

SSPA Construction Techniques

- 6m, 2m, 222MHz, 70cm
- 23cm and above
- 1.8 – 54MHz

digressed a bit at mentioning 1.8-54, didn't I?

But Wait...

- Let's examine how to build that SSPA
- And operate our radio and SSPA in a manner that complements our esteemed position in the food chain
- And then maybe we should look at modern SDR radios/amplifiers/accessories that will expand our enjoyment of the hobby

WWW.W6PQL.COM

- Retired from HP/Agilent mid-2006
- Web site started as a technical sharing site
 - Most projects initially were for my own use
 - Snowball effect to where it is now
 - Primary target audience is DIY amateur

Some Examples of Color Schemes and Options



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Rack Mount Option

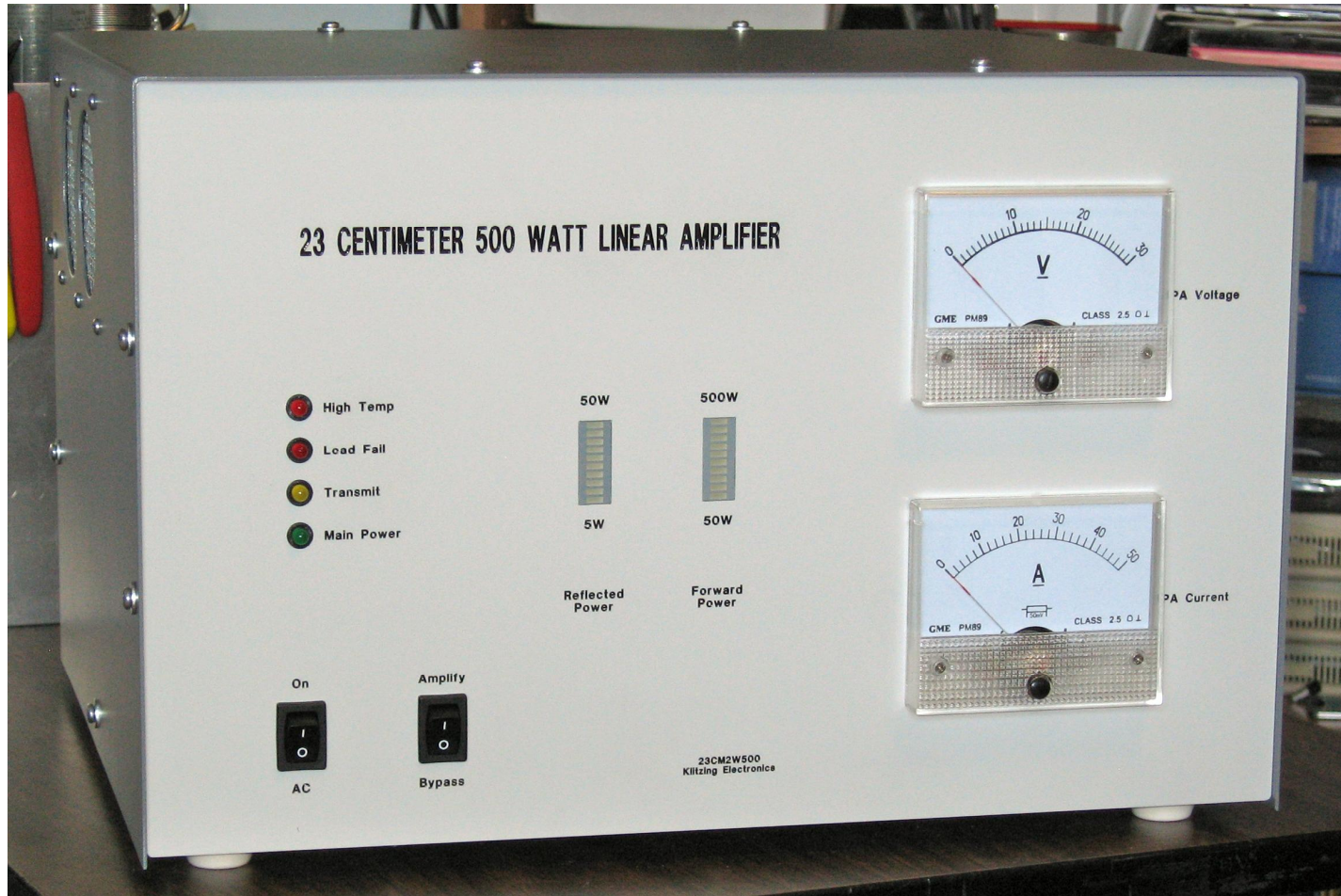


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Desktop Amp for 1296



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150w version for 1296

with internal power supply



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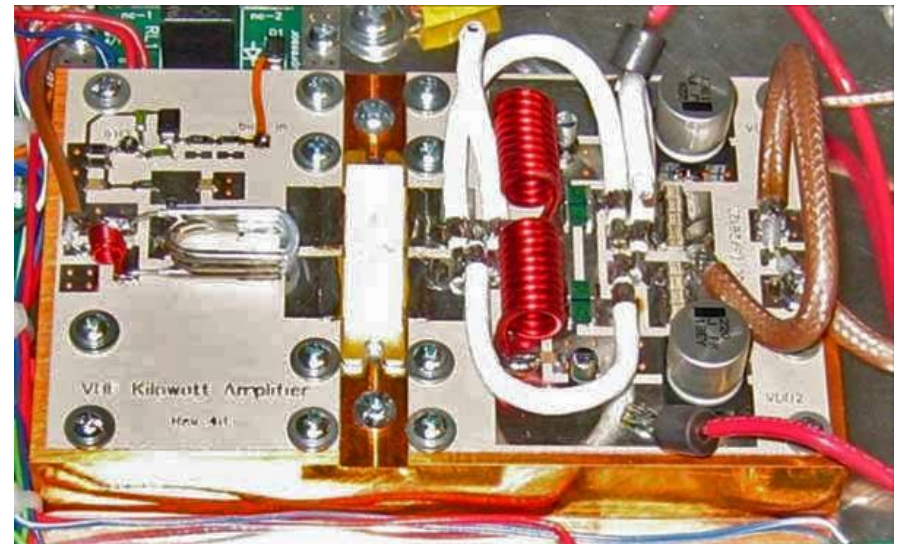
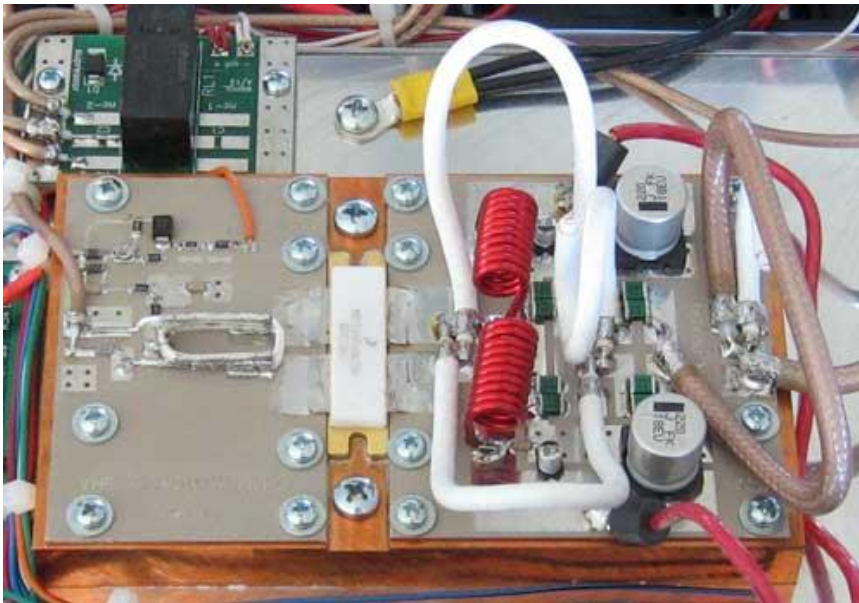
BIG LDMOS devices are available

