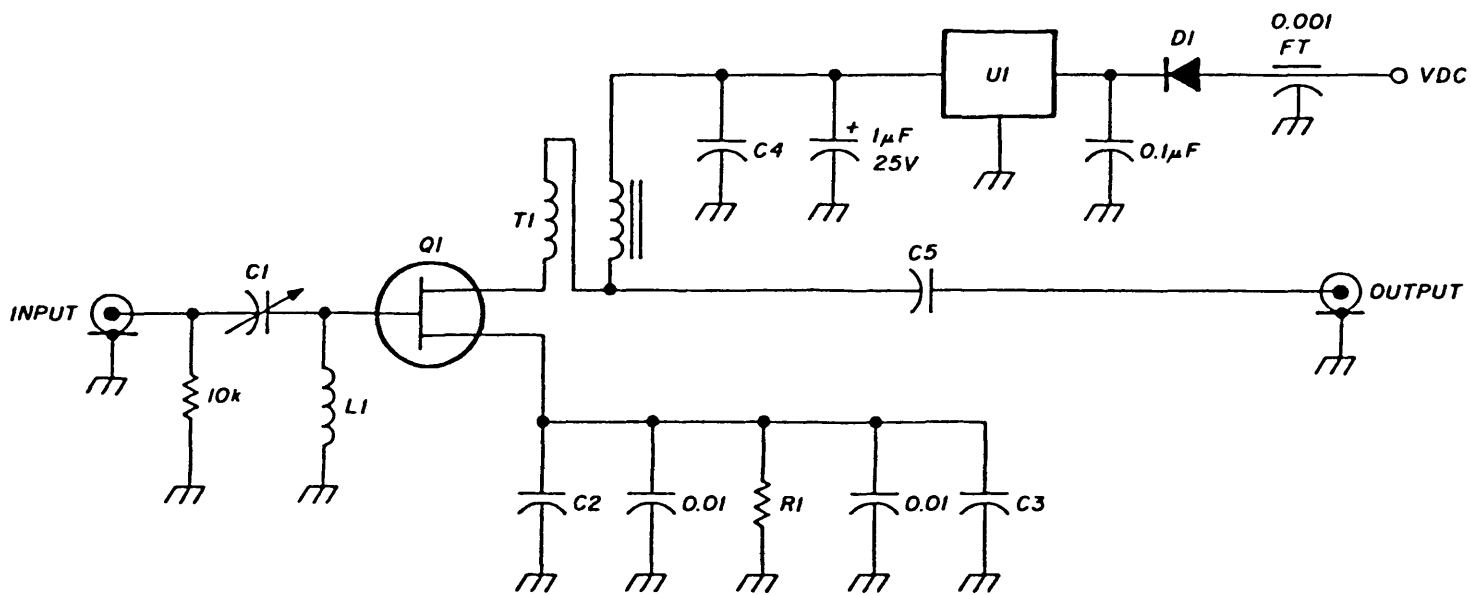
The amplifier is neatly constructed with a quality printed circuit board, BNC connectors, and a rigid aluminum housing. A schematic of the amplifier is shown in Figure 1; the GASFET is a Mitsubishi MGF-1400.

Measurements of noise temperature, gain, input return loss (IRL), and output return loss (ORL) were made over the 350 MHz to 550 MHz band using an Apple Computer controlled HP346B noise source and NRAO test receiver and a Wiltron scalar network analyzer; results are shown in Figure 2. At the optimum frequency of approximately 430 MHz, the noise temperature is 73K (0.97 dB noise figure), IRL is 5.5 dB (VSWR = 3.2), ORL is 6 dB (VSWR = 3), and gain is 16 dB. The noise temperature was also checked by the hot/cold load method using the NRAO LN1 liquid-nitrogen noise temperature standard; 1.5K higher noise temperature was measured.

An attempt to improve noise temperature and IRL was made by installing a high quality MGF-1412-0.8 transistor and tuning C1 and L1. When adjusted for best IRL, the results were a noise temperature of 64K (0.87 dB noise figure) and IRL of 18 dB (VSWR = 1.29); when adjusted for best noise, a temperature of 49K (0.68 dB noise figure) and IRL of 5.5 dB (VSWR = 3.2) was measured.

In conclusion, the amplifier does not meet its noise figure specification and is poorly matched at input and output. The problem of different input network optimizations for noise and IRL is inherent in a GASFET amplifier

