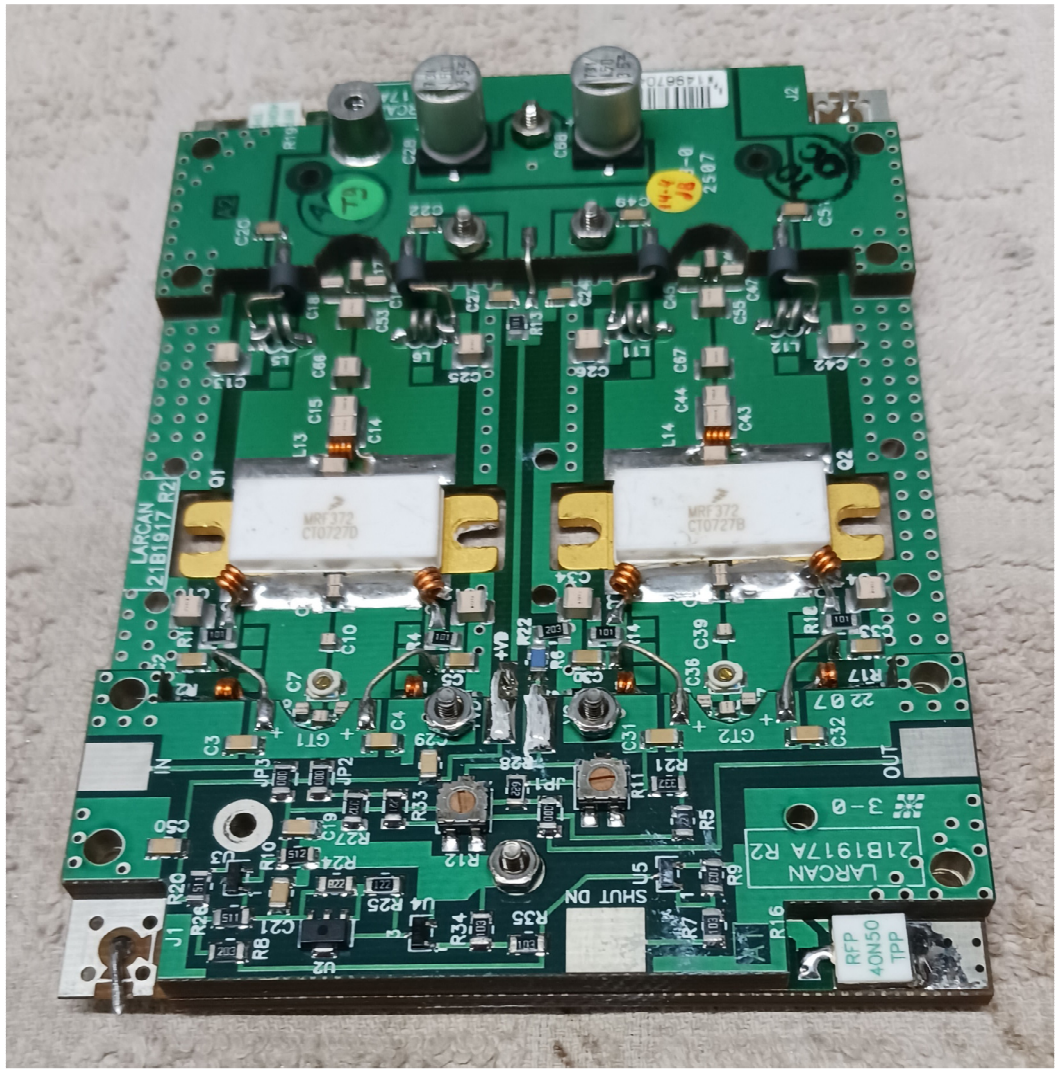
Larcan TV SSPA Pallet Conversion to 432

K1FMS – WA1PBU – KI2L – K1WHS – KV1J – VE2XX – N1JEZ


LARCAN
21B1917 R2
MRF372
C107270
MRF372
C107278
IN
OUT
SHUT DN
RFP
40N50
TPP

. .'eescale Semiconductor
Technical Data

Document Number: MRF372
Rev. 9, 5/2006

RoHS

RF Power Field-Effect Transistor

N-Channel Enhancement-Mode Lateral MOSFET

MRF372R3
MRF372R5

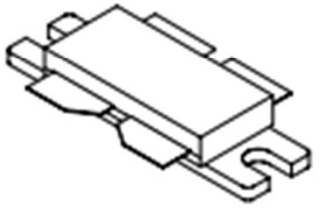
470-860 MHz, 180 W, 32 V
LATERAL N-CHANNEL
RF POWER MOSFET

Designed for broadband commercial and industrial applications with frequencies from 470 to 860 MHz. The high gain and broadband performance of this device make it ideal for large-signal, common source amplifier applications in 32 volt transmitter equipment.

- Typical Narrowband Two-Tone Performance @ f1 = 857 MHz, f2 = 863 MHz, 32 Volts
  - Output Power — 180 Watts PEP
  - Power Gain — 17 dB
  - Efficiency — 36%
  - IMD — -35 dBc
- Typical Broadband Two-Tone Performance @ f1 = 857 MHz, f2 = 863 MHz, 32 Volts
  - Output Power — 180 Watts PEP
  - Power Gain — 14.5 dB
  - Efficiency — 37%
  - IMD — -31 dBc
- Capable of Handling 3:1 VSWR @ 32 Vdc, 857 MHz, 90 Watts CW Output Power

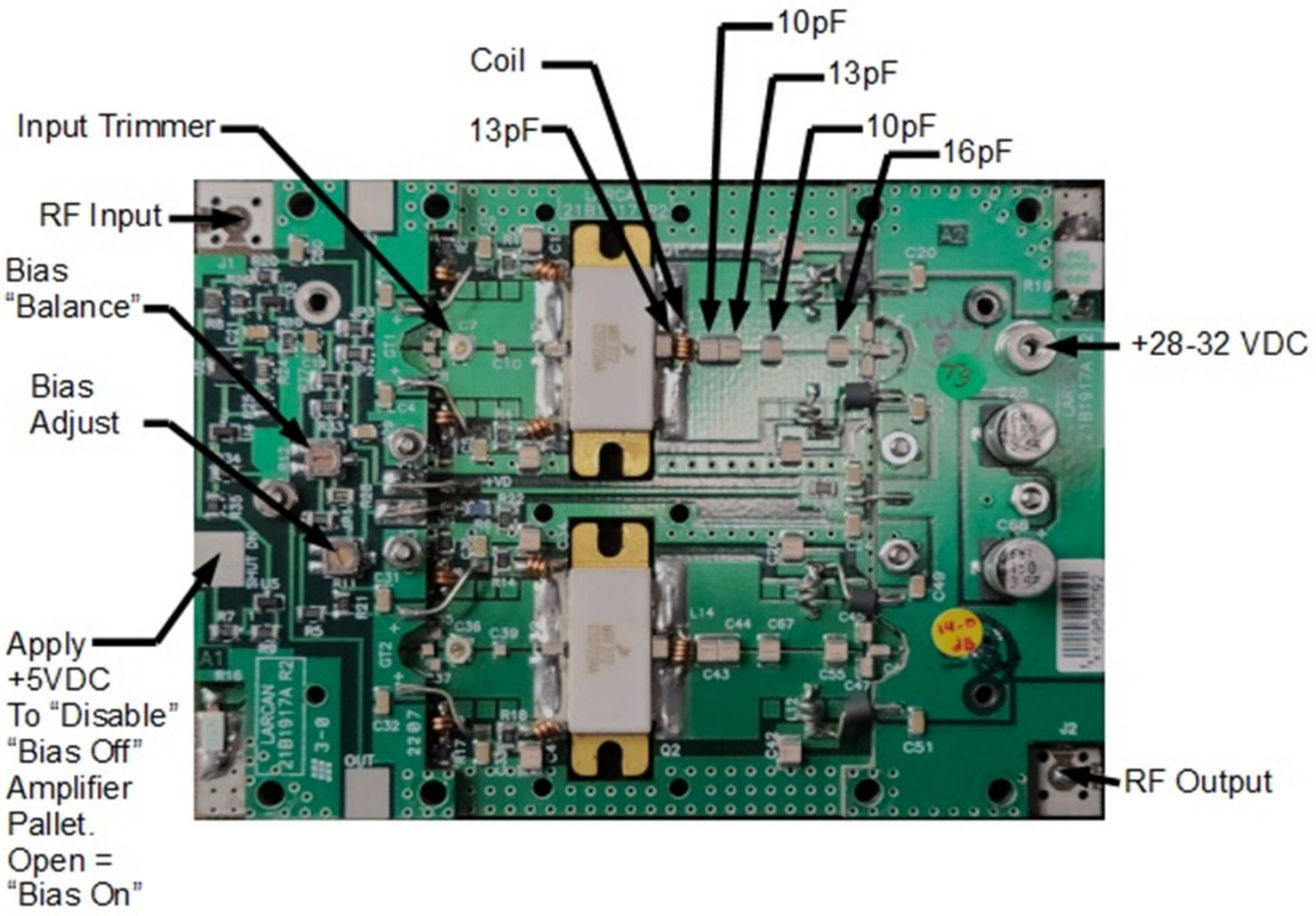
Features

- Internally Matched for Ease of Use
- Integrated ESD Protection
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- RoHS Compliant
- In Tape and Reel. R3 Suffix = 250 Units per 56 mm, 13 inch Reel.
  R5 Suffix = 50 Units per 56 mm, 13 inch Reel.