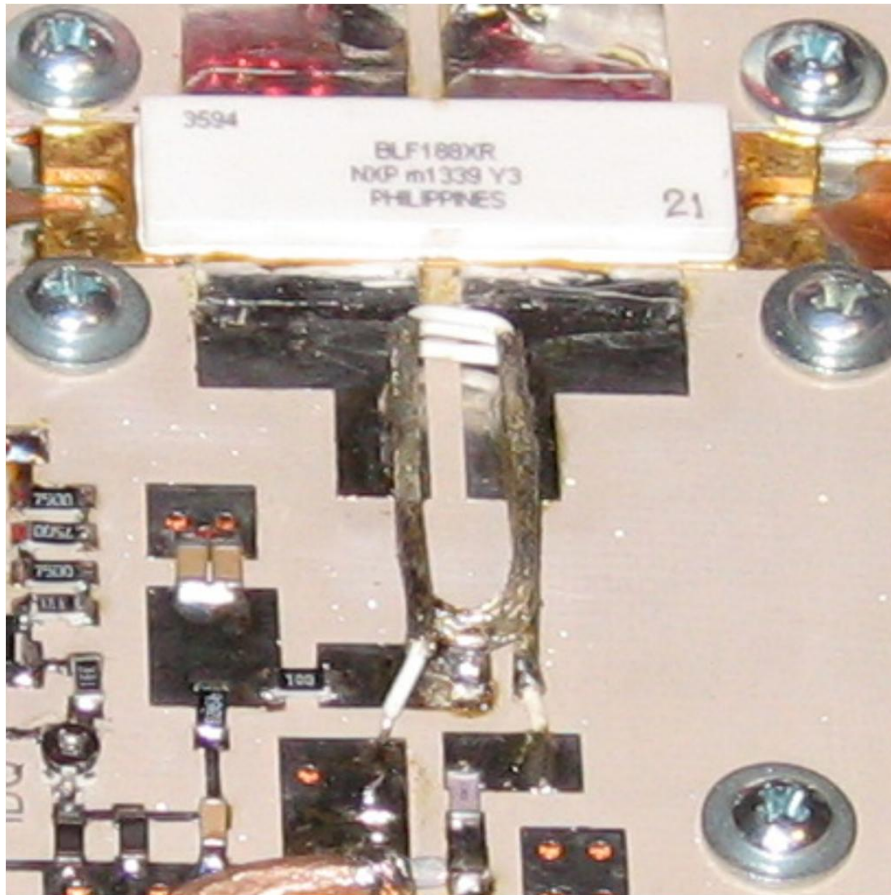
At “reasonable” cost

– Freescale and NXP (Phillips)

- MRFE6VP1K25H - 1.25kw (Freescale) HF to ~300MHz**
- MRFE6VP5600H – 600w (Freescale) HF to 450 MHz**
- MRF1K50 – 1.5KW**
- BLF188XR -1.4KW (NXP) HF to ~300MHz**
- BLF184XR – 600w (NXP) HF to 450MHz**

VHF RF Decks



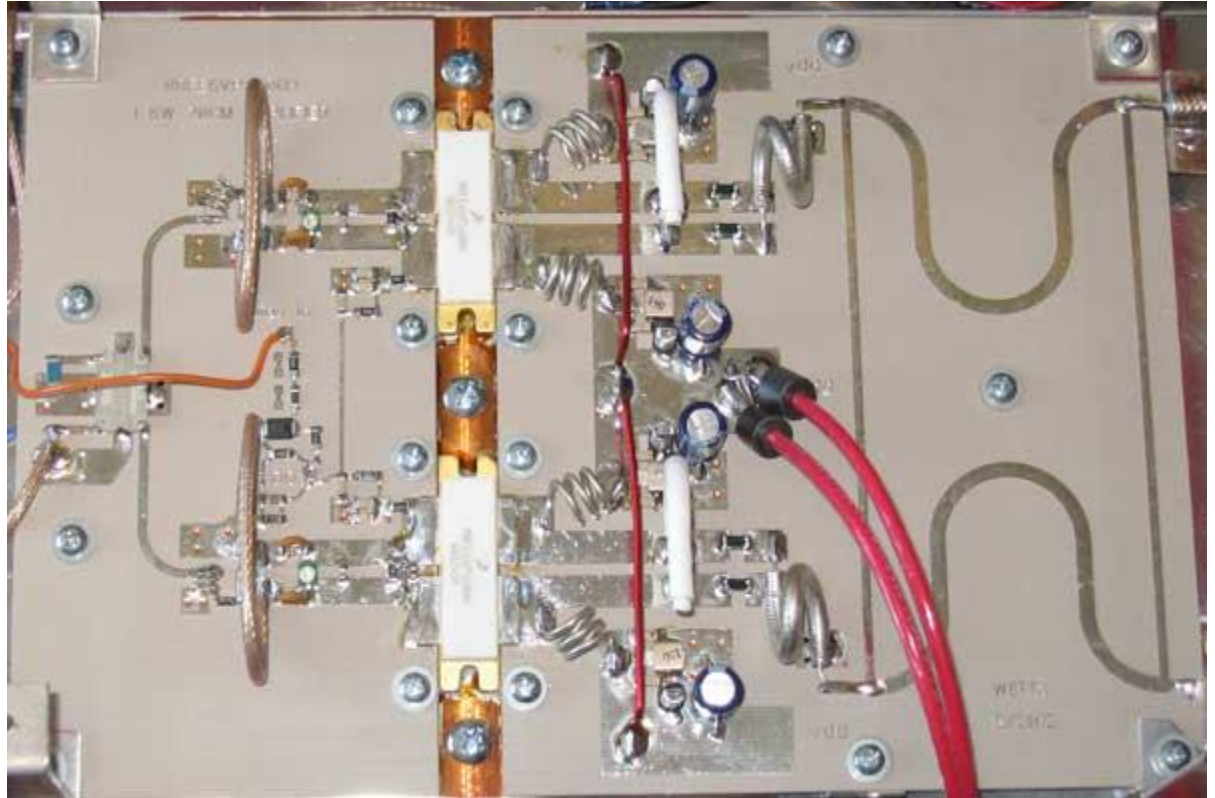


We must kill all of that extra low frequency gain. This design used for 2m and 222 has an ally in that battle, the input transformer. It's nature at lower frequencies is to short the gates together