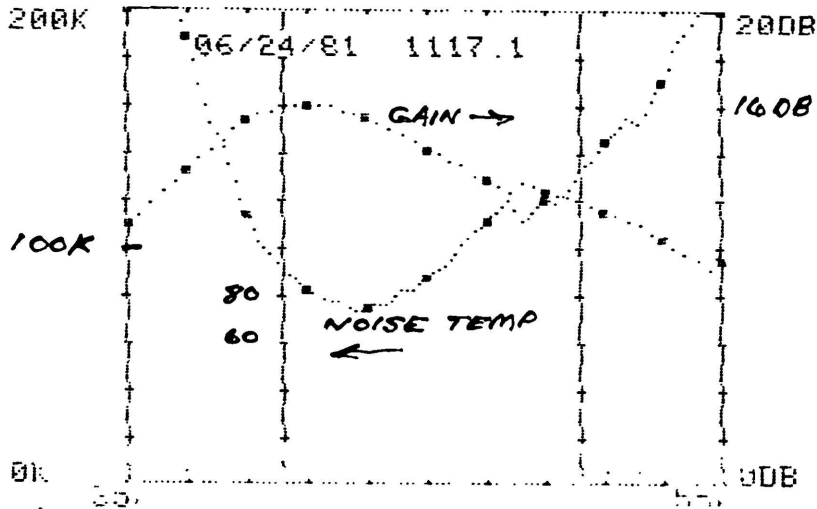
without feedback (i.e., feedback is needed but this requires stabilization networks to prevent microwave oscillations - a more complex amplifier). The noise temperature is similar to that measured with the MGF-1412-0.8 in NRAO amplifiers at 1.5 GHz (although 36K has been measured at 610 MHz). This fairly constant noise temperature below 2 GHz is also inherent in GASFET's and is shown on all manufacturers' data sheets.



Model	C1	L1	All Models
P50VDG	20 pF	23T No. 30 T-25-12	C2, C3
P136VDG	5 pF	8T No. 20 0.3125 dia.	C4
P144VDG	5 pF	7T No. 20 0.3125 dia.	C5
P220VDG	5 pF	5T No. 20 0.250 dia.	D1
P432VDG	5 pF	3T No. 20 0.125 dia.	Q1
			R1
			T1
			U1
			68 pF
			270 pF
			.01 uF
			1N4148
			MGF-1400
			100
			5T No. 32 FT-23-63 bifilar
			78L05

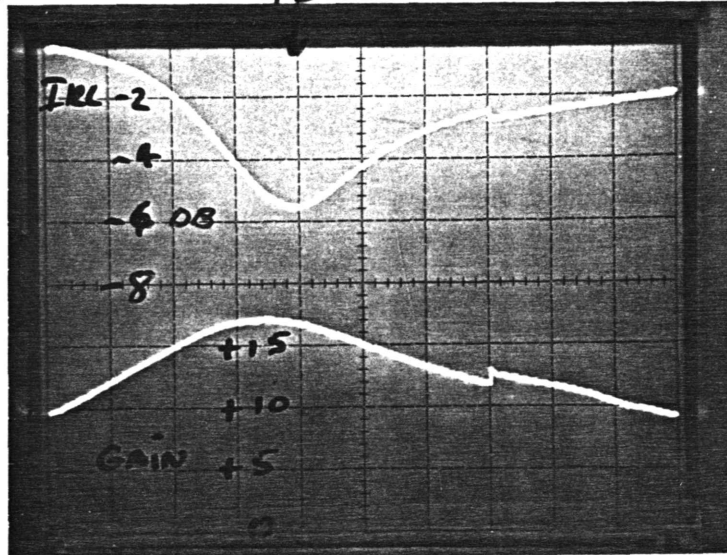
Fig. 1. Amplifier schematic. The calculated inductance of L1 is approximately 40 nh.

1) ARR-432
 1117.1 06/24/81 TAU=96 TLO=72.6 @ 426 GL=11.9 GH=16 T=239K
 2.39,23.9,2.39 2.39,23.9,2.39 2.39,23.9,2.39



GAIN AND
 NOISE TEMP
 VS FREQUENCY
 350 - 550 MHz

350 430 MHz 550



INPUT RETURN
 LOSS



GAIN



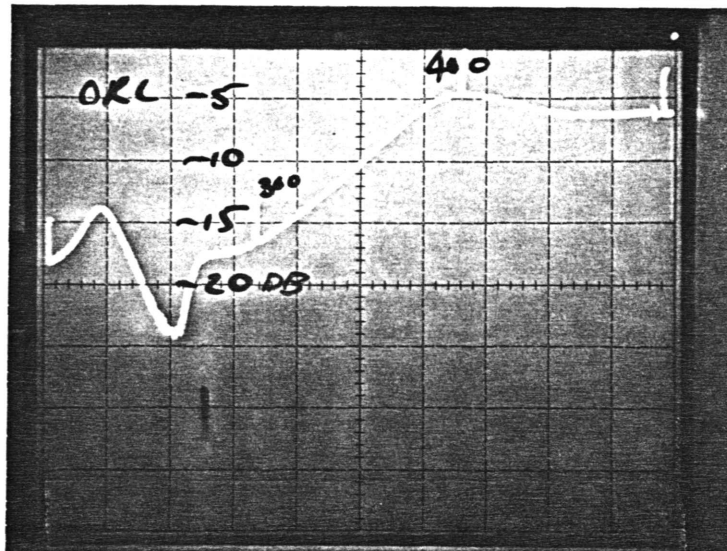
ARR-432

6-24-82

ORL

ARR-1412-8

6-25-82



OUTPUT RETURN
 LOSS

200 - 500 MHz

200

500

Fig. 2. Measured characteristics of amplifier as received.