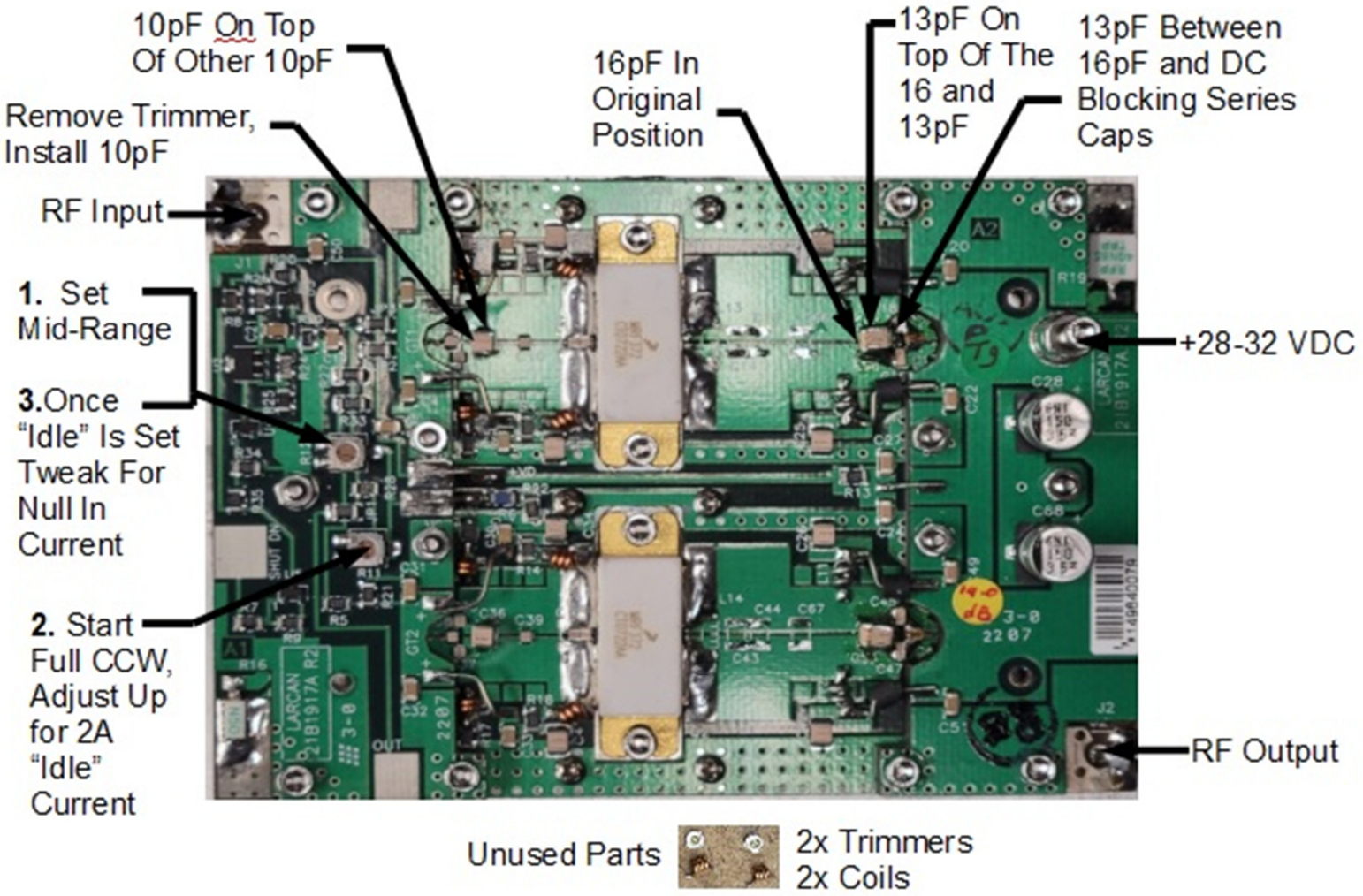
CASE 375G-04, STYLE 1
NI-860C3

NFORMATION



Stock Larcan UHF-TV Pallet

2024 K1FMS



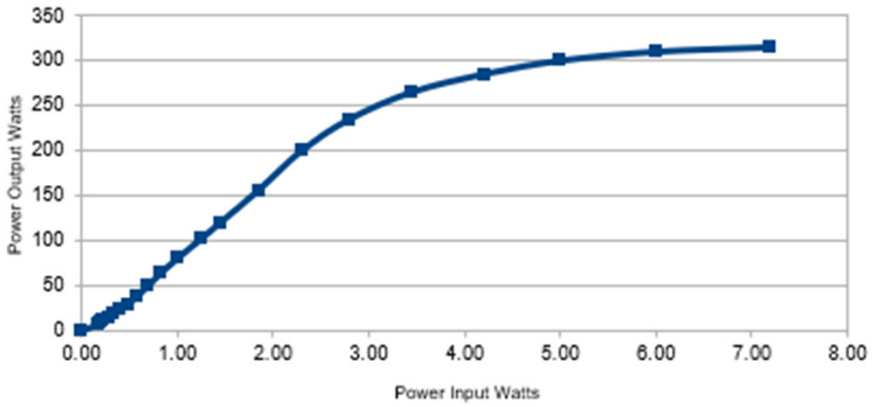
Retuned for 432 MHz Larcan UHF-TV Pallet

2024 K1FMS

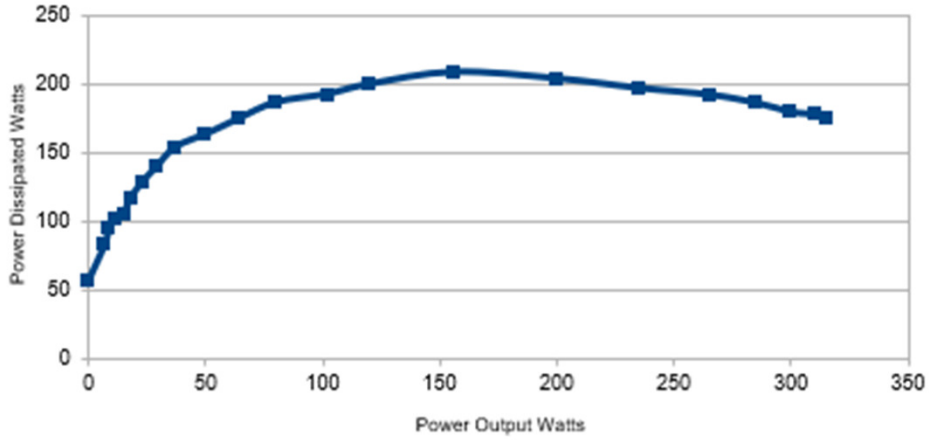
Larcan 432 MHz Amplifier Pallet

Generator Output	Power Input	Power Output	Voltage	Current	Gain	Efficiency	Dissipation
RF Off	0.00	0	28	2	N/A	0.0%	56
-15 dBm	0.18	7	28	3.2	15.9	7.8%	83
-14 dBm	0.2	9	28	3.7	16.5	8.7%	95
-13 dBm	0.22	11	28	4	17.0	9.8%	101
-12 dBm	0.28	15	28	4.3	17.3	12.5%	105
-11 dBm	0.33	18	28	4.8	17.4	13.4%	116
-10 dBm	0.4	23	28	5.4	17.6	15.2%	128
-9 dBm	0.48	29	28	6	17.8	17.3%	139
-8 dBm	0.57	37	28	6.8	18.1	19.4%	153
-7 dBm	0.7	50	28	7.6	18.5	23.5%	163
-6 dBm	0.83	64	28	8.5	18.9	26.9%	174
-5 dBm	1	80	28	9.5	19.0	30.1%	186
-4 dBm	1.25	102	28	10.5	19.1	34.7%	192
-3 dBm	1.45	120	28	11.4	19.2	37.6%	199
-2 dBm	1.85	156	28	13	19.3	42.9%	208
-1 dBm	2.3	200	28	14.4	19.4	49.6%	203
0 dBm	2.8	235	28	15.4	19.2	54.5%	196
1 dBm	3.45	265	28	16.3	18.9	58.1%	191
2 dBm	4.2	285	28	16.8	18.3	60.6%	185
3 dBm	5	300	28	17.1	17.8	62.7%	179
4 dBm	6	310	28	17.4	17.1	63.6%	177
5 dBm	7.2	315	28	17.5	16.4	64.3%	175