70 CM is a different animal

70cm

- 1.25kw part produces ~350w with low efficiency
 - 600w part produces 500w at P1db with 53% efficiency
 - Two of the 600w parts produce 1kw at P1db with 53% efficiency



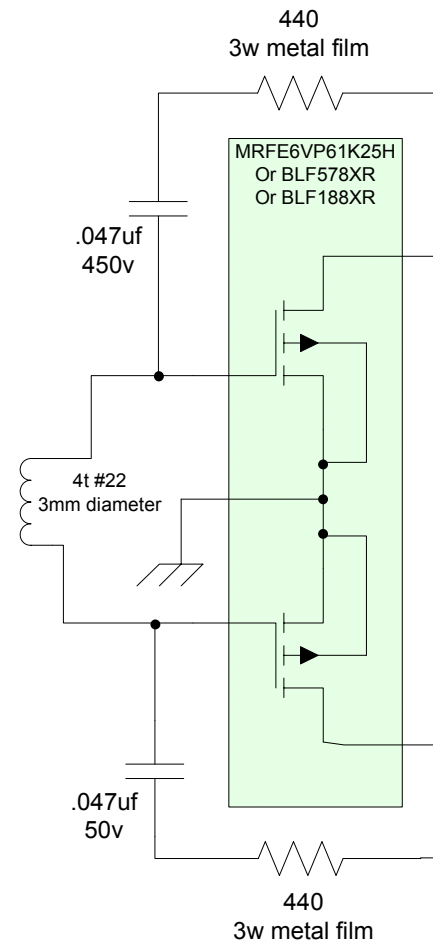
Design Cautions

1. All bands

- Use good quality PC board substrate
- Matching components (capacitors)
 - Best capacitor for matching is coaxial
- Instability due to low frequency gain
 - Gate components
 - Degenerative feedback (res/cap in series drain to gate)

