W5HN

North Texas NTMS Microwave Society

Backyard Microwave EME
An Update

Microwave update 2007

Dave Robinson WW2R, G4FRE

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Remember from last year?

- Inspired for a long time by the KD5RO article in MUD Proceedings 1989 “Microwave EME using a Ten Foot TVRO antenna”

Searched for a dish for a long time with no success, then one day N5PYK announced he was moving to College Station donated his dish

C band satellite polar mounts are nowhere near Polar mounts. Need modification

Fight to eliminate every little loss. With a small dish every 0.1dB counts

Lock L.O. to GPS to maintain frequency stability

If not concreted to ground make sure lots of weight on dish mount legs

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Current Equipment 23cm

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- WD5AGO preamp on G4DDK PCB. 0.26dB NF
- 20 year old 2x2C39A EME Electronics PA 200W
- 70’ LDF4 TX feeder
- G4DDK Xverter (2 IF outputs)
- RA18H1213G Predriver (7W)
- FT847
- PIC Sequencer
- VK3UM Autotracker

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1296 Dish Configuration

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TH338 Amp

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TH338 Amp: Cathode Cooling

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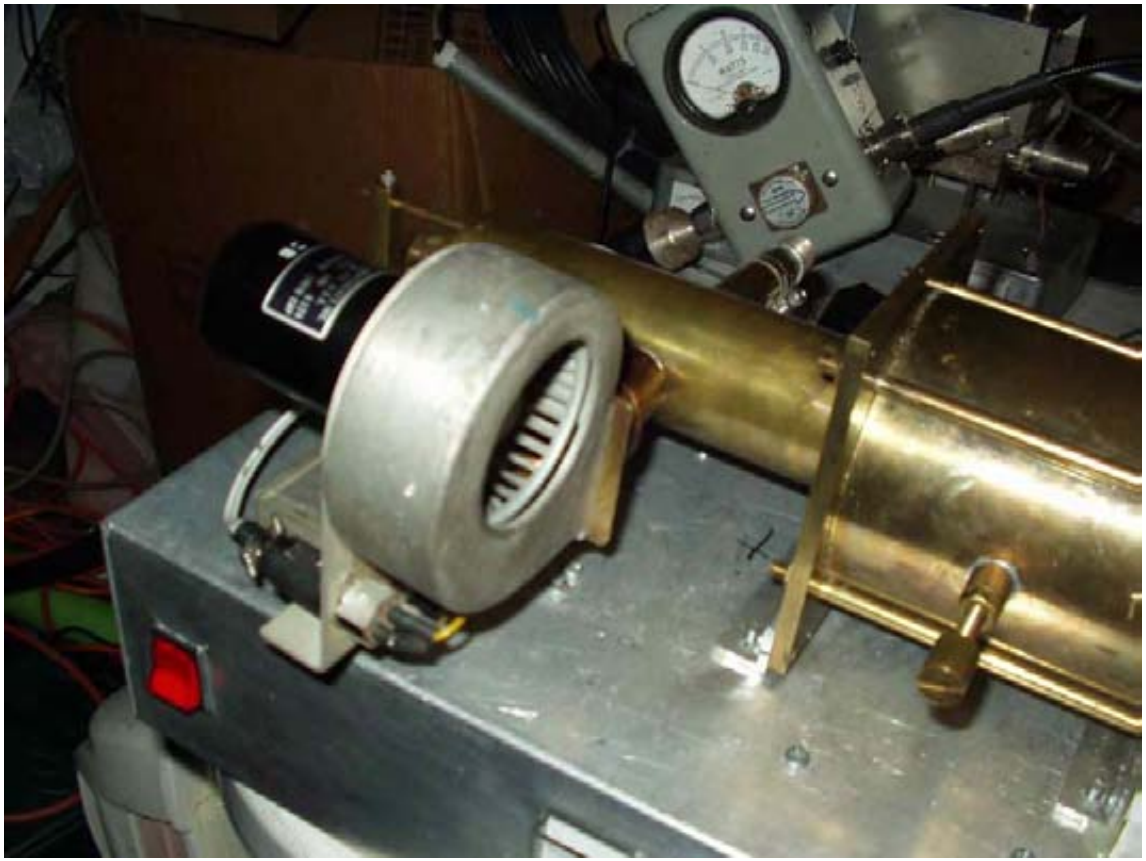

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TH338 Amp: Anode Cowling

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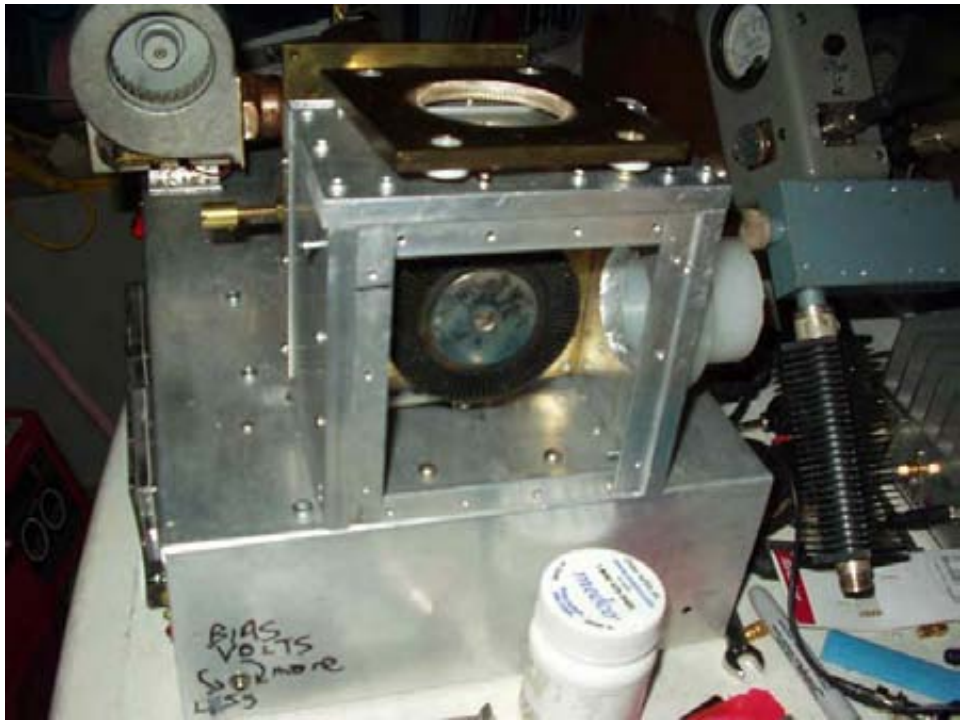

After many “punch throughs” realised HB9BBD was correct:-

Use Kapton NOT PTFE for anode insulator

15W in 330W out with 1700V on load. Above this voltage TUBE arcs

Sticking to 200w till get 100 grids!

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Original Actuator mount

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Then came the wind

May 2: 81mph winds (and driving rain/thunder/ lightning)

Sleeve holding actuator to post slipped. Actuator slipped

Dish swung vertical, bent rim in 4 places damaged 4 panels

Following morning bought 3 G clamps, steel angle, spent 3 hours straightening dish

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Add muffler clamps…wont slide