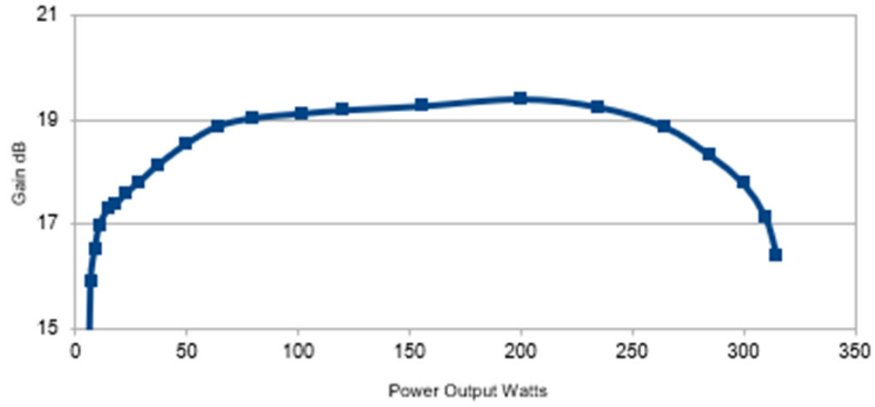
Power In vs Power Out



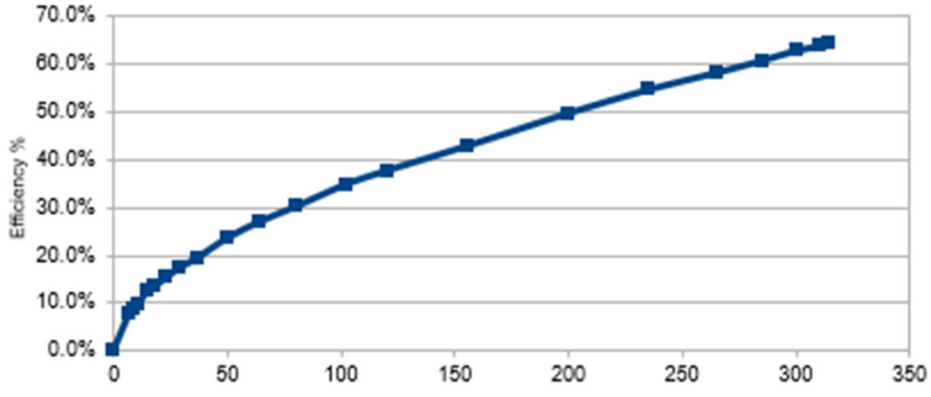
Power Output vs Dissipation

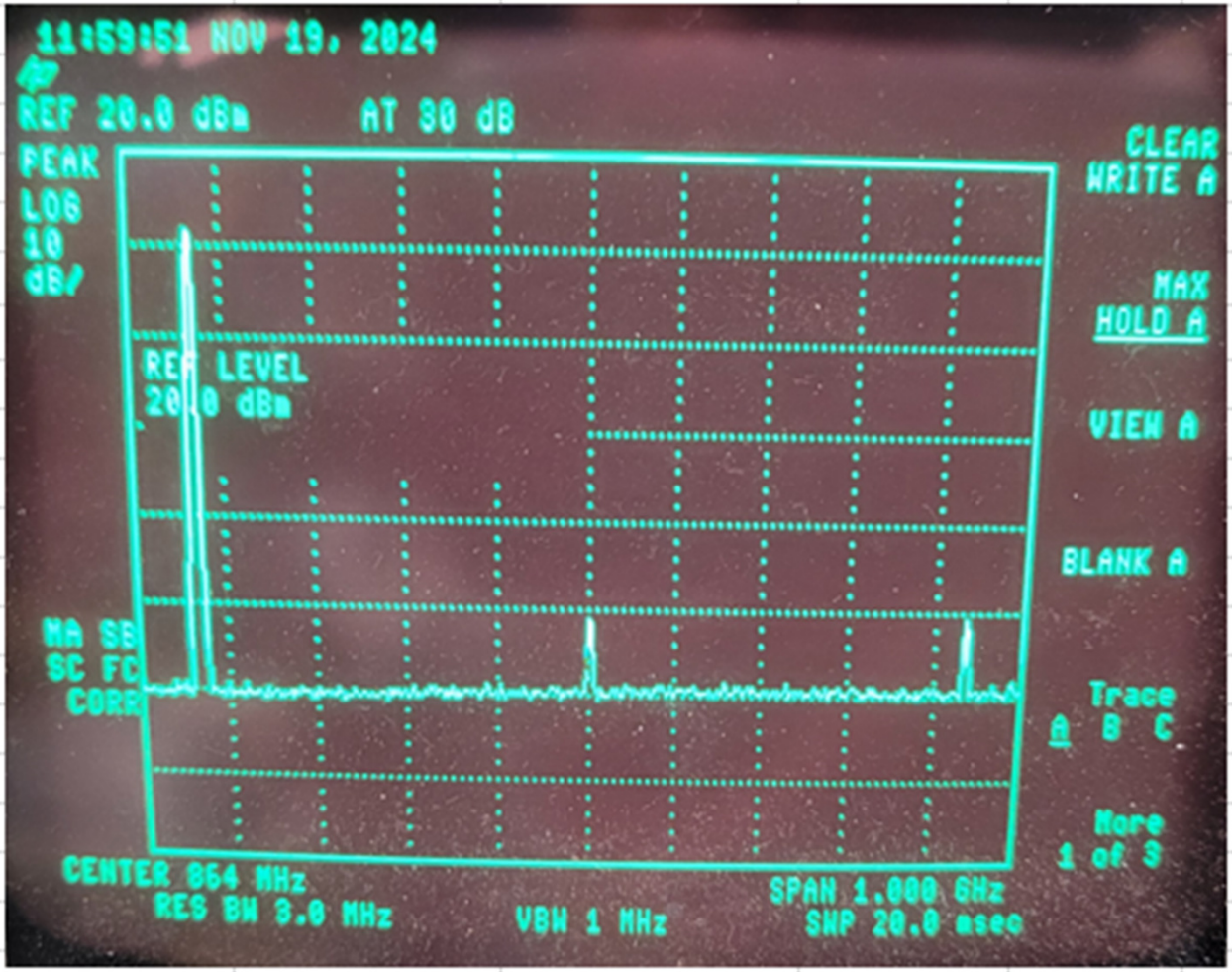


Power Output vs Gain



Power Output vs Efficiency





Harmonics

2^{nd} = - 44dB

3^{rd} = - 42dB

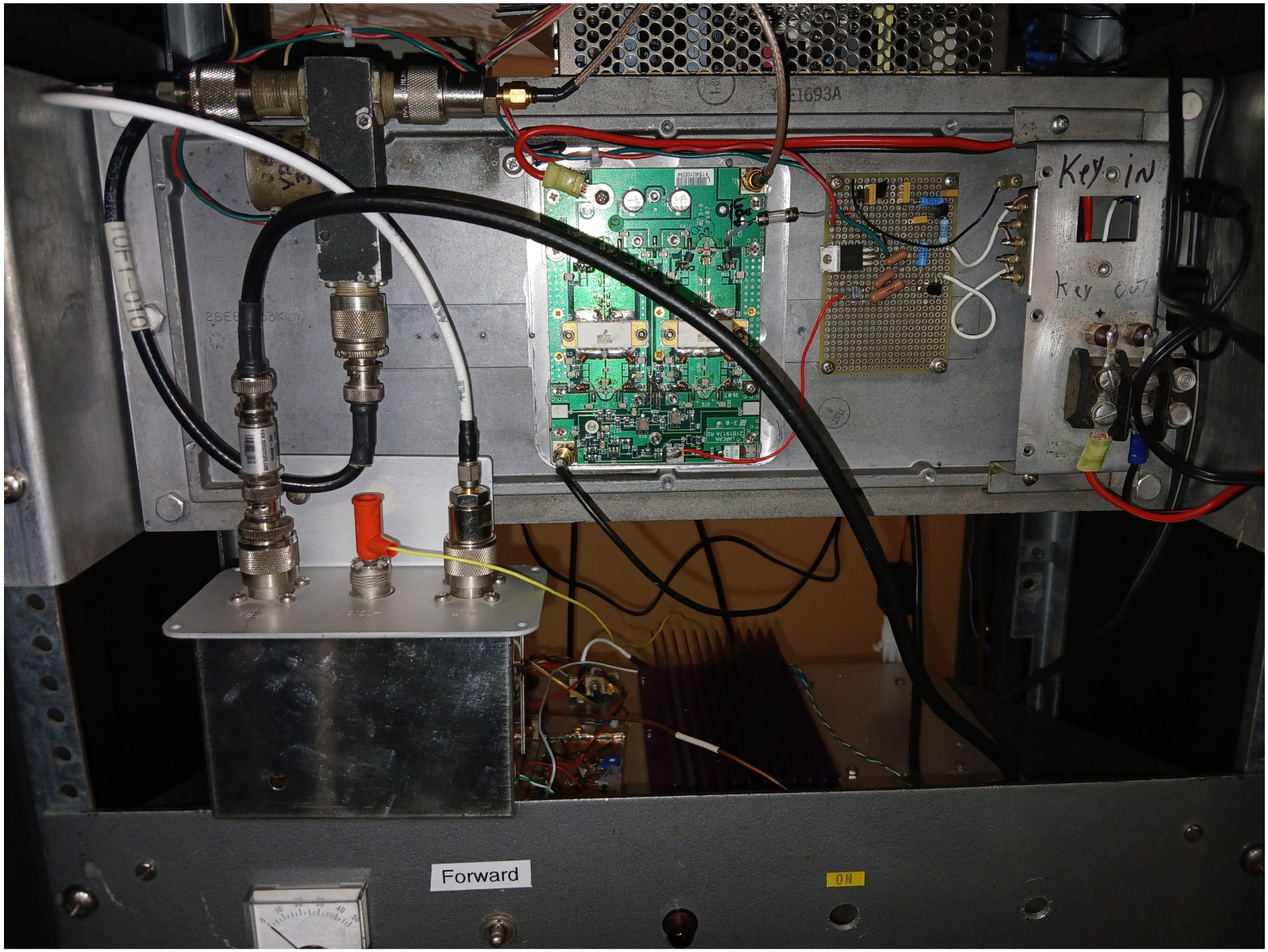
WA1PBU

I followed the crowd. I did the mods per Fred (K1FMS). He knows where the goodies are.