2. Bias stability (thermal drift)

- LDMOS IDQ thermal drift
 - Use of thermistors for stabilization



Mounting of Degenerative Feedback Components on 70cm KW board

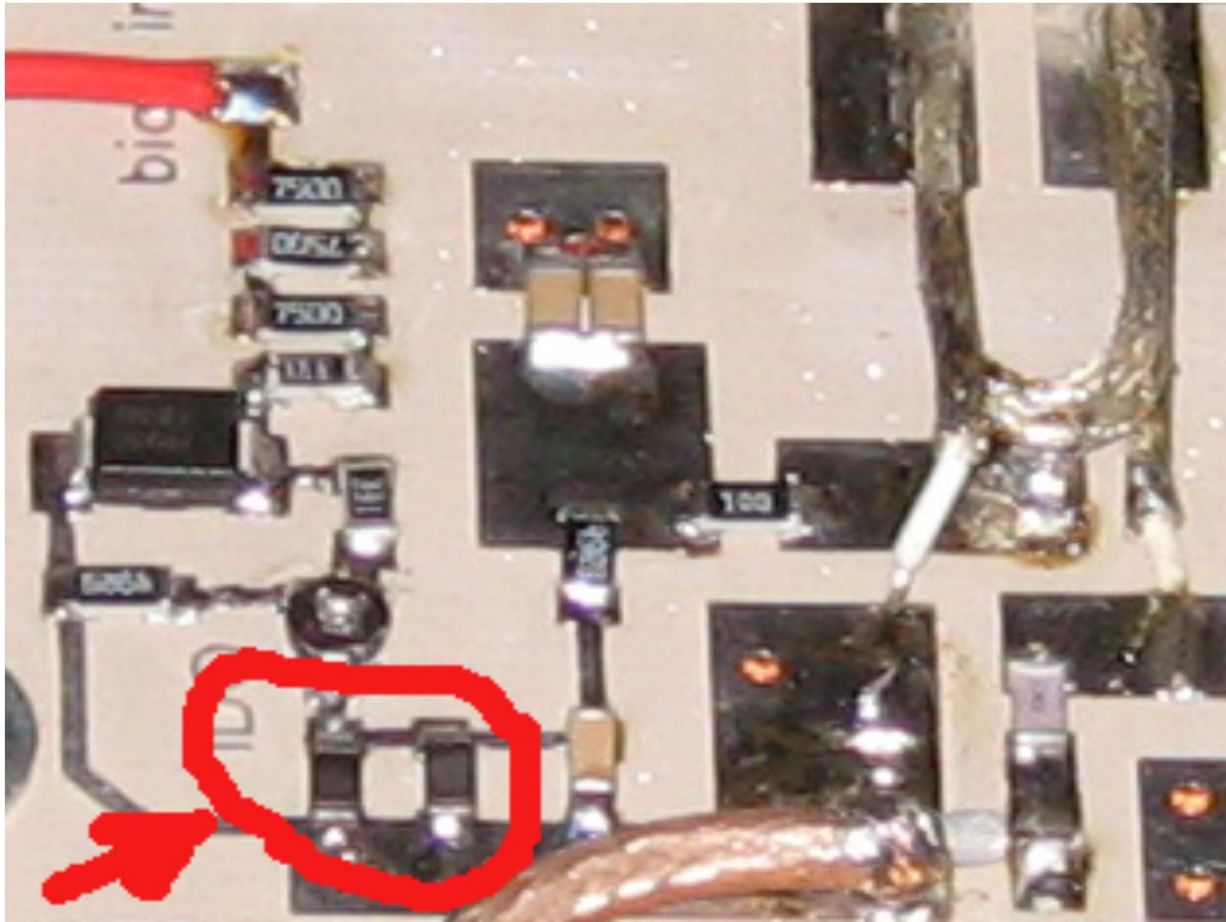


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Thermistor Location



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A Legal-Limit 6 Meter SSPA

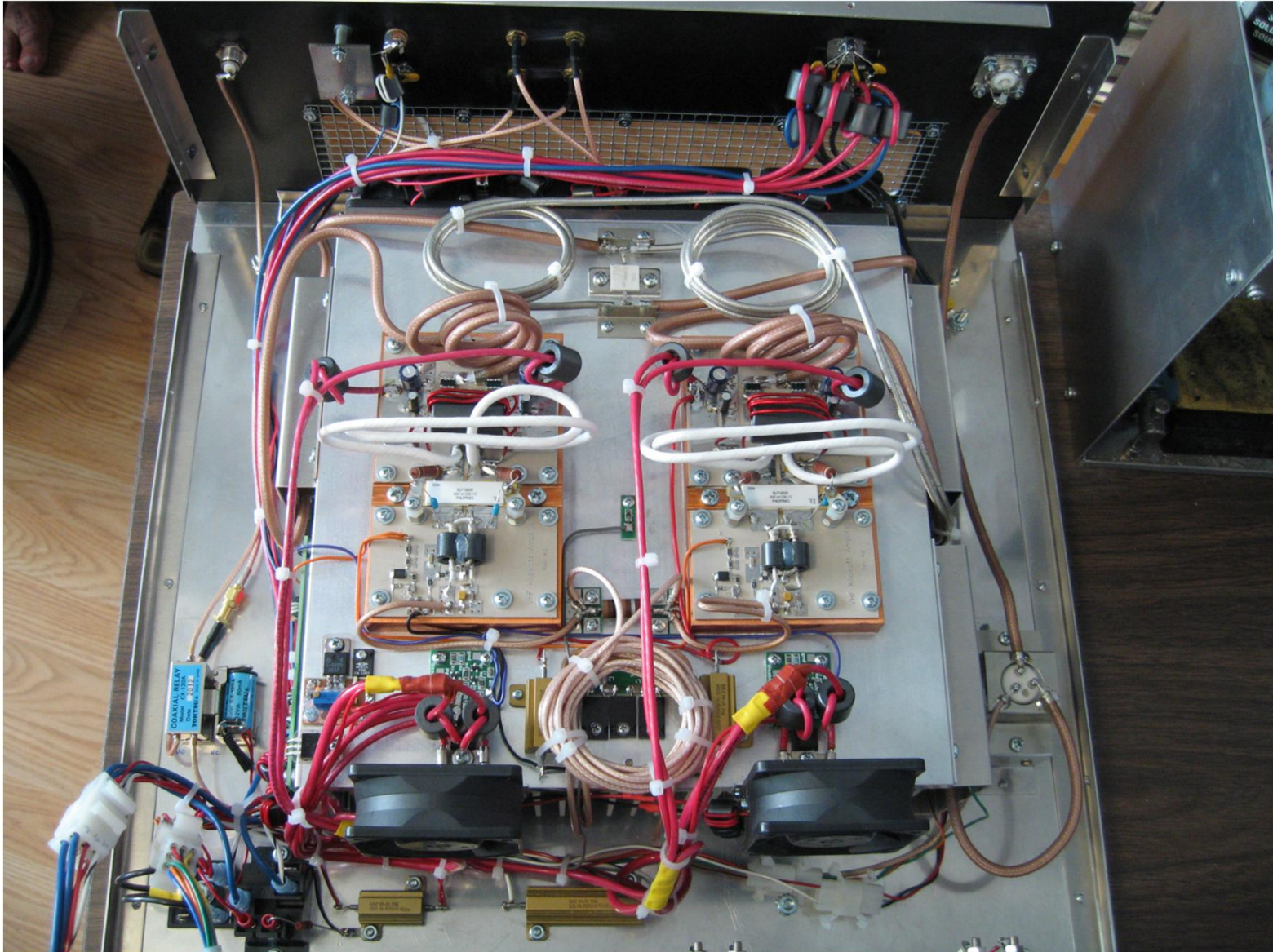


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And on the inside...



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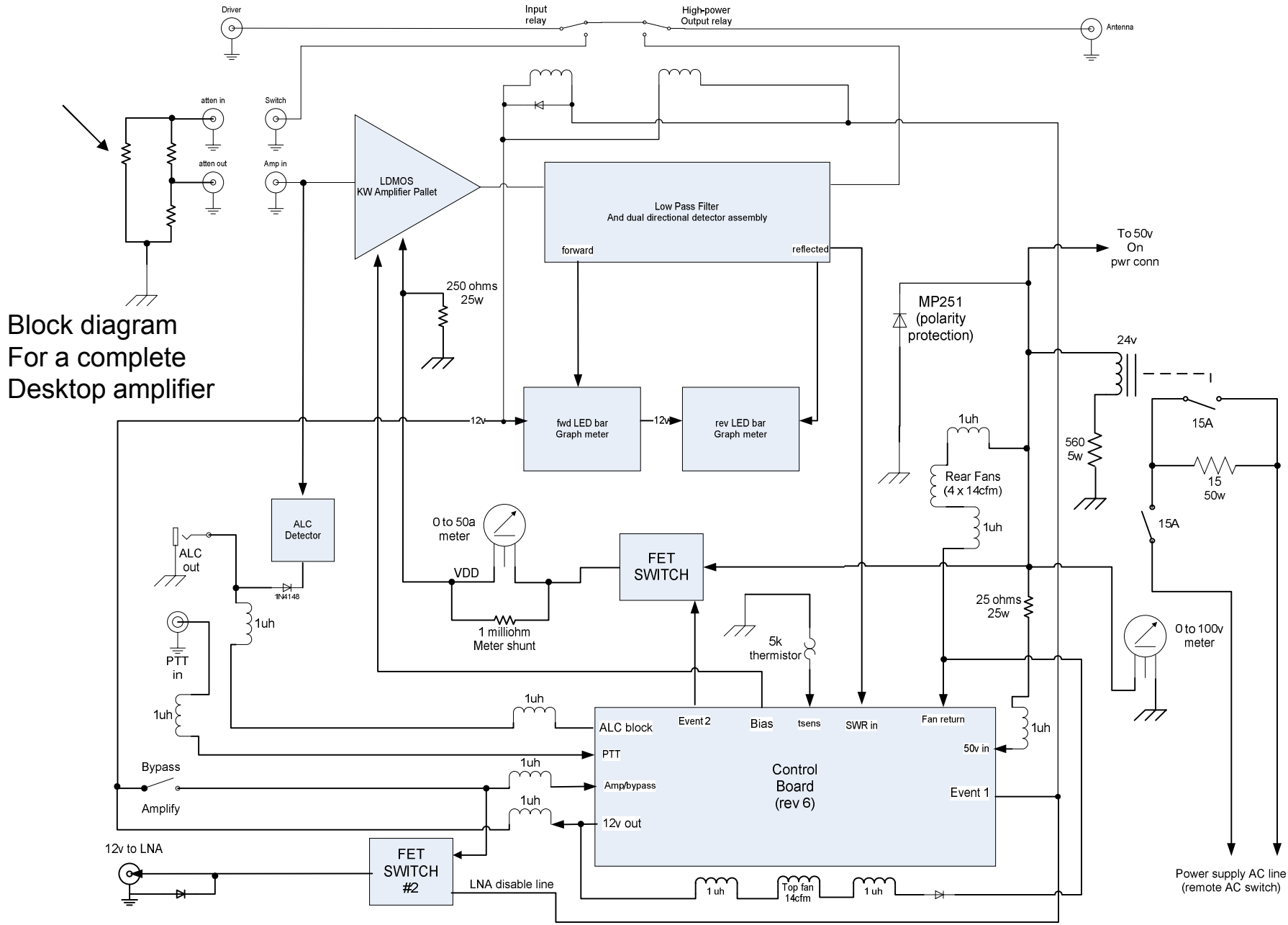
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Bills of Materials