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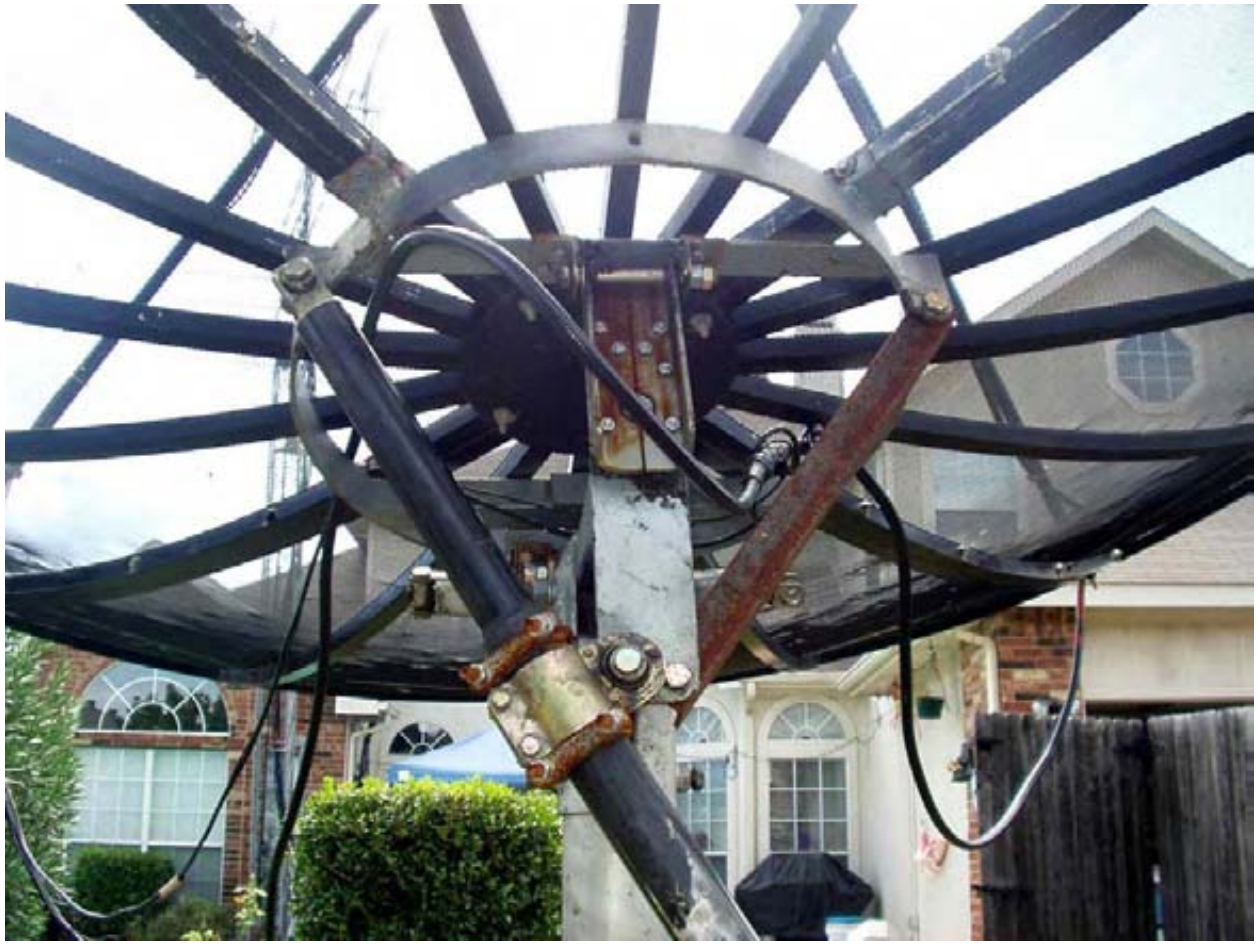
When not in use added extra brace



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Results so far:1296MHz CW

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G4CCH K5SO VE6TA K9SLQ G3LTF K5JL F2TU K2UYH W5LUA K4QI OZ6OL OZ4MM ZS6AXT F6KHM LX1DB(SSB) LA8LF K5GW OK1CA RW1AW IK2MMB HB9Q OK1DFC JR4ZZS IW2FZR ES5PC PA3CSG SM3AKW OE9ERC CT3/DL1YMK KL6M VK3UM SM6CKU OK1KIR ON7UN DL1YMK K0YW WA6PY HB9BBD SM4DHN HB9SV K1RQG N2IQ N2UO K5PJR W7BBM NA4N WB2BYP GW3XYW ES6RQ 8N1EME AD6IW DF3RU N0OY AL7RT WA5WCP KH7X TF/DL1YMK G3LQR RW3BP WA5WCP/WY WA5WCP/UT WA5WCP/ID SM2CEW W2UHI

123 Qs 62 Inits 4 Cont 28 DXCC 40 Grids 19 States

Still some left to work! (9 ESCAPEES so far)

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Results so far:1296MHz JT65C

SM5LE VK7MO G4DDK RW3BP
G4DZU G4CCH OK1KIR VA7MM
OE9ERC PA0BAT ES5PC K2UYH
GW3XYW ES6RQ UR5LX W5LUA
PA3FXB PA3DZL

18 Initials 12 DXCC 17 Grids 2 States!

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Original Equipment 13cm

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- WD5AGO preamp 0.55dB NF
- Spectrian Amplifier mounted at dish (160W max). 48V operation.
- Homemade VE4MA Superfeed using copper tube mailed by PA3CSG. Tuned for “reasonable” return loss
- DB6NT Xverter For 2304/2320. IF is FT847
- For 2424MHz RX use ADC7133 Satellite down converter to FT847 IF at 168MHz

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Original 13cm Feedpoint Configuration

WD5AGO NE32584/ATF10136 0.55dB NF DEMI 0.6dB second stage (Xverter in shack 70’ away). SMA protection relay.

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New 13cm Preamp

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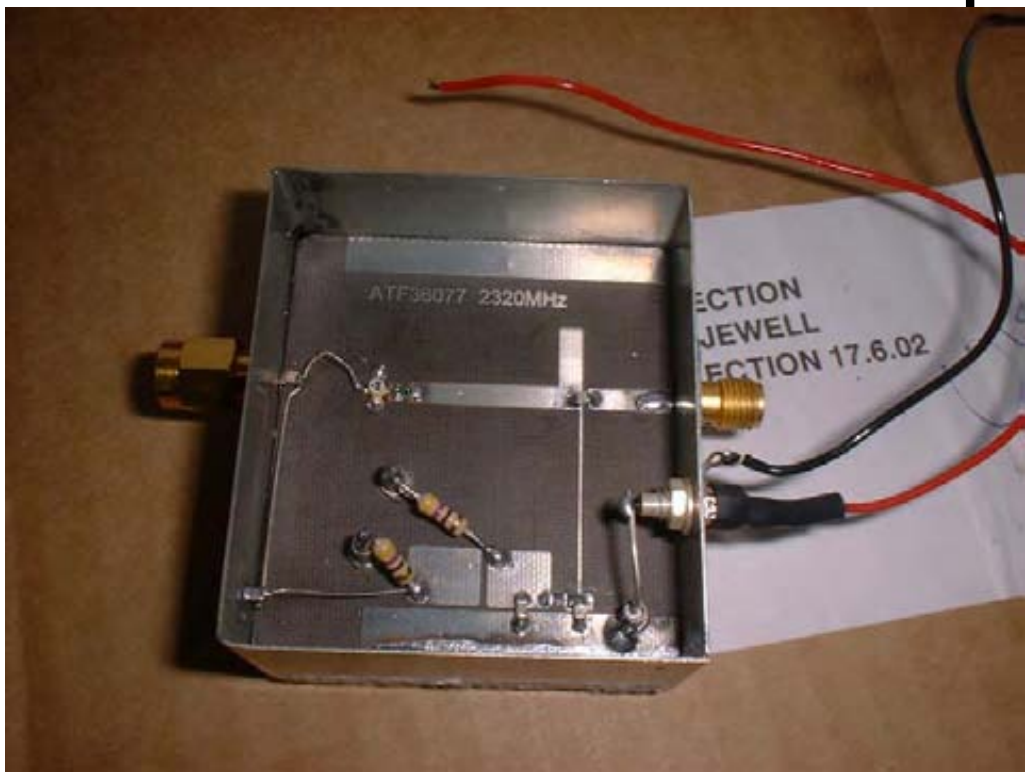

G4DDK realisation of W5LUA 1999 MUD preamp. ATF36077 device 0.33dB NF

Note input circuitry in air not on PCB.