I don't have as much DC power supply as would be optimum. (28.5 Volts, at probably 15A) I do not want that much power in any case (I am too close to the Cape). I get an easy 20dB of gain, and my MAX output is about 250.

I have to limit that a bit. Careful of overdrive and it sounds great (low distortion). I have mine mounted on a MICOR heat sink. Runs cool and steady. I utilized the bias pad marked "shut down". it works well for standby. I recommend making NO connections to the other bias pads.

I use this a lot, and it is very stable. Very satisfying. The only delicate area is the gates. Overdrive or other abuse kills instantly. Bias circuit protects from casual static. I should do a 2 tone, but lots of other priorities.


Key in
Key out
Forward
ON

KI2L

Never under estimate my capacity to 'blow up shit"

Hey guys. I'm just trying to sort out my 432 PA deck. I can't seem to get more than about 200 W out of it and I'm wondering if there's any additional tuning that needs to be done other than replacing the capacitors?

I don't know that I'm getting more than about 24 1/2 V, maybe 25 out of the power supply. It's got plenty of amperage, but I can't get the voltage to climb up any further with any adjustments I can find.
(Bob)

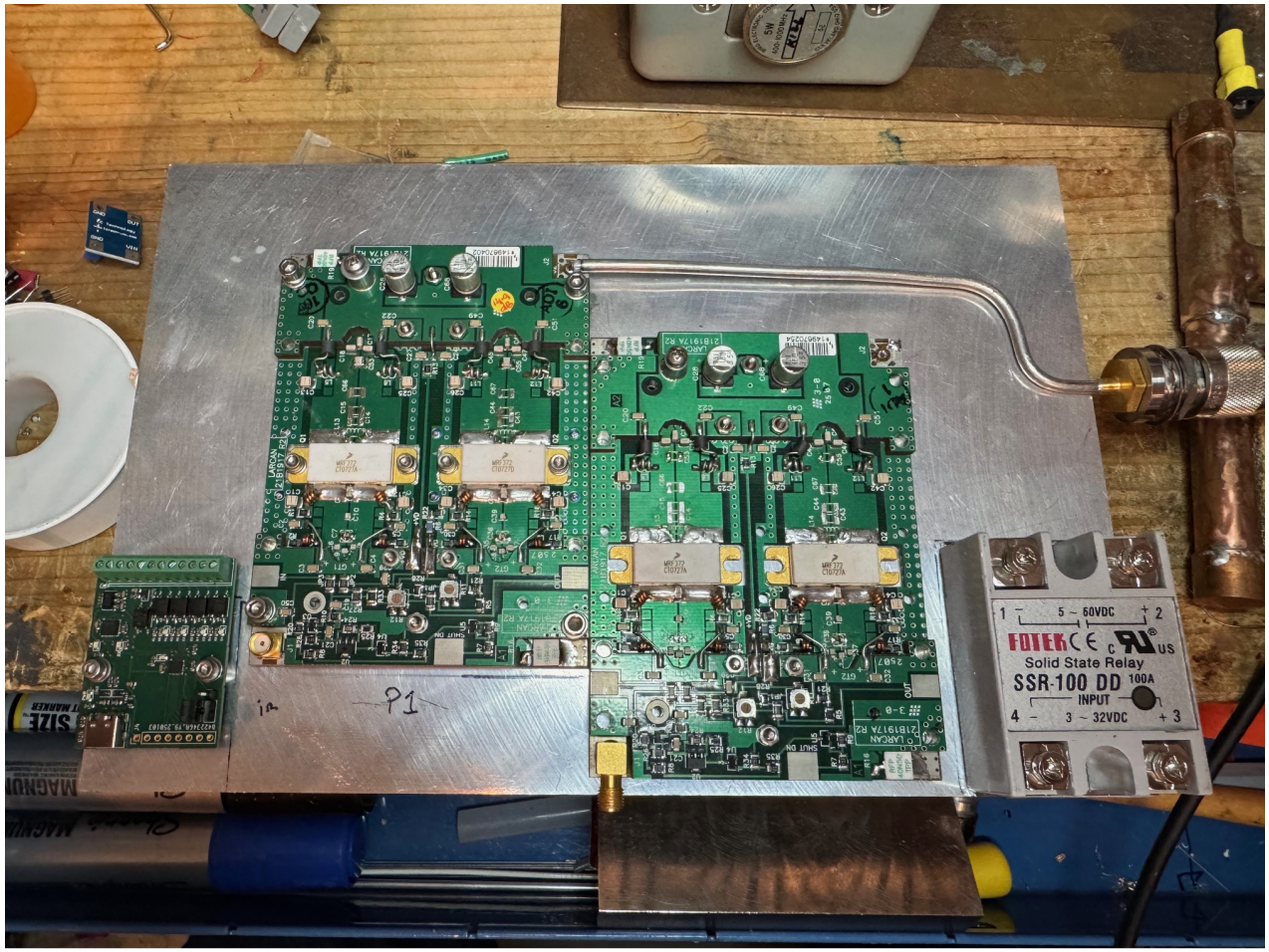
At 24v I wouldn't expect much more. These really want 28 to 32. At 28 300w is pretty typical and At 32 I see 350 to 400.
(Fred)

Tough to find a way to generate more than 26v out of what I have on hand.
I would like to build 3 amps, two identical two pallet amps for ~700W, one for the van, one for the house, and a monster 5 pallet version for up on the hill. But the P/S is killing me on the first one. If I could dial the 12v supplies down to sub 11v, it would be great, but not finding it.
(Bob)

https://www.jameco.com/z/LRS-600-27-MEAN-WELL-599W-Single-Output-27V-22-2A-Enclosed-Switching-Power-Supply_2337503.html
(Fred)

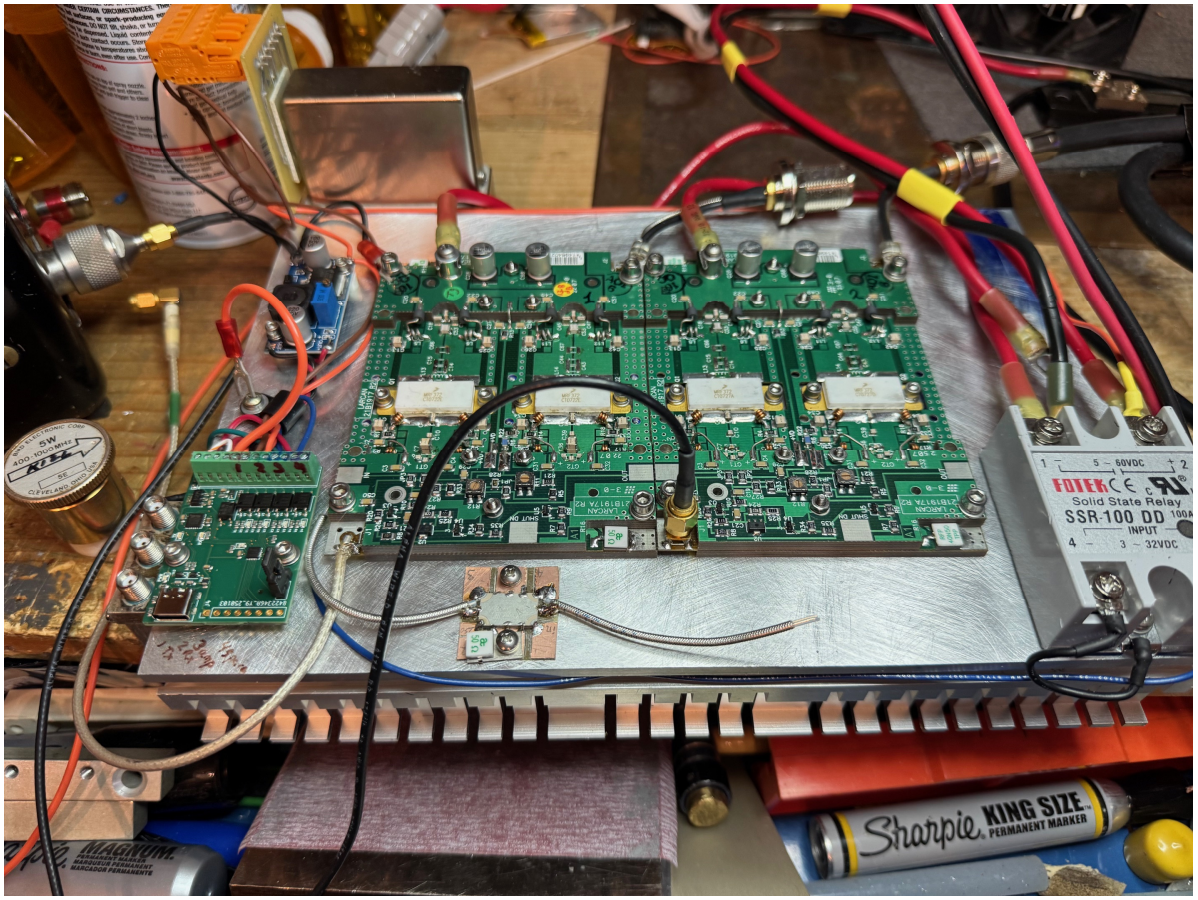
KI2L

Never under estimate my capacity to ‘blow up shit”