http://www.w6pql.com/1_kw_sspa_for_1_8-54_mhz.htm

http://www.w6pql.com/1_kw_2m_ldmos_amplifier.htm

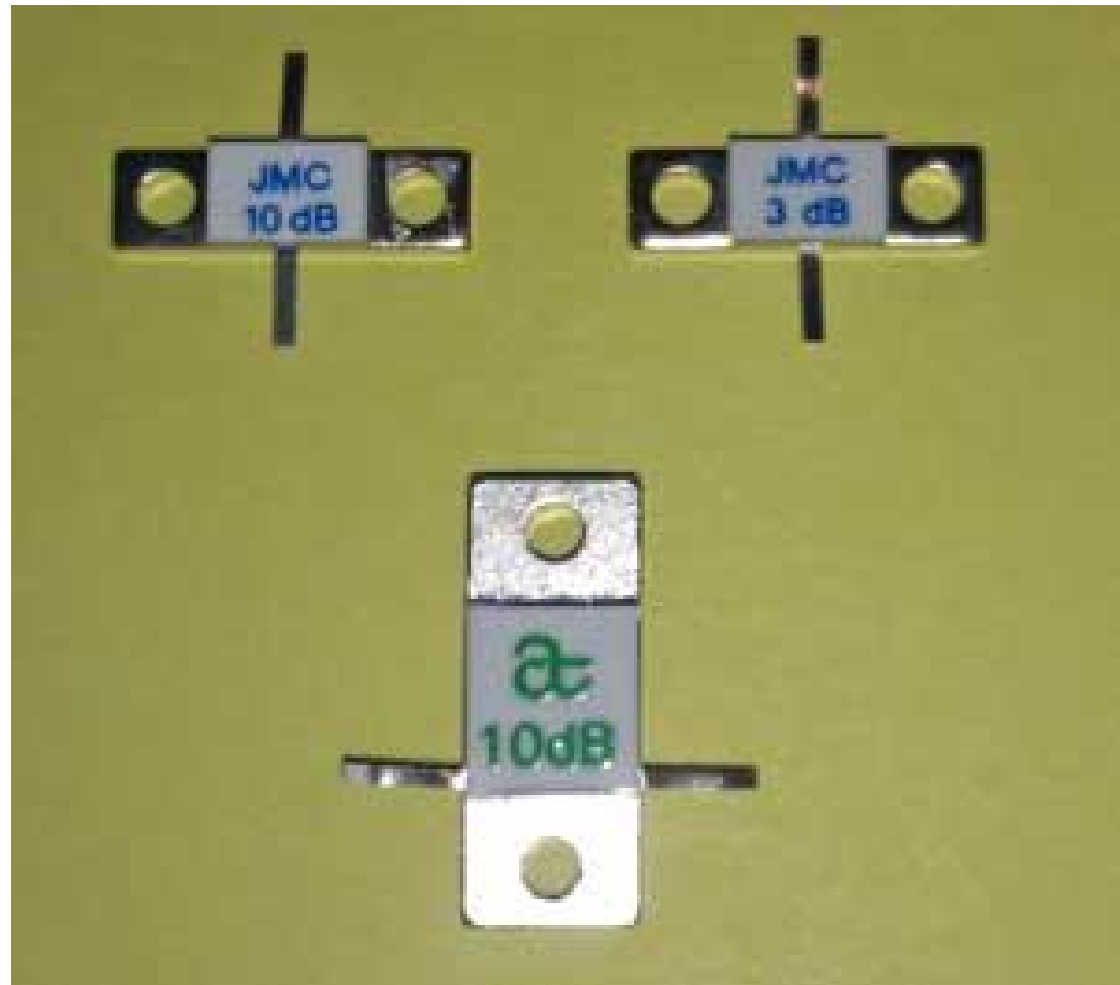
description	p/n	quantity	supplier
#10 THHN stranded wire, black		15ft	Ace hardware
#10 THHN stranded wire, red		15ft	Ace hardware
#14 THHN stranded wire, blue		5ft	Ace hardware
#14 THHN stranded wire, red		5ft	Ace hardware
#18 THHN stranded wire, red		5ft	Ace hardware
White rubber feet, 4 per pack		1 pack	Ace hardware
multi-conductor hook-up wire, 10ft	10cs22	10ft	Allelectronics
meter, panel, 100V DC	PMD-100V	1	Allelectronics
meter, panel, 50A DC	PMD-50A	1	Allelectronics
meter shunt, 50A	snt-50	1	Allelectronics
5mm led, red	LED-1	2	Allelectronics
5mm led, yellow	LED-3	1	Allelectronics
5mm led, green	LED-3	1	Allelectronics
60mm fan, 17cfm, 12v	CF-583	5	Allelectronics
sma jack for rg174/rg316	Ebay	4	Ebay
sma plug for rg174/rg316	Ebay	4	Ebay
rg142 coax, 5ft	Ebay	1	Ebay
rg316 coax, 6ft	Ebay	1	Ebay
flat washer, #4	90126a505	box of 100	McMaster-Carr
flat washer, #6	90126a509	box of 100	McMaster-Carr
flat washer, #8	90126a512	box of 100	McMaster-Carr



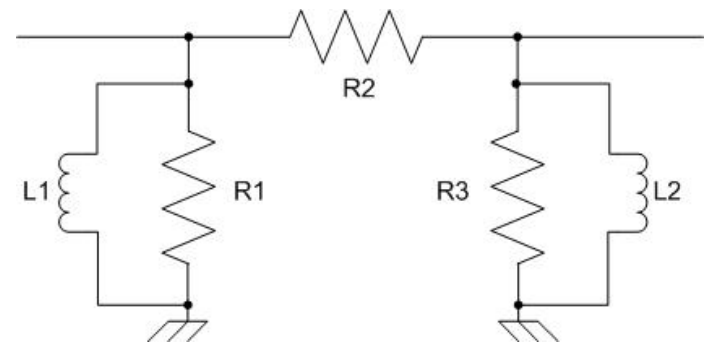
Block diagram
For a complete
Desktop amplifier