Sun noise up 1dB

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Current Feedpoint configuration

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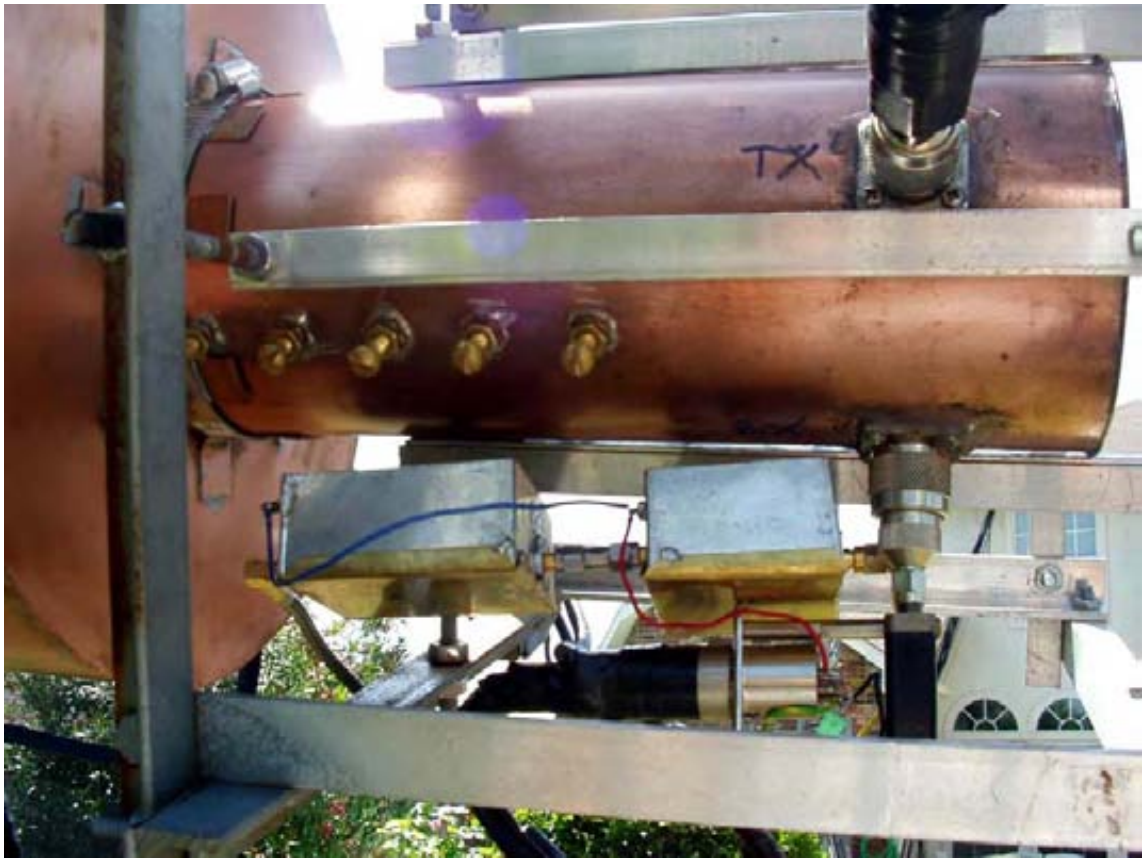

G4DDK preamp. ATF10135 2nd stage

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Equipment changes: 13cm

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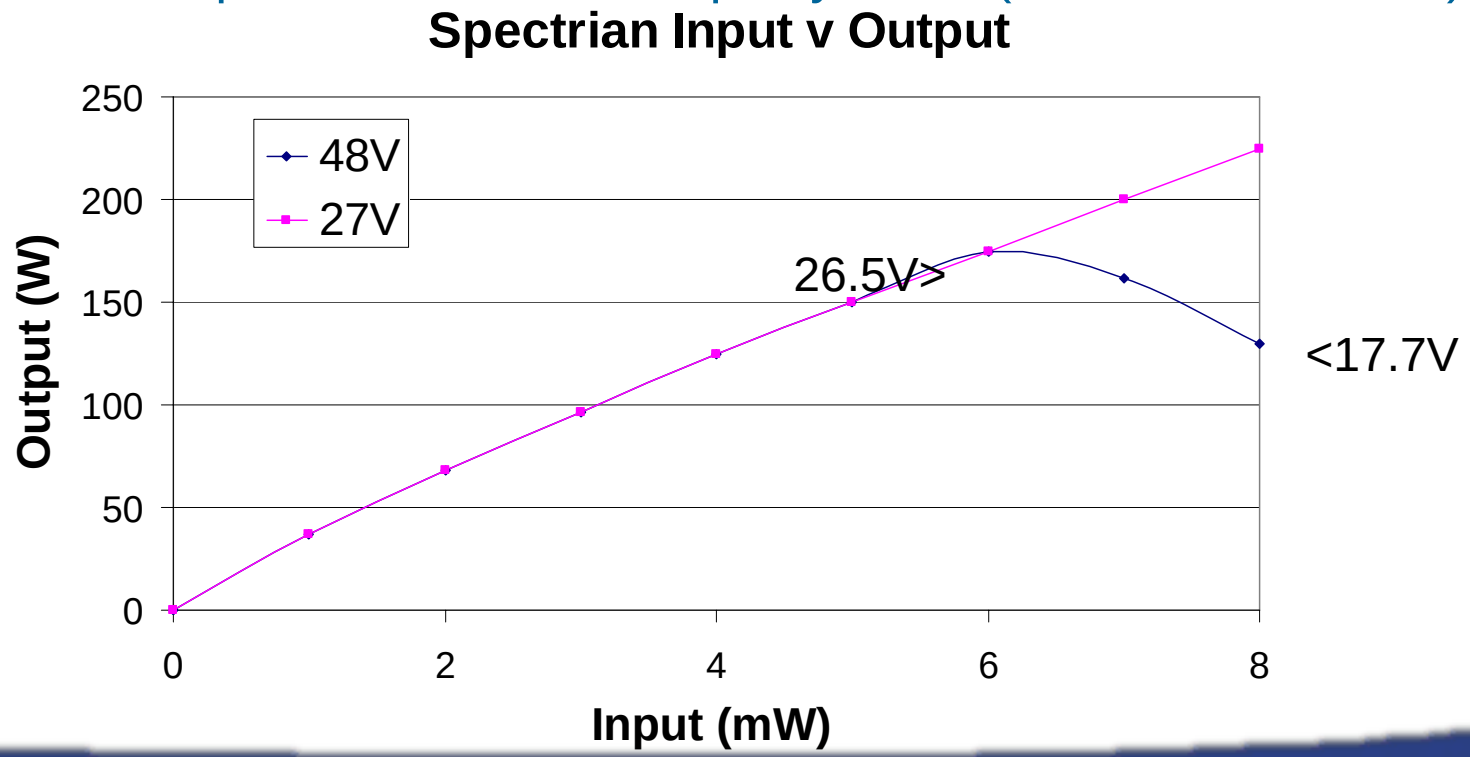
- Spectrian Amplifier now using 27V.
- Internal 48/26.5V converter folds back if too much current…drops from 26.5 to 17.7V below)
- Breaker trips at 37A…don't keep key down (or remove breaker)



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13cm Results so far (cw)

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- 2-Apr-06 VE6TA DO33
- 8-Apr-06 OK1CA JO70
- 8-Apr-06 F2TU JN38
- 8-Apr-06 W5LUA EM13
- 8-Apr-06 OK1KIR JN79
- 8-Apr-06 OZ4MM JO55
- 9-Apr-06 G3LTF IO91
- 11-Apr-06 OE9ERC JN47 (SSB)
- 16-Sep-06 K5GW EM13
- 17-Sep-06 K2UYH FN20
- 17-Sep-06 PA3CSG JO21
- 17-Sep-06 RW1AW KO33
- 21-Apr-07 SM3AKW JP92
- 21-Apr-07 KL6M BP51
- 22-Apr-07 ES5PC KO38
- 19-May-07 TF/DL1YMK HP64
- 11-Aug-07 LX1DB JN39