KI2L

Never under estimate my capacity to ‘blow up shit”



KI2L

Never under estimate my capacity to 'blow up shit"

Bob,
Yes, power drops FAST below 28v and rises FAST above that! At 32VDC I have seen an EASY 400W out of 1 pallet. These are fairly fragile old LDMOS (early generations) parts. My suggestion is the best protection for them for the money is buy spare pallets at ~$11 each.

The lower the voltage (within reason) the more rugged the amplifier will be. If you want 400W rugged run at 25 or 26V and use 2 modules if 300W is good enough then run 28VDC. If you have to have 350 to 400 from 1 pallet then 32VDC is for you, but you may be using MRF372's as fuses!

Remember 400 to 300 watts is 1.25dB. If anyone thinks 1.25dB will make or break a QSO with QSB and can intelligently explain how it will, I'd love to hear it!
73
Fred

K1WHS

I bought five pallets based on what Mr Fred said. In goofing around with them I managed to blow one of them up just by reducing the drive from 150 watts output down to close to zero. I suspect the HP 8640B put out a spike from the power pot. This has happened before, when Fred switched the attenuator switch on the 8640. The bottom line is that any drive spike can be death to the FETs. In my case, one of the MRF-372 gates shorted and it pulled down the gate supply, so the amp would not draw current. After seeing that I blew one half of the amp up, I went and ordered another five pallets. I have converted about seven or eight of them. They all produce over 300 watts at 28 VDC.

I have rigged up a water cooled heatsink with a pump and heat exchanger, and that works very well pulling all of the heat out of the devices. The actual devices running full power 300+ watts only heats up to maybe 36C after a minute of key down transmit. The heatsink itself stays under 30 C! This is very nice.

K1WHS

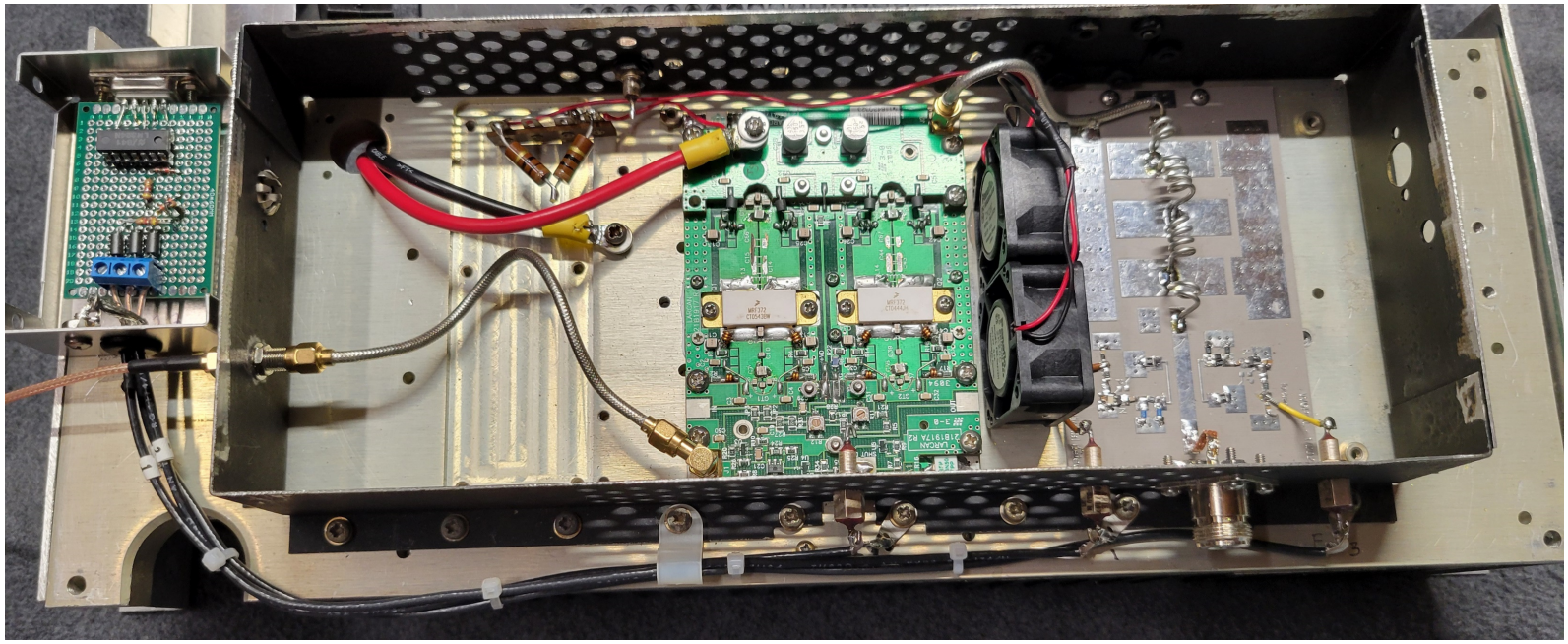
I ran into a problem in trying to use a common reactive divider such as used for antennas. The VSWR that the amp sees is just too high. My plan is to build a 3 dB Hybrid with stripline construction for the output stage. Then I can combine two amps and run it at the 500 watt output level which will fit in with my solar power system at my shack.

One comment that I would make is that the connection of chip caps to the circuit board should be done carefully by scraping away the board mask material and then tinning the bare copper where the chip caps will go.

With shaky hands, poor eyesight and general decrepitness of us old folks, it is easy to miss properly soldering the chips. The result is an unbalanced amp and overheated 50 ohm balance loads. Take some time to enlarge the solderable surface area for the chip caps. A few minutes there can save headaches down the line.