Flange-Mount Attenuators

- Available in 3,6,10,20 and 30 db packages (availability varies)
- Made by ATC and Johanson
- 100 watt package
- Requires transition boards



A more flexible option

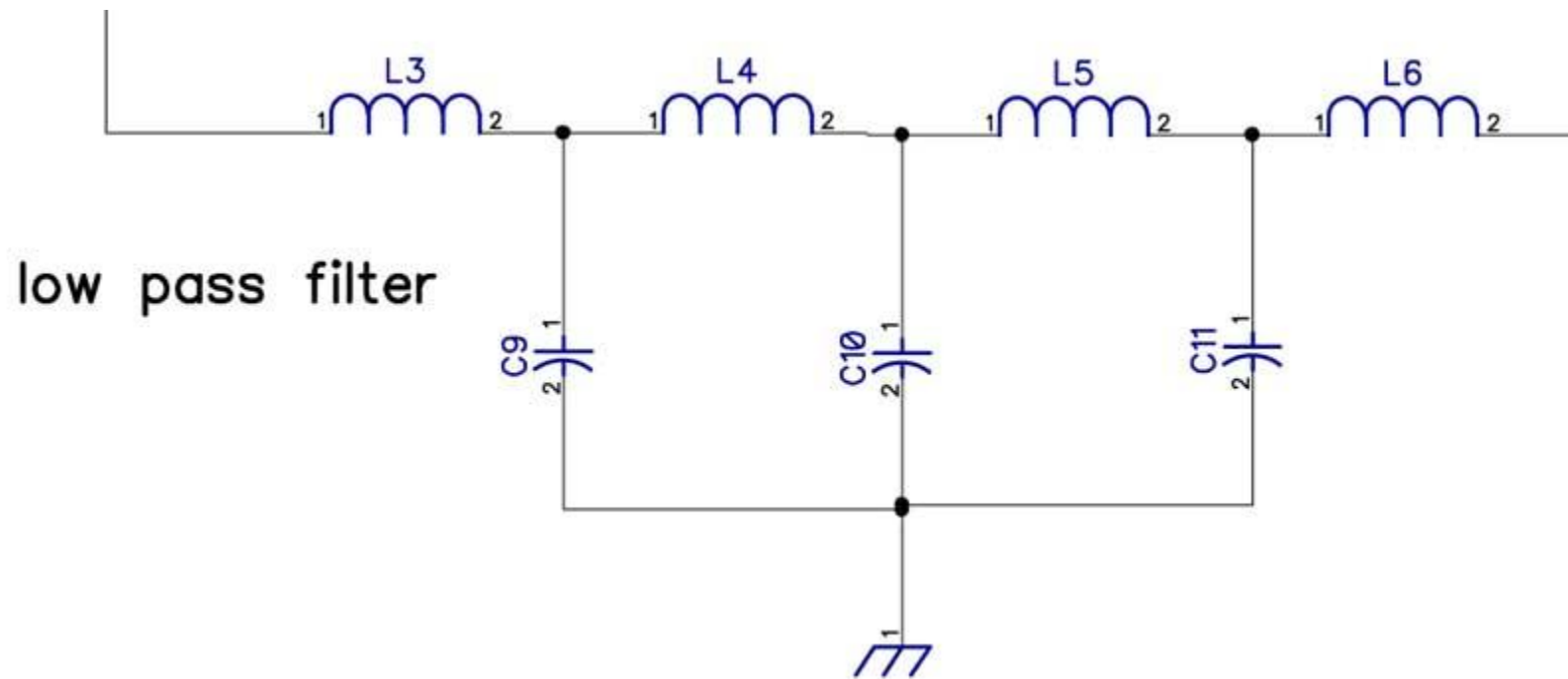


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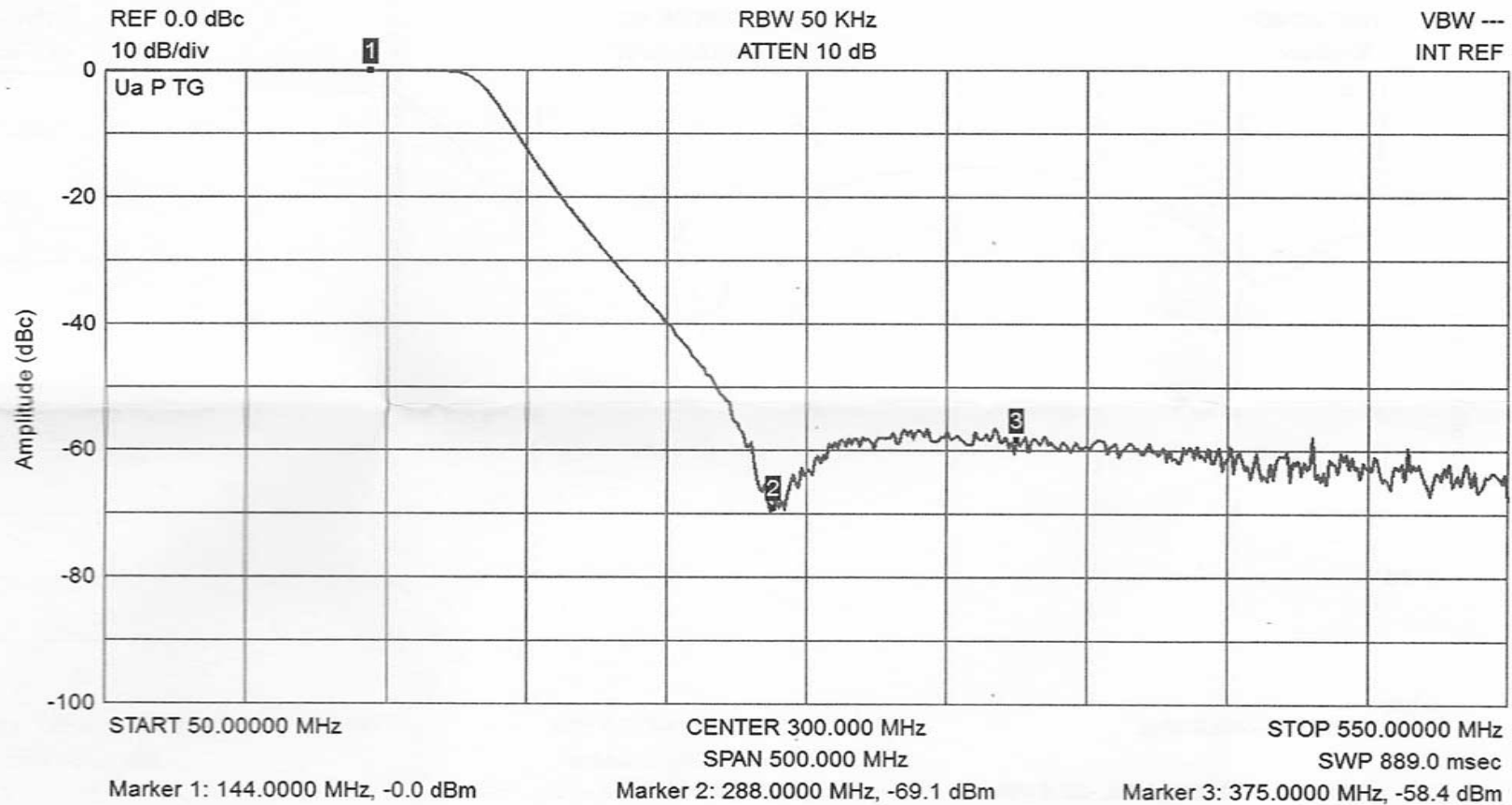
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Low Pass Filter