31 QSOS

17 INITIALS

13 Grids

14 DXCC

3 States

6 Escapees

Plus W5LUA and VK7MO on JT65C

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Independent RX from Xverter

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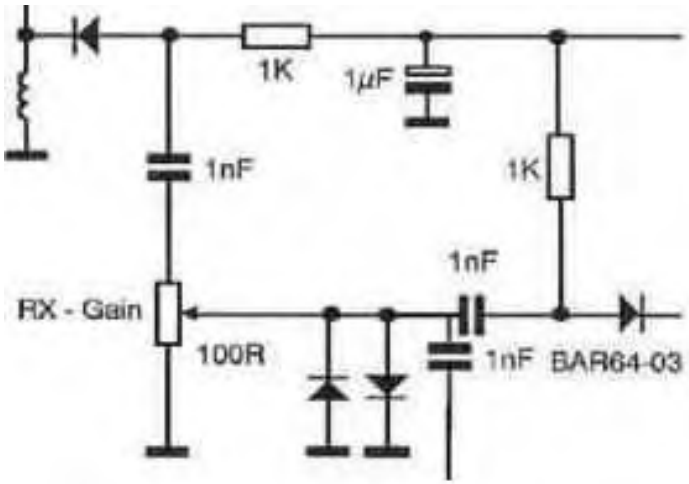
Obtained a GR-1236 noise measuring meter. Retuned to centre on 28MHz

Added MCL 50 ohm to 400 ohm matching transformer on input

Need 2nd output from DB6NT MKU23MK2 transverter to feed GR-1236

Tried tapping off signal from RX level pot



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Independent RX from Xverter

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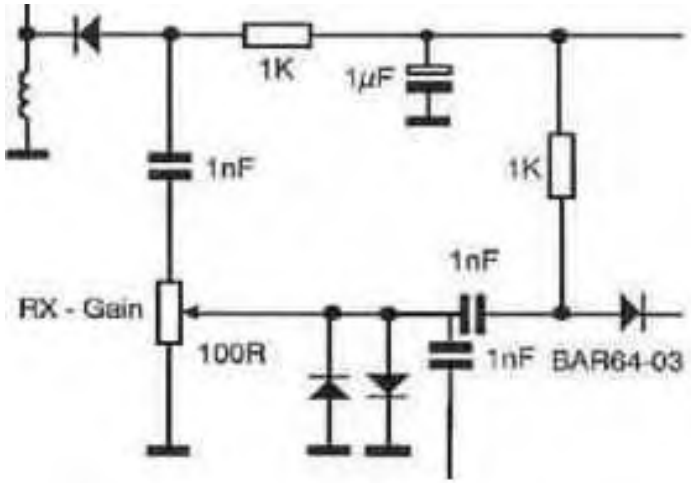
Need 2nd output from DB6NT MKU23gMK2 transverter to feed SDRIQ

Tried tapping off signal from RX level pot



1W 144MHz IN

-12dBm OUT to RX

Not good

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Independent Rx from Xverter

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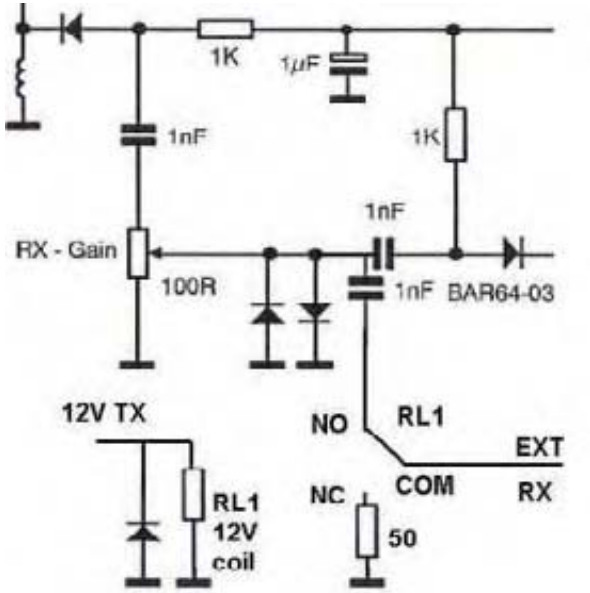

Add isolation relay. Terminates RX in 50 ohms on TX. 144 level –75dBm

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Remote Spectrian monitoring
The need!

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During 13 sked with G3LTF he was not responding to Rs
Went and measured output. None.
Found Isolator output terminal vaporised.
Replaced Isolator. Full output restored.
Worked ES5PC and OZ4MM.
Got called by K5GW but he also did not respond to report
Went and measured output. None.
Obviously need to remote monitor AMP from shack!

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Remote Spectrian monitoring
An aside!

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Found Isolator output terminal vaporised and substrate missing from track at isolator output. Also hot heliax connector.

(Worked RW1AW and G3LTF with 60W, but not KH7X)

Once told if replace Spectrian output board should replace input board as they are matched pair
Order red combiner/splitter pair (and some spare isolators)
Replaced just output board….120W output
Replaced input board as well…back to 160W…advice was correct
Note from specification sheet the Spectrian isolators are only rated at 125W

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Remote Spectrian monitoring (Power)

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While replacing output board found what appeared to be RF detectors feeding a 6 pin connector

Pin 1	produced 5V when 200W “forward”
Pin 2	produced a reflected power voltage
Pin 3	8V supply to detectors
Pin 4,5,6	Ground

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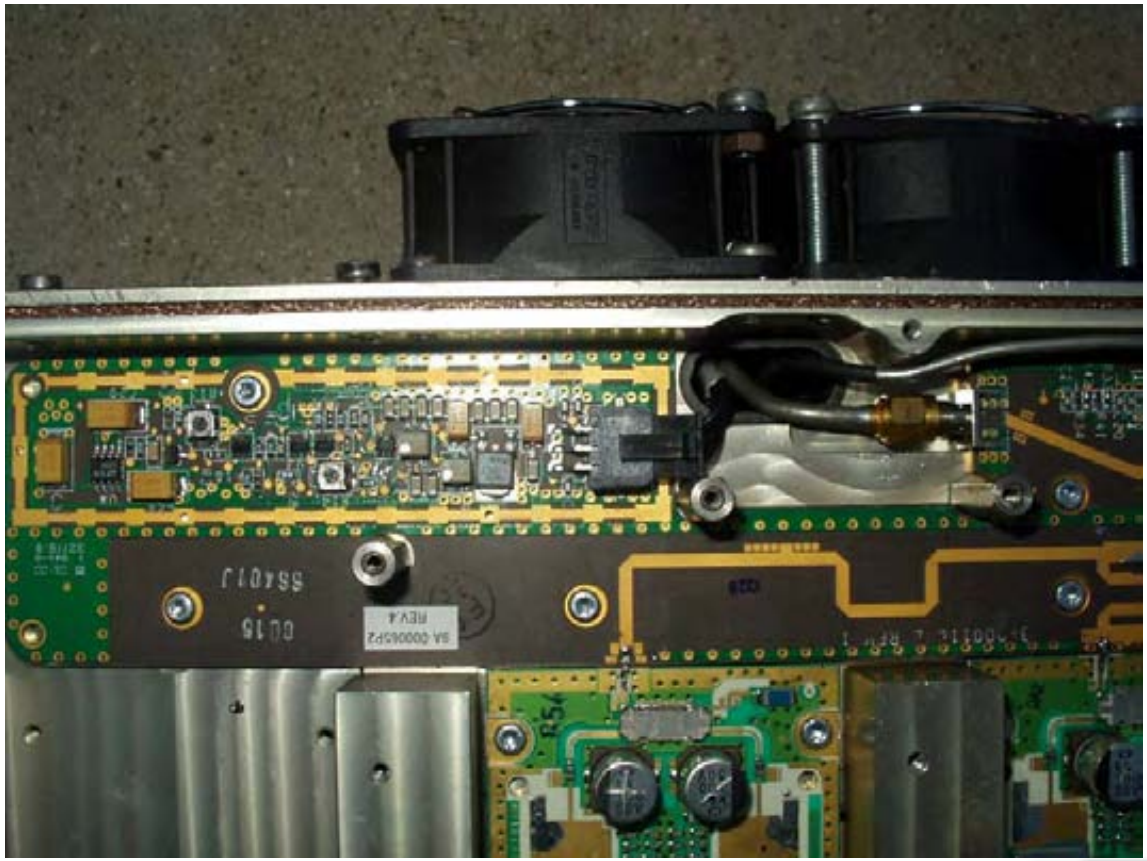
Power Detector Connector (Output combiner PCB)