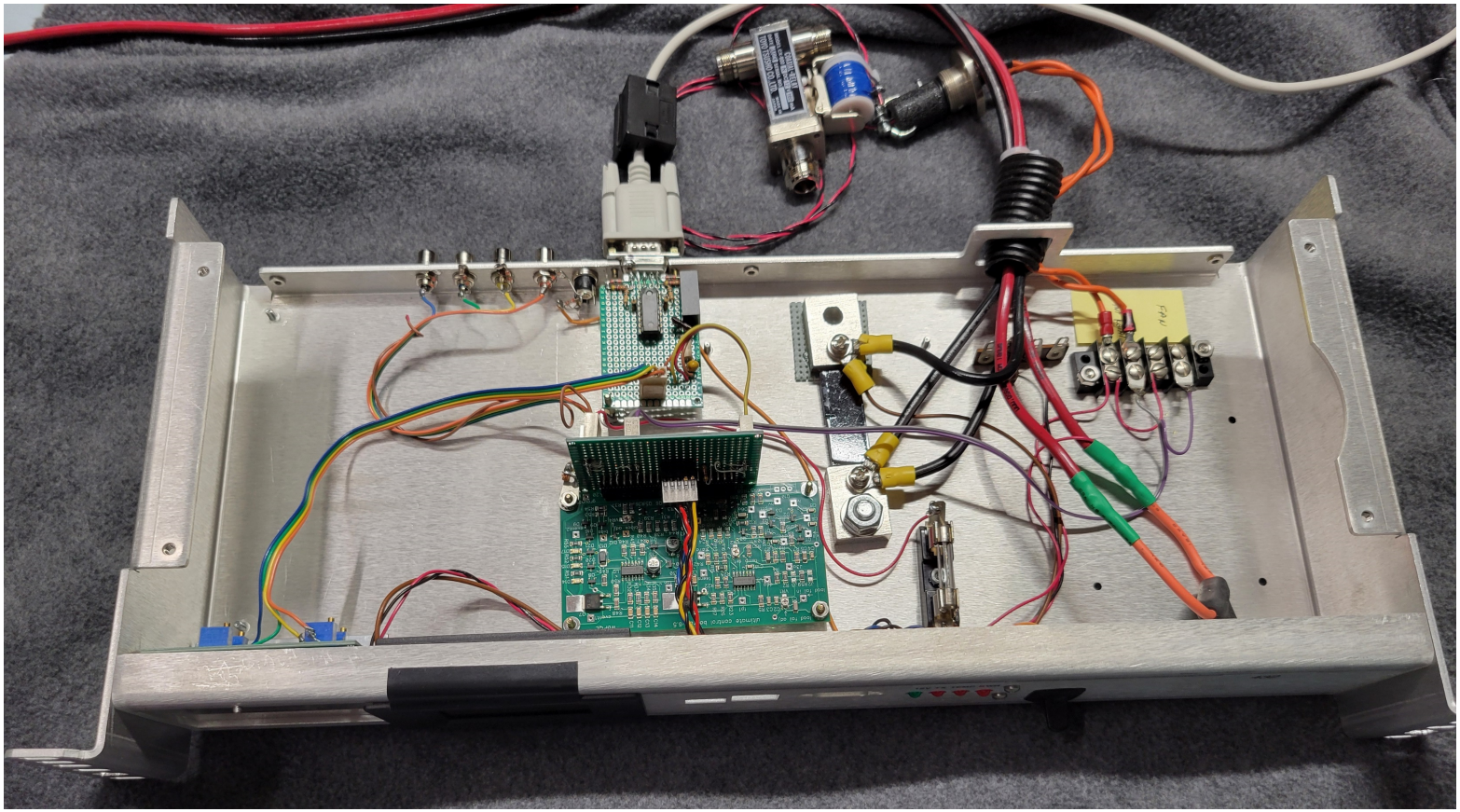
KV1J

I get 360 watts out. Use a W6PQL LPF board and drives LED bar displays on the controller box. The amp is on a Motorola UHF repeater heatsink. I am building a second one with two boards but have not solved the higher current power supply yet. The small fans between the LPF and the RF board were just thrown in since they were on the bench and maybe help keep the PCB and the LPF cooler.



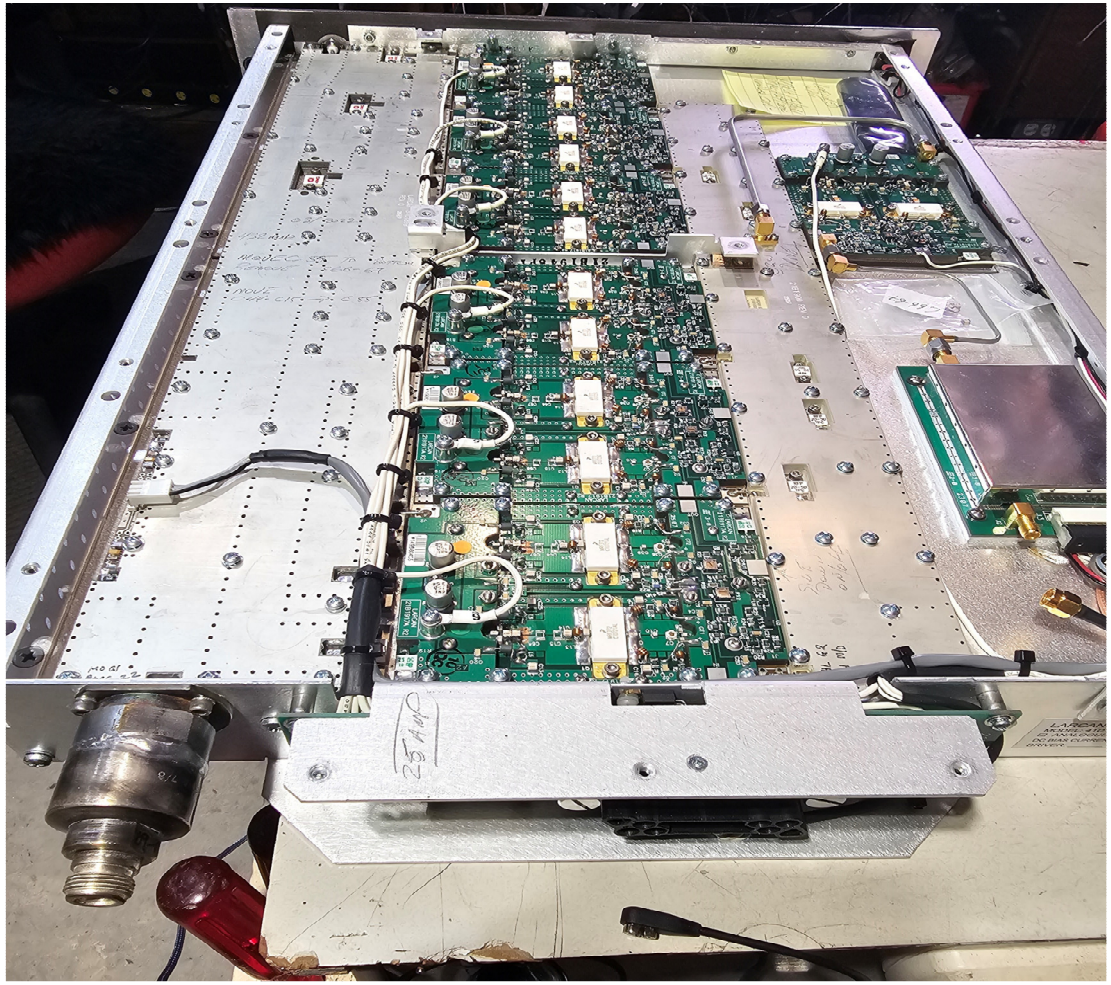
KV1J

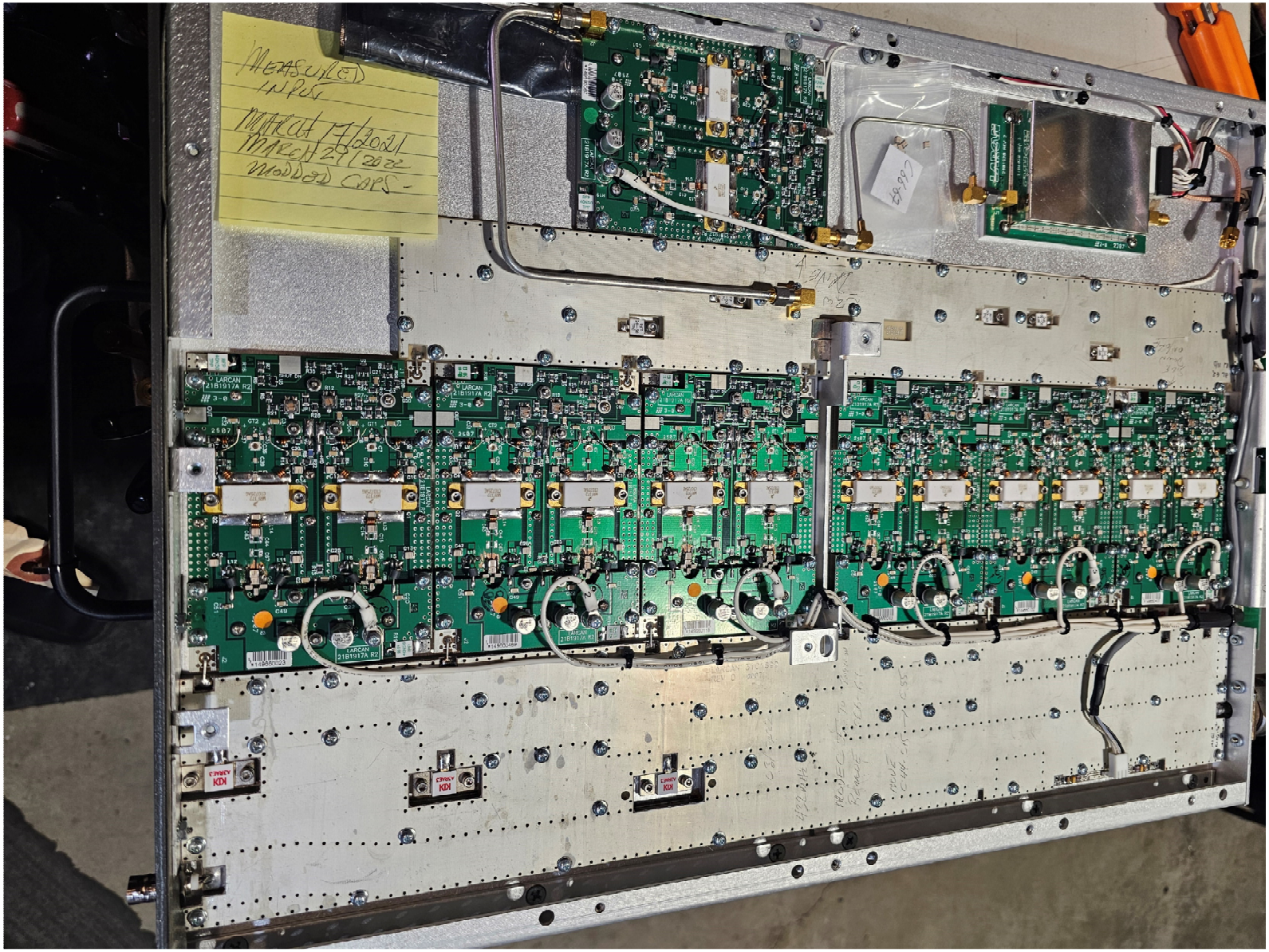
The controller uses the W6PQL board and a current shunt to a display for current and voltage.