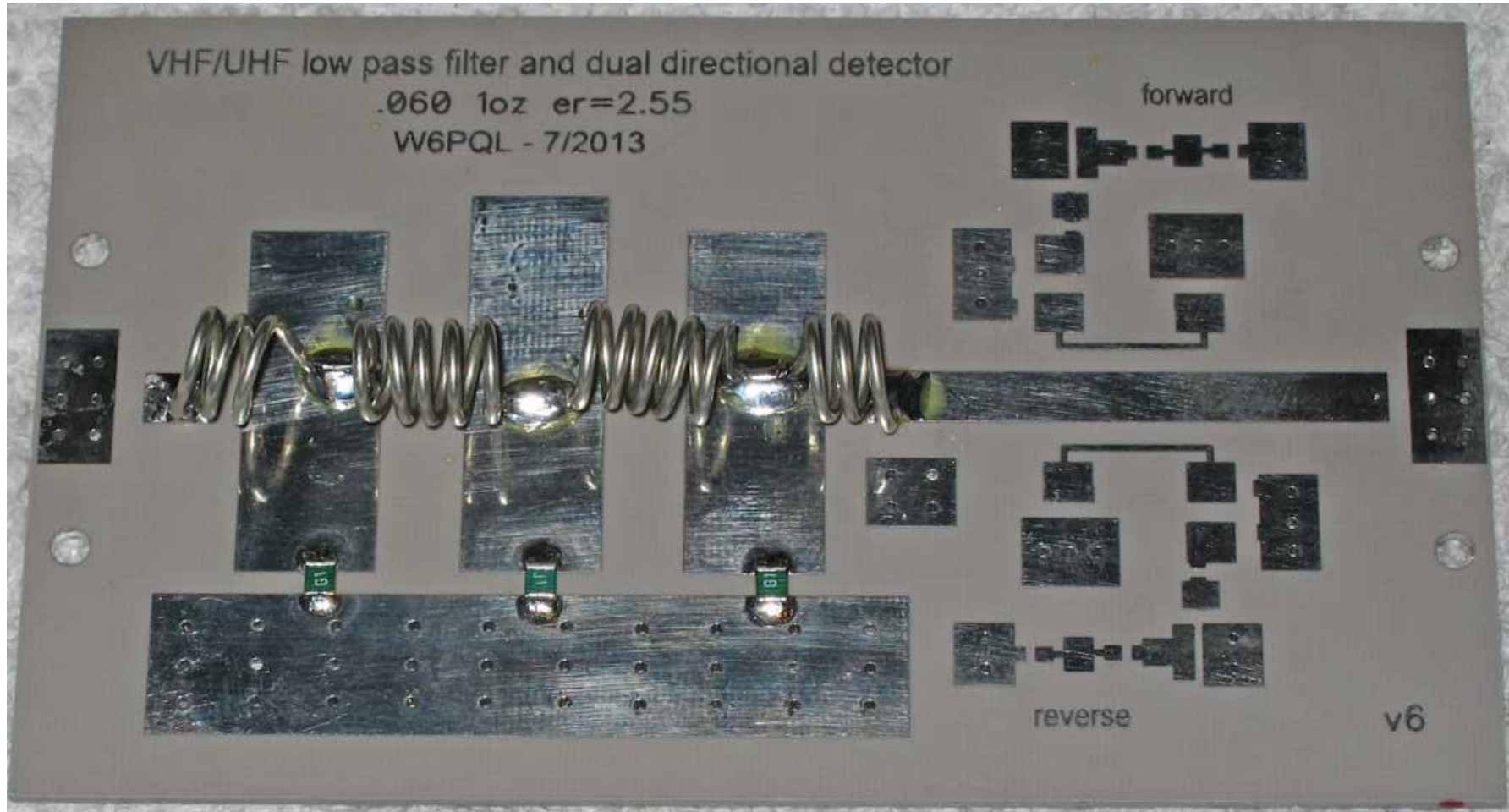
Filter Passband

2m setup



Low Pass Filter

with dual directional detector



Low Pass Filter

with dual directional detector



1. Coupler will sample both forward and reflected power levels
2. Each band can be configured for correct signal levels
 - On-board attenuators set the correct signal levels for the detector diodes

Antenna Relays (output)