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Power output connector
Other end of cable on Micro Board

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Remote Spectrian monitoring (Temperature)

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Each of the 4 PA modules has a temperature monitor output (10mV/ degree F)

All 4 temperature voltages appear on J4 of the power distribution board

I chose to just monitor just the temperature of the centre final amp module

Module	Module Pin	J4 Pin
Driver	9	20
Amp 1	1	22
Amp 2	1	29
Amp 3	1	32

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Temperature monitoring
All temps appear on this connector

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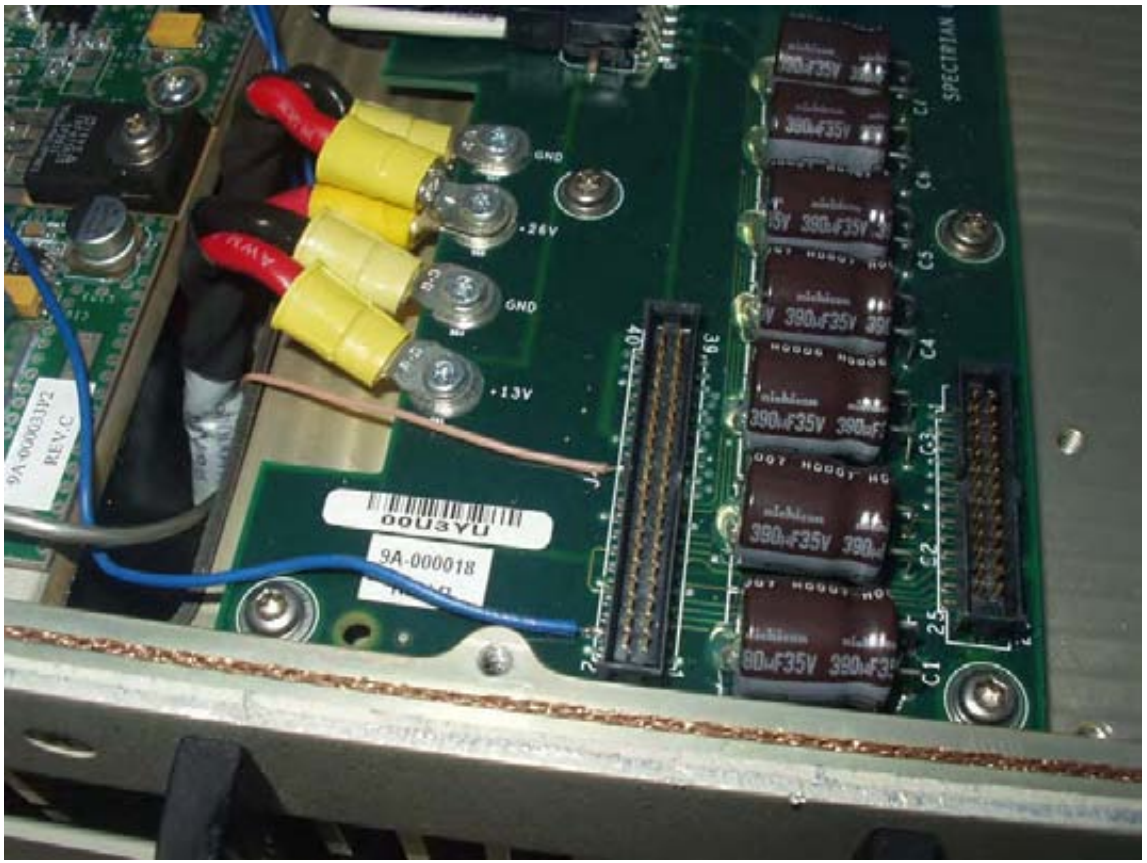

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Remote Spectrian monitoring (Current)

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Uses Allegro current monitor chip as Paul Wades “Lossless current monitor”

I modified circuit to have non floating output and provide 0-5V output for 0-75A

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Remote Spectrian monitoring

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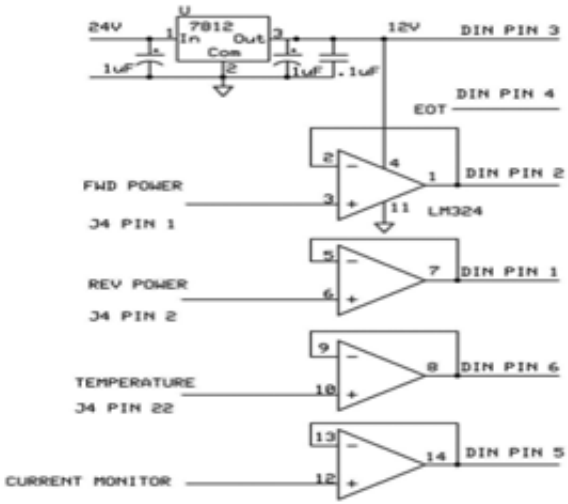
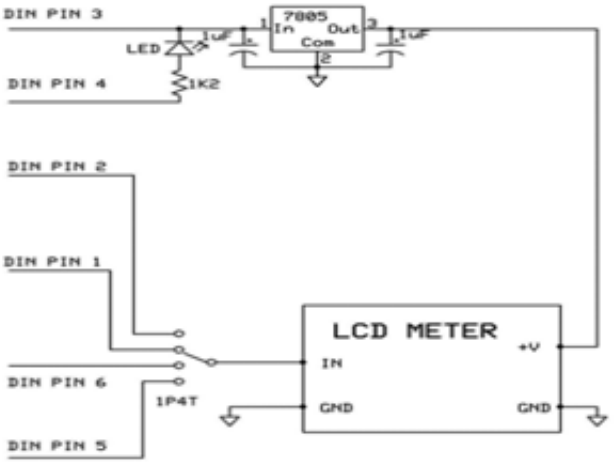
AMP



DISPLAY



SPECTRIAN MONITOR		
David Robinson	Rev 1.1 23/8/2007	W5ZR

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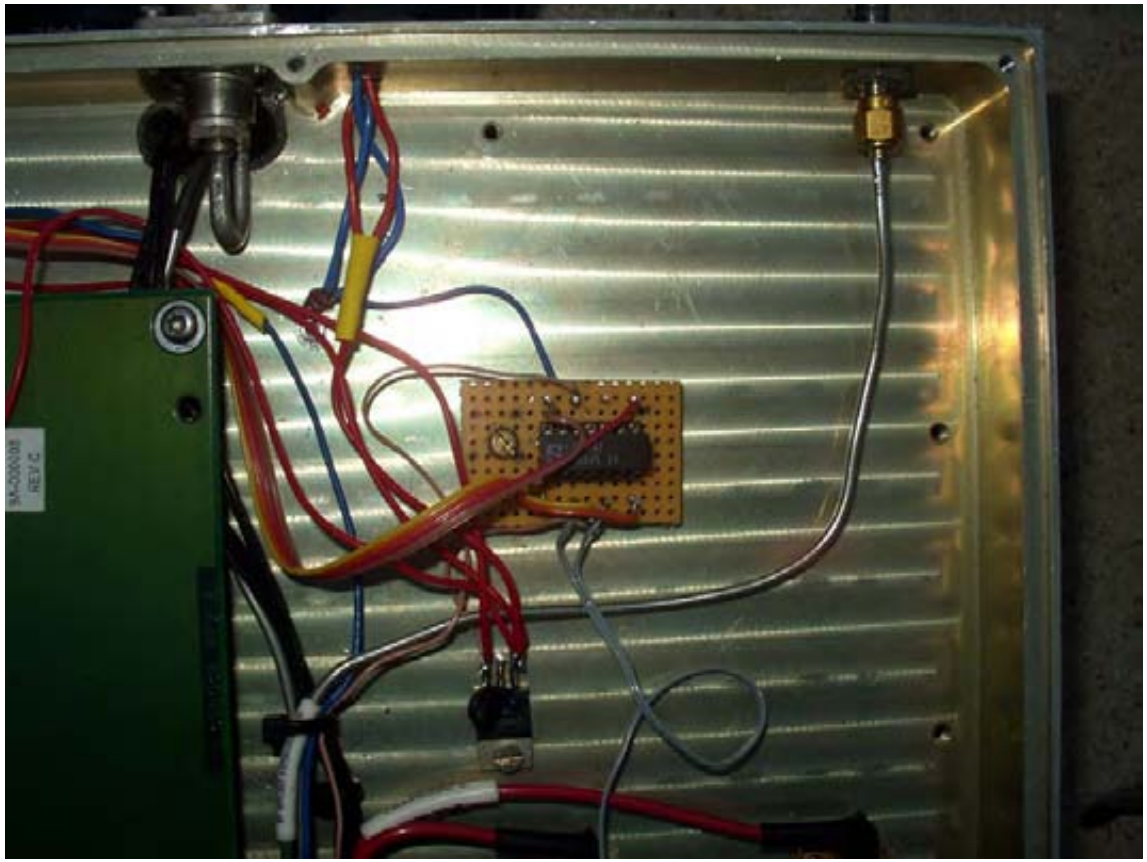
Remote Spectrian monitoring Interface to outside world