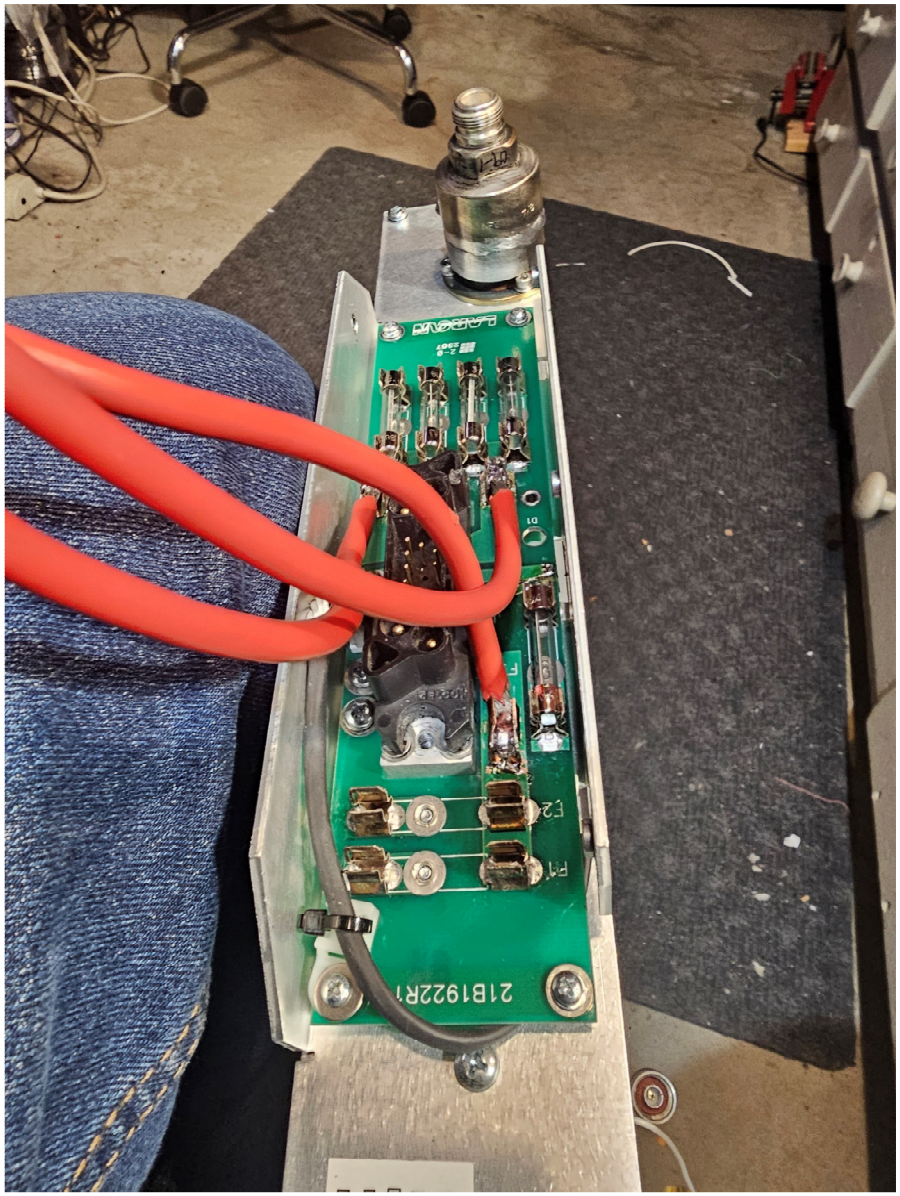


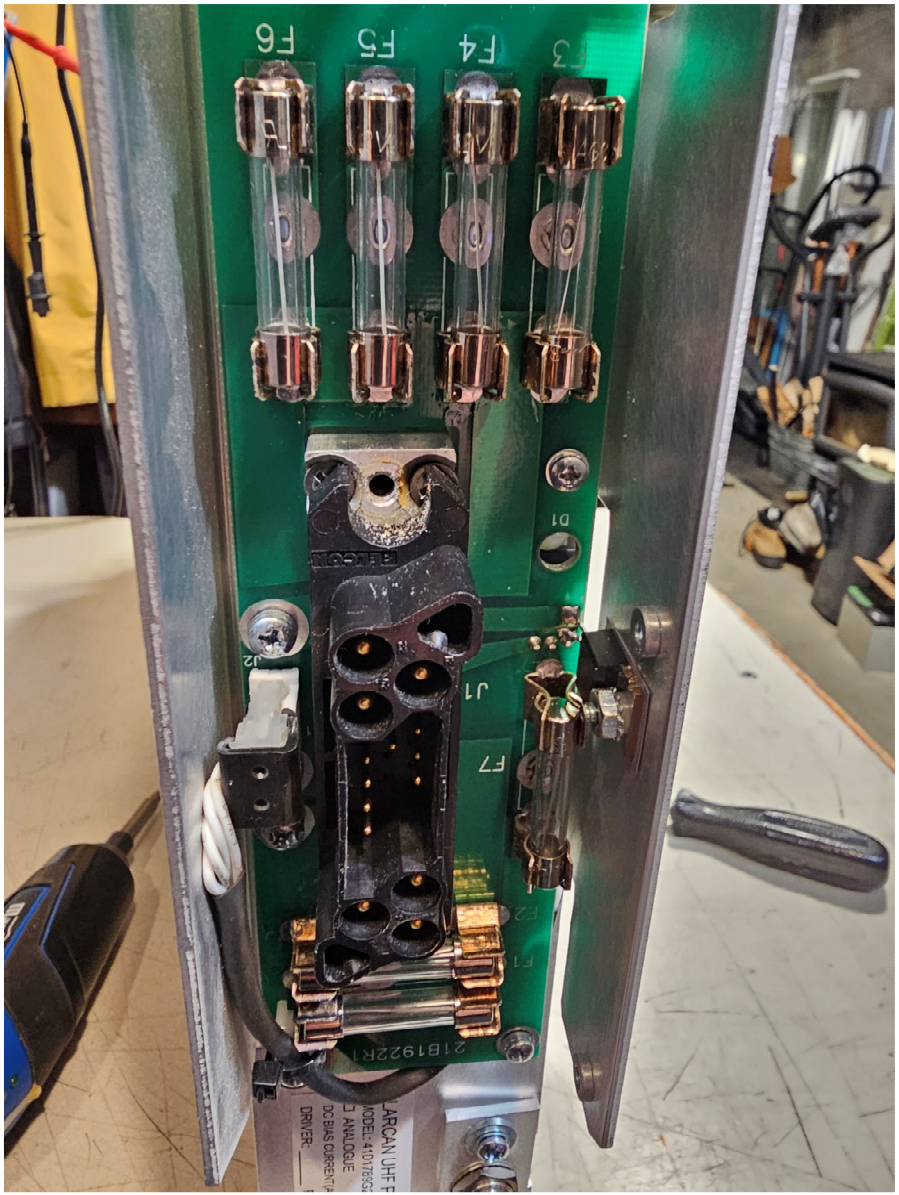
VE2XX

“Go Big or Go Home”