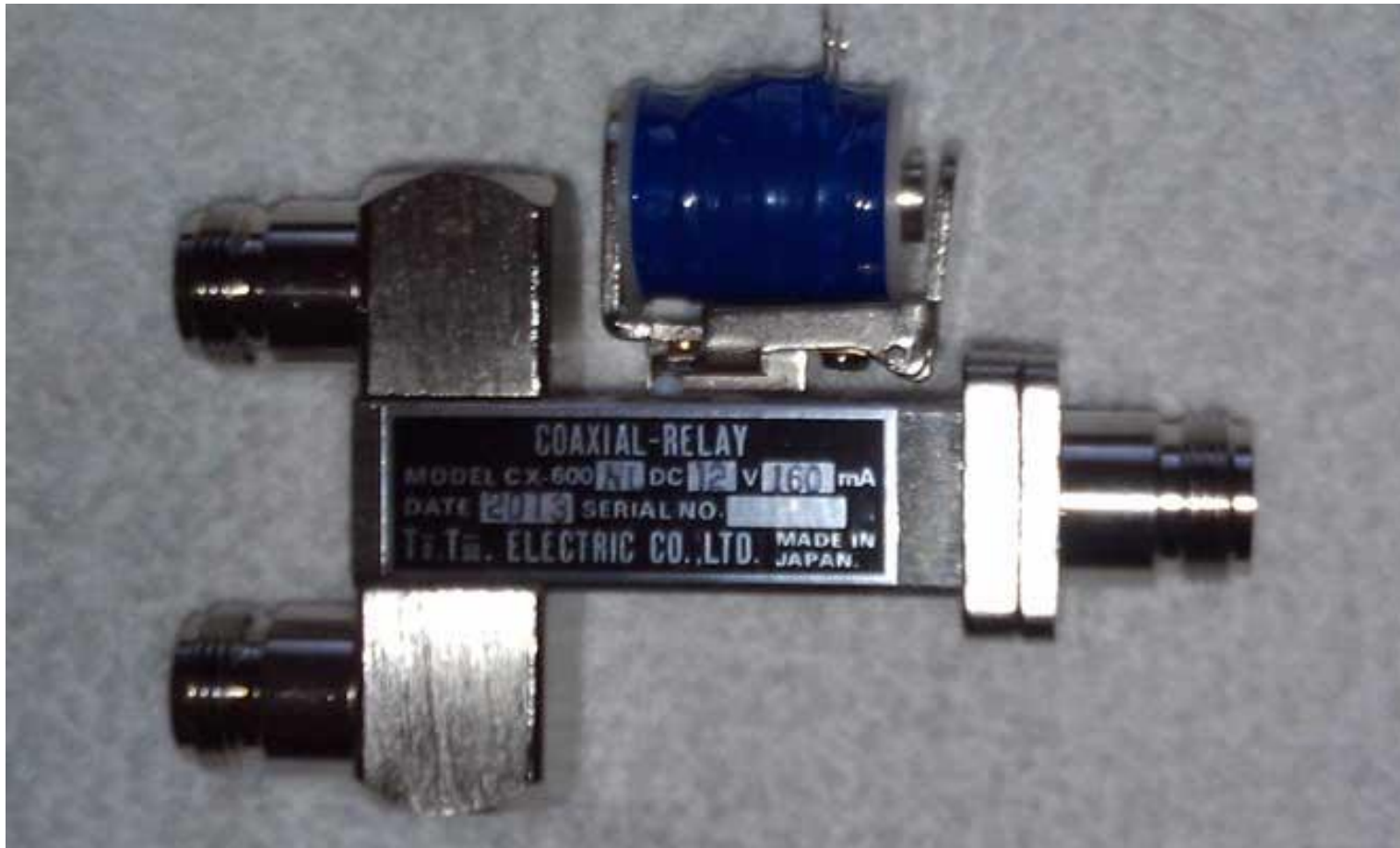
← Transfer switch
Dow Key model 412



↑ SPDT model 402

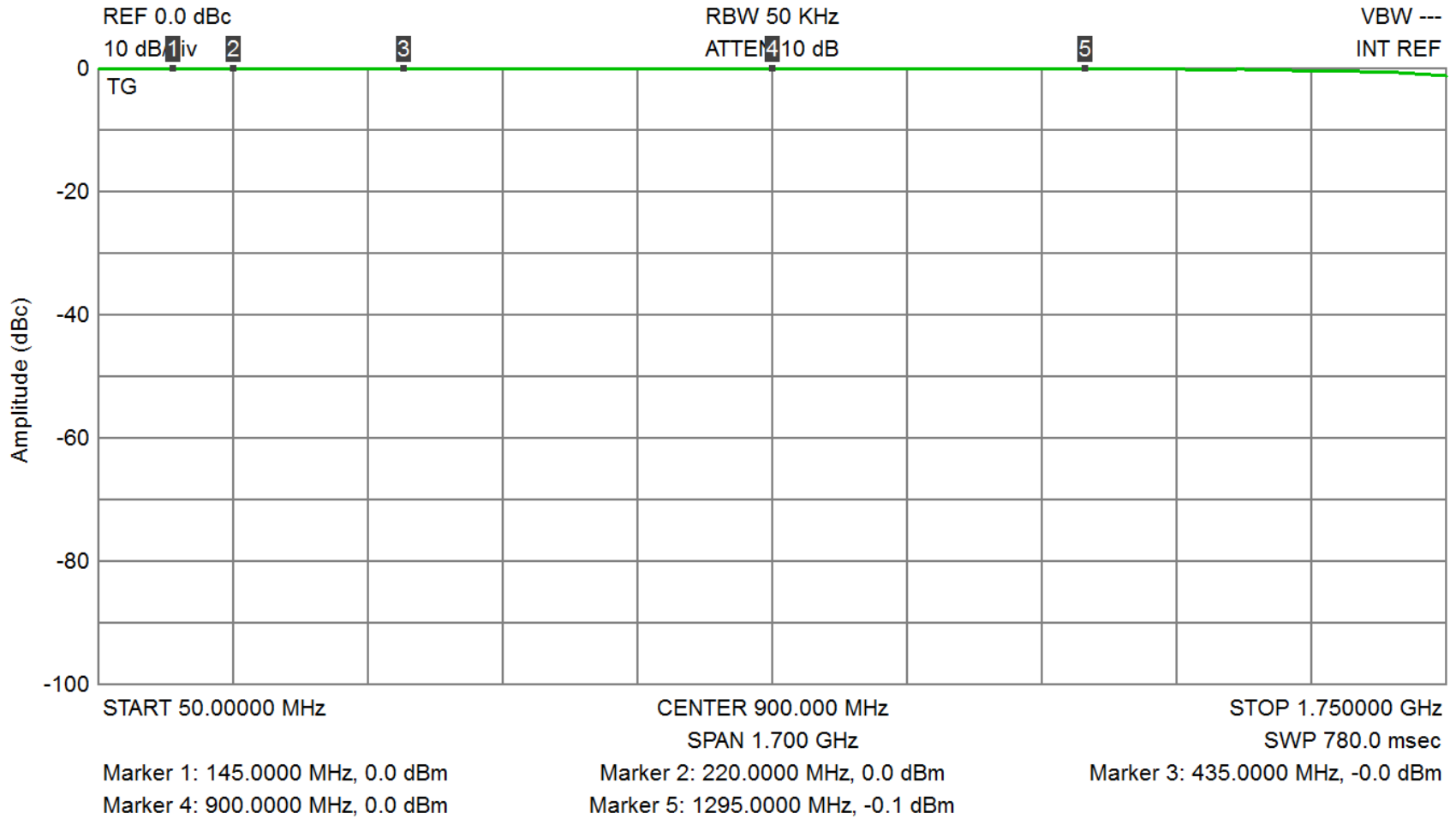
Antenna Relays (output)

SPDT – Tohtsu model CX600NL