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SDRIQ

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- 0.5kHz – 30MHz
- AM, WFM, USB, LSB, N-FM, DSB, CW demod
- Can record up to 190kHz of spectrum

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SDRIQ 1296MHz Interface

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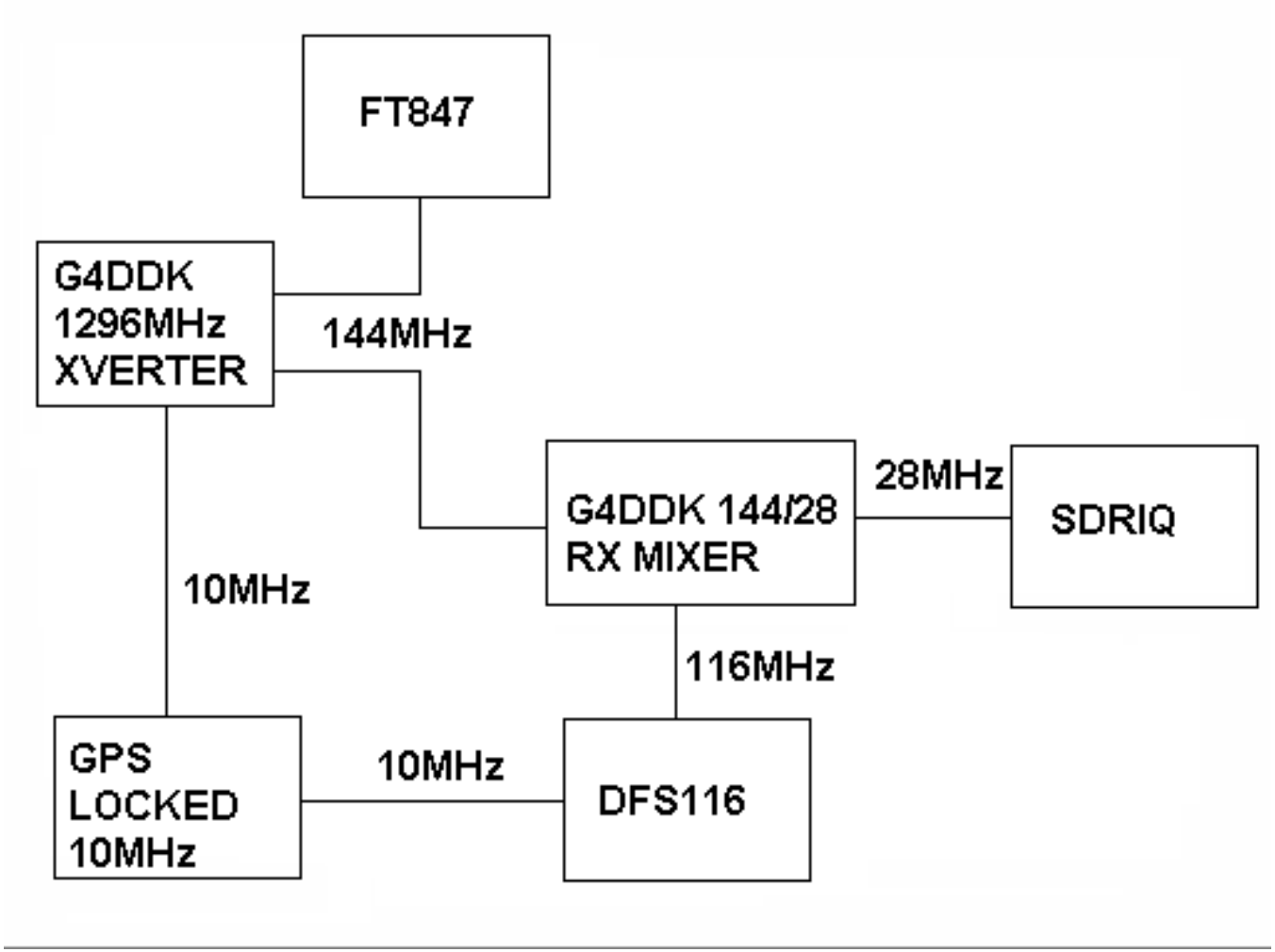

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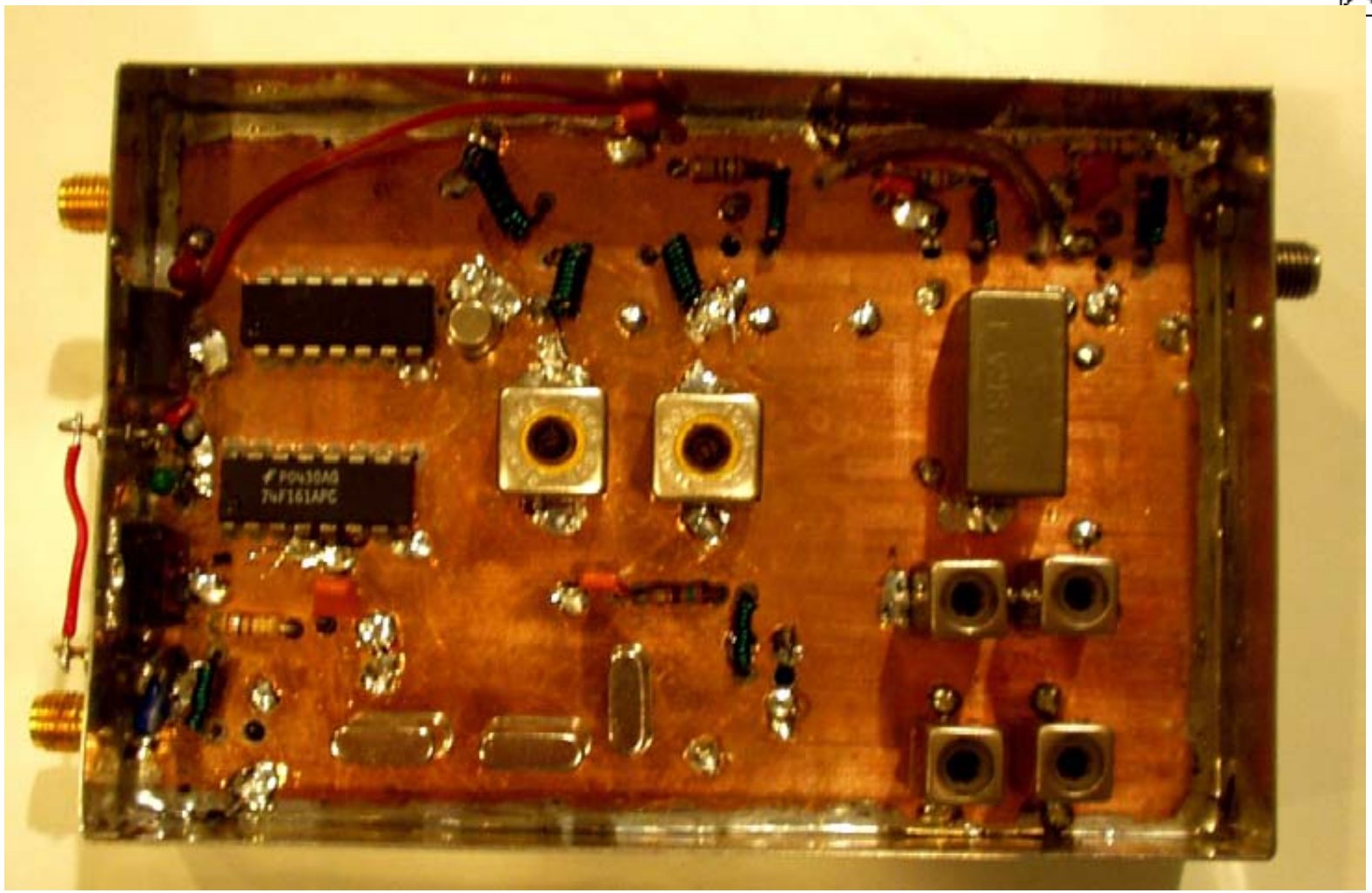
DFS116



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Dubus contest 1296MHz

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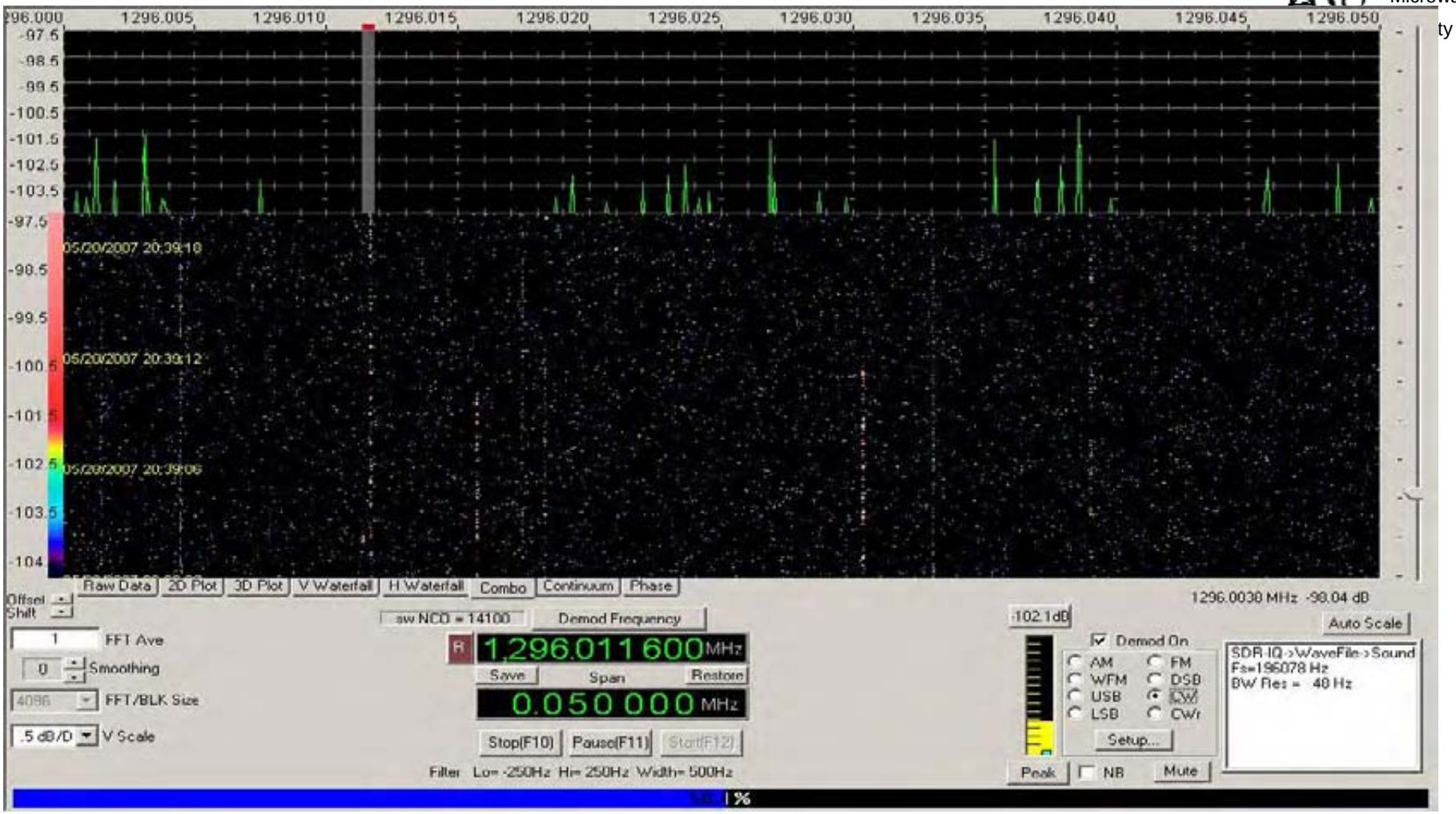

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29 Aug 0440z

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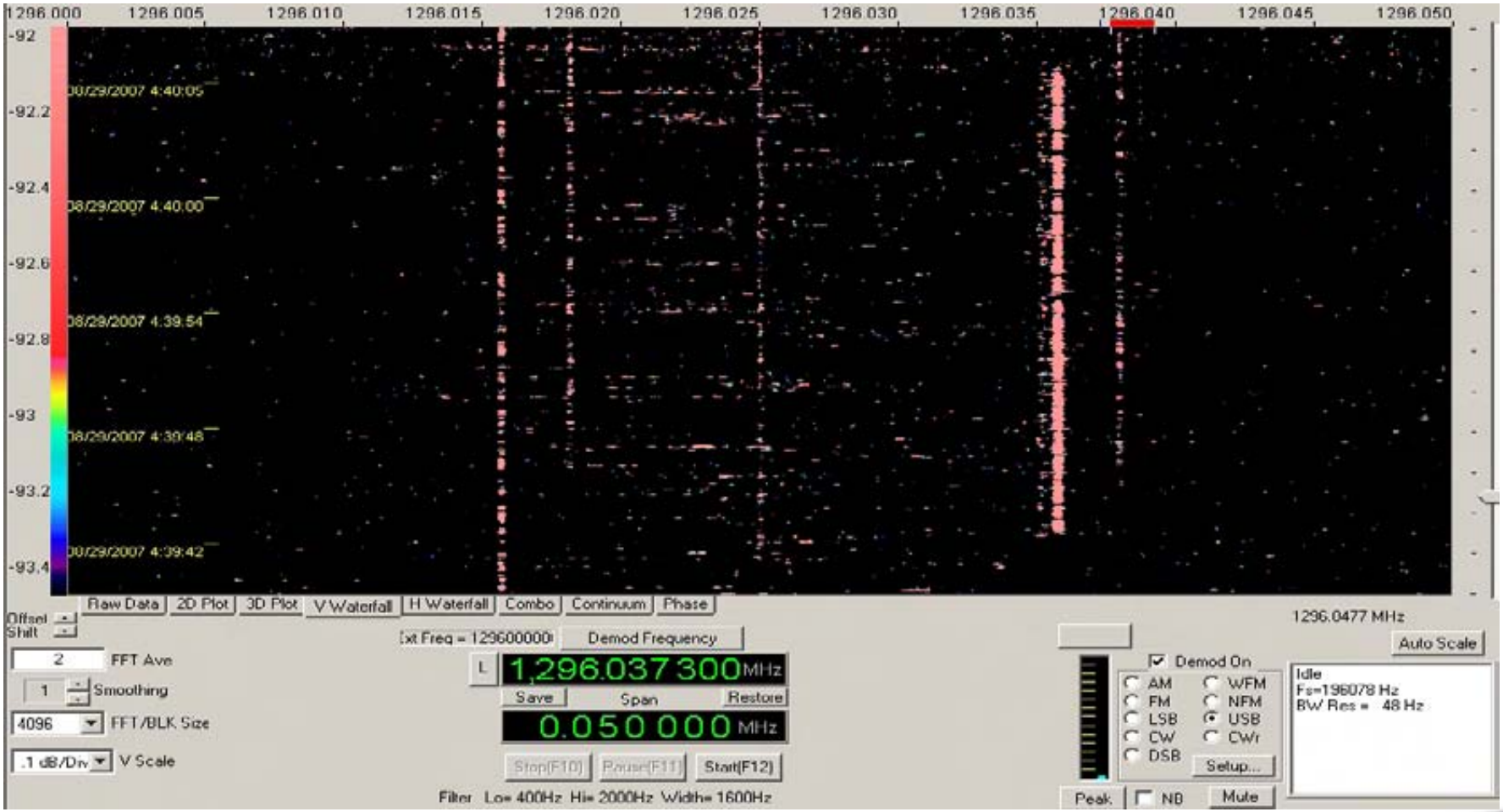
K5SO F2TU W5LUA W5LUA ECHO



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SDRTX

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9cm

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- Activity weekend announced Jun 16.

The Plan:-

- Scaled 1296MHz VE4MA feed to 3456MHz using 2.5” copper tube
- Activity on 3400 and 3456MHz: Too much separation for one IF
- Use DB6NT tropo xverter, will retune it to change bands if needed
- Built 3400MHz receive converter for Xband
- DEMI preamp 0.65dB/16dB
- Mount 50W Toshiba Amp at feedpoint
- Amp powered with two Vicor 48/12V 150W converters mounted at feedpoint

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1st weekend(1)

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3400/144 Rx converter

DB6NT 3456/144 Xverter

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3456MHz Feed

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Scaled VE4MA 1296MHz feed

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1st weekend(2)

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Right: Toshiba Amp Lower: 48/12V DC/DC Center: DEMI Preamp 0.65dB NF

Heard G4NNS and W5LUA but they couldn't hear me

Most activity on 3400MHz!

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1st weekend(3)

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Removed equipment from feedpoint overnight

Next morning after putting PA on feed big lightning strike 10’ from dish

PA not producing output. Inside showed charred components and wiring

Luckily Xverter (still on shack floor) not damaged

Had sked with VE4MA. Found RW89 TWT which gives 15W. Put it in Kennel

Nothing heard either way on sked

Decided not to put any amps at feedpoint in future, accept feeder loss!

Must be a feed problem so reviewed return loss: couldn’t measure circularity

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Rig for VE4MA sked after lightning hit!

RW89 TWT 15W o/p (note bpf on output of DB6NT xverter, spurious <-30dbC)

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9cm

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- As the first weekend was enjoyed by so many a 2nd weekend was arranged for July 8.
- Converted 3400/144MHz Rx converter to 3400/144 Transverter by adding sma relay, IF pin switch and ERA3, 50mW output
- Toshiba amp fed by 12.6V mains PSU mounted in kennel on ground

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3400/144 Xverter

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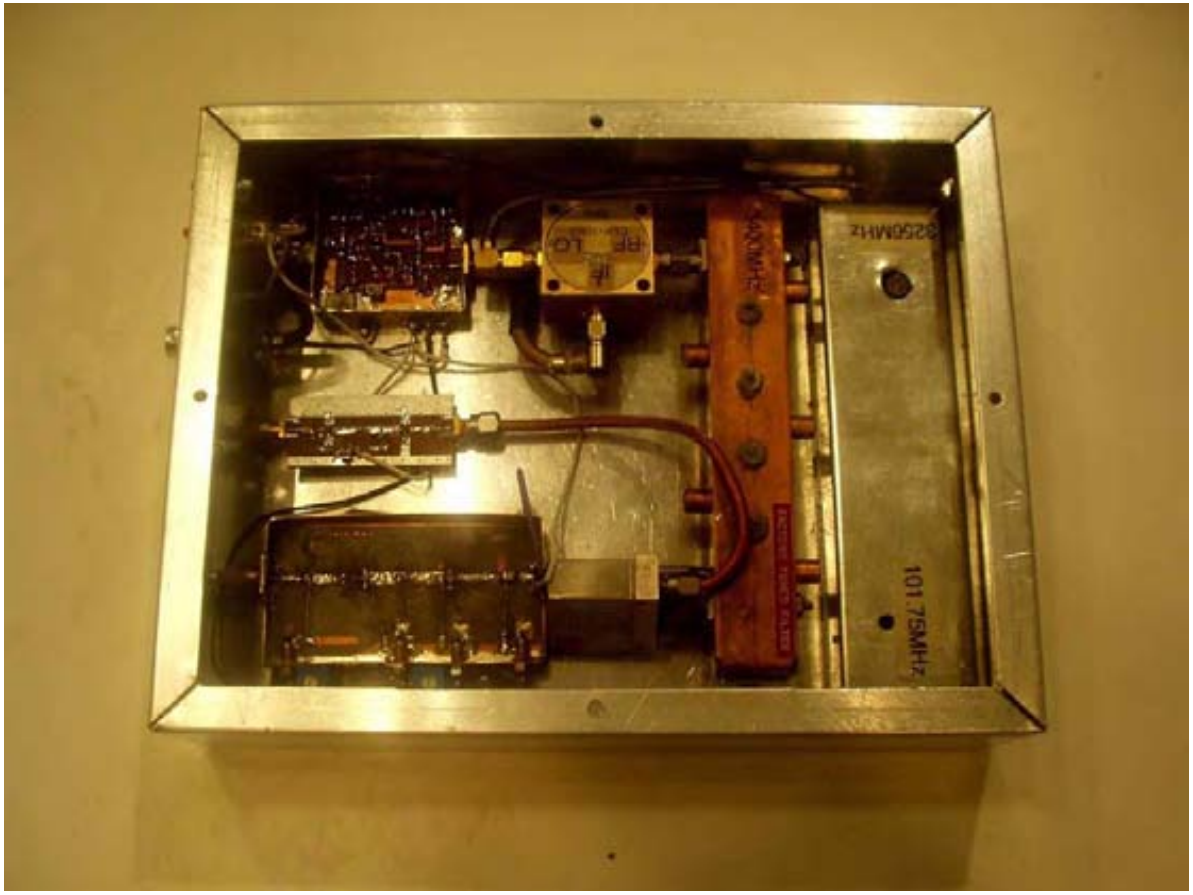

DDK009 L.O. Triple balanced mixer. Collins surplus filter. G4DDK IF pin switch. Old W5LUA ATF10136 preamp (0.6dB NF!) ERA 3 TX Amp. 12V SMA relay splits rx and tx paths

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2nd weekend(1)

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Top: Toshiba Amp

Middle: 3400MHz/144 Xverter. 3456/144MHz xverter

Bottom: 12.6V 20A PSU

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2nd weekend(2)

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Worked G3LTF on sked: not as loud as 1st weekend

Heard VK3NX, W5LUA and VE4MA on skeds, but they couldn't hear me

Could see G4NNS on Spectrian and he could see me but not loud enough for QSO. Condx not as good as 1st weekend

Just when I though would only make 1 QSO worked LX1DB, just before his moon set

Took feed to W5LUA to measure; circularity acceptable

Looking forward to next activity period!

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Triplets!

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Left to right 1296MHz 2304MHz 3456MHz

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432MHz

- Return after 8 years. 4xFO25 refurbished

BEFORE: 10 BANDS

AFTER: 1 BAND

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Next Dish Projects

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- 902MHz: EIA feed built, 250W output
- Hydrogen line observations @1420MHz

Acknowledgements

North Texas NTMS Microwave Society

- To G4DDK, K5GW, W5LUA, PA3CSG for advice and assistance
- To K1RQG for getting my VK3UM tracker board going after 15 years!
- To Meg for encouraging me to decorate the backyard with the oversize garden ornament
- Finally to N5PYK for moving and donating the dish

More information

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- DFS9096: http://g4fre.com/dfs9096.pdf
- 1296MHz: http://g4fre.com/1296eme.htm
- 13cm: http://g4fre.com/13cm_eme.htm
- 9cm: http://g4fre.com/3456eme.htm
- 2nd Rx: http://g4fre.com/DB6NT2ndrx.htm
- Spectrian monitoring: http://g4fre.com/Spectrian.htm
- SDRTX: http://www.scrbg.org/g4jnt/SDRTxSW.htm