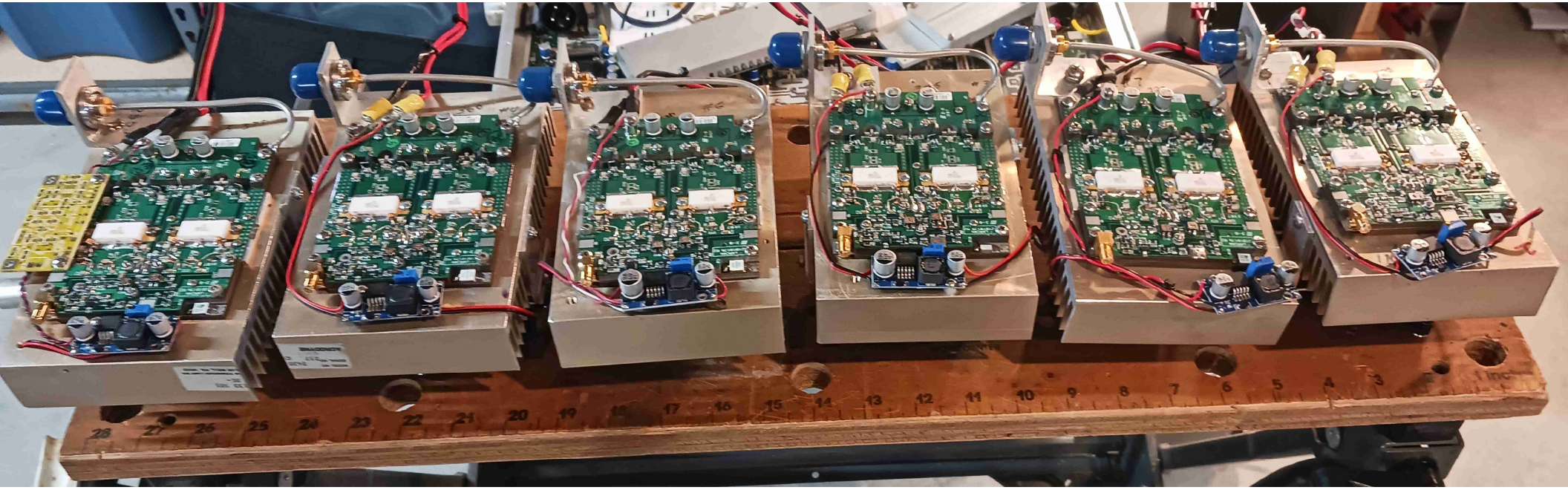



MEASURED
INPUT
MARCH 21 2022
MODDED CAPS -

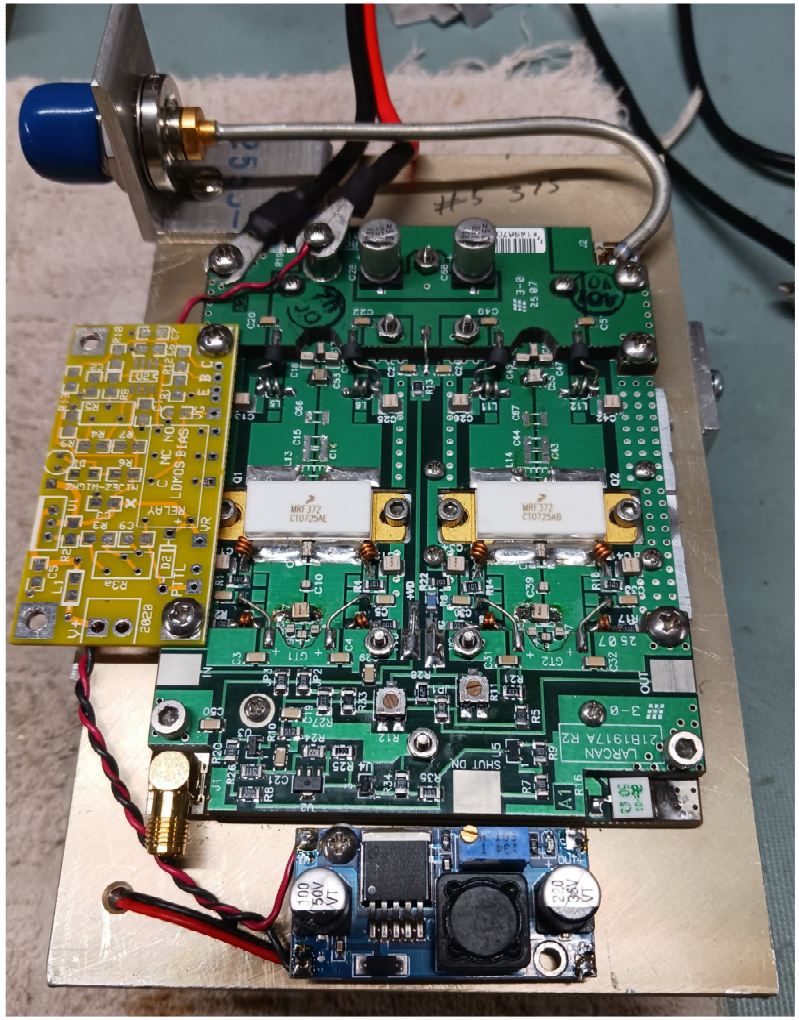



F3
F4
F5
F6
F7
J1
J2
D1
21B1922R1

N1JEZ

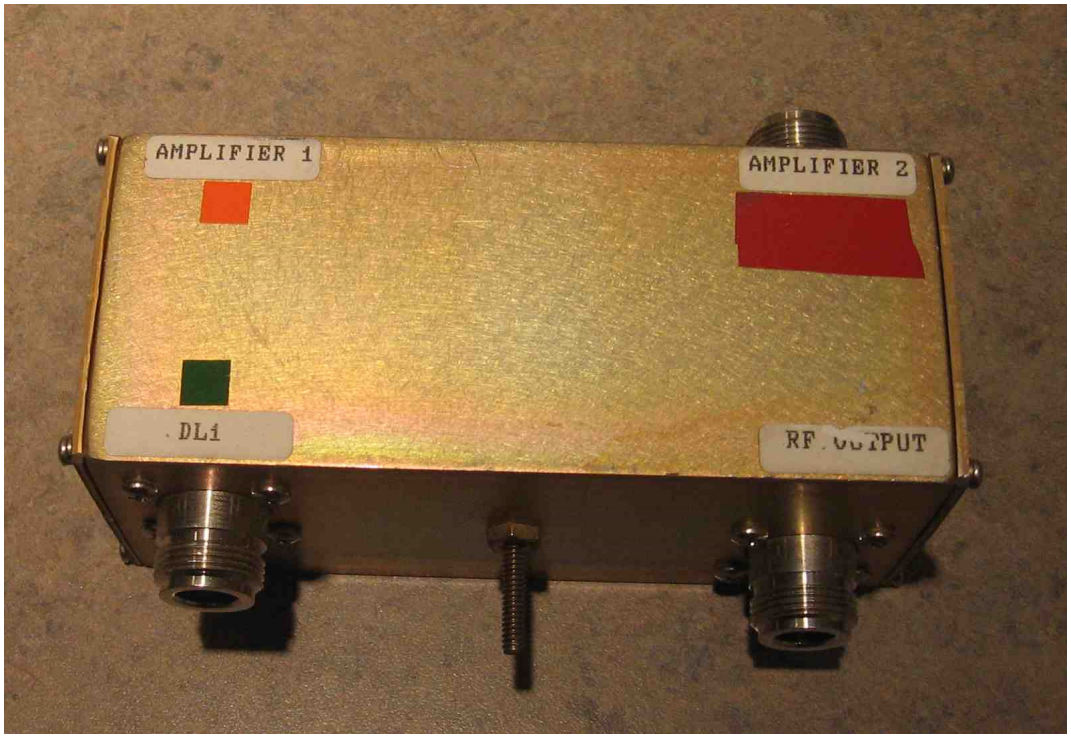


N1JEZ


MRF372
C10725AE
MRF372
C10725AB
LARCAN
Z1B1917A R2
SHUT DN
IN
OUT
RELAY
PTT
LDMOS BIAS

N1JEZ

N1JEZ
Split/Combine



N1JEZ

For combining 2 pallets, I used an Anaren splitter because I had several in a drawer.

For combining the outputs, I used an Acrodyne unit that was salvaged from an analog TV transmitter that was on CH 20 (~510 MHz) It combined two kW SSPAs.

On the Anaren, the feed to each pallet was the identical physical length.

On the output, I used two identical cables from Pasternak that I got at a Conference.

I used one Wattmeter/kW dummy load on the combiner output and another Wattmeter/dummy load on the reject port of the combiner.

The two pallets I used were a 360W and a 330W as I recall. This was early in the project.

Power output combined was 650W saturated and 5W in the reject load, so a decent balance for us Hams.

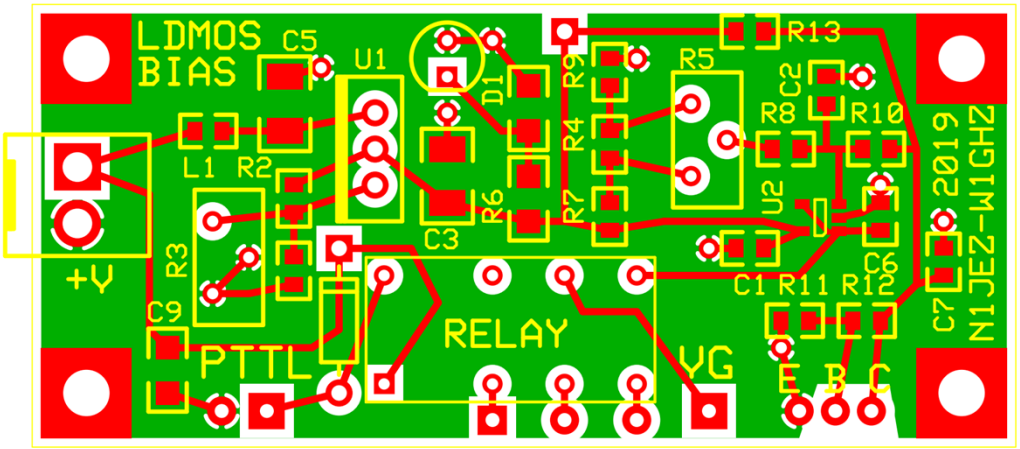
I have two pallets now that measure 360W and 375W that I will try next. All my pallets are running 29 volts under load.

N1JEZ

One thing I have noticed is that some pallets have idling current that changes, The bias pot is very touchy. I have some 11T SMD pots that I will try. That will prove to me whether it's in the touchy pots or the devices themselves.

Fred did mention that these parts are pretty old before it was understood that they really needed temperature compensated regulated bias.

I plan to try one of the boards that Paul and I put together for temperature compensated regulated bias. It will be interesting.



THE END

QUESTION

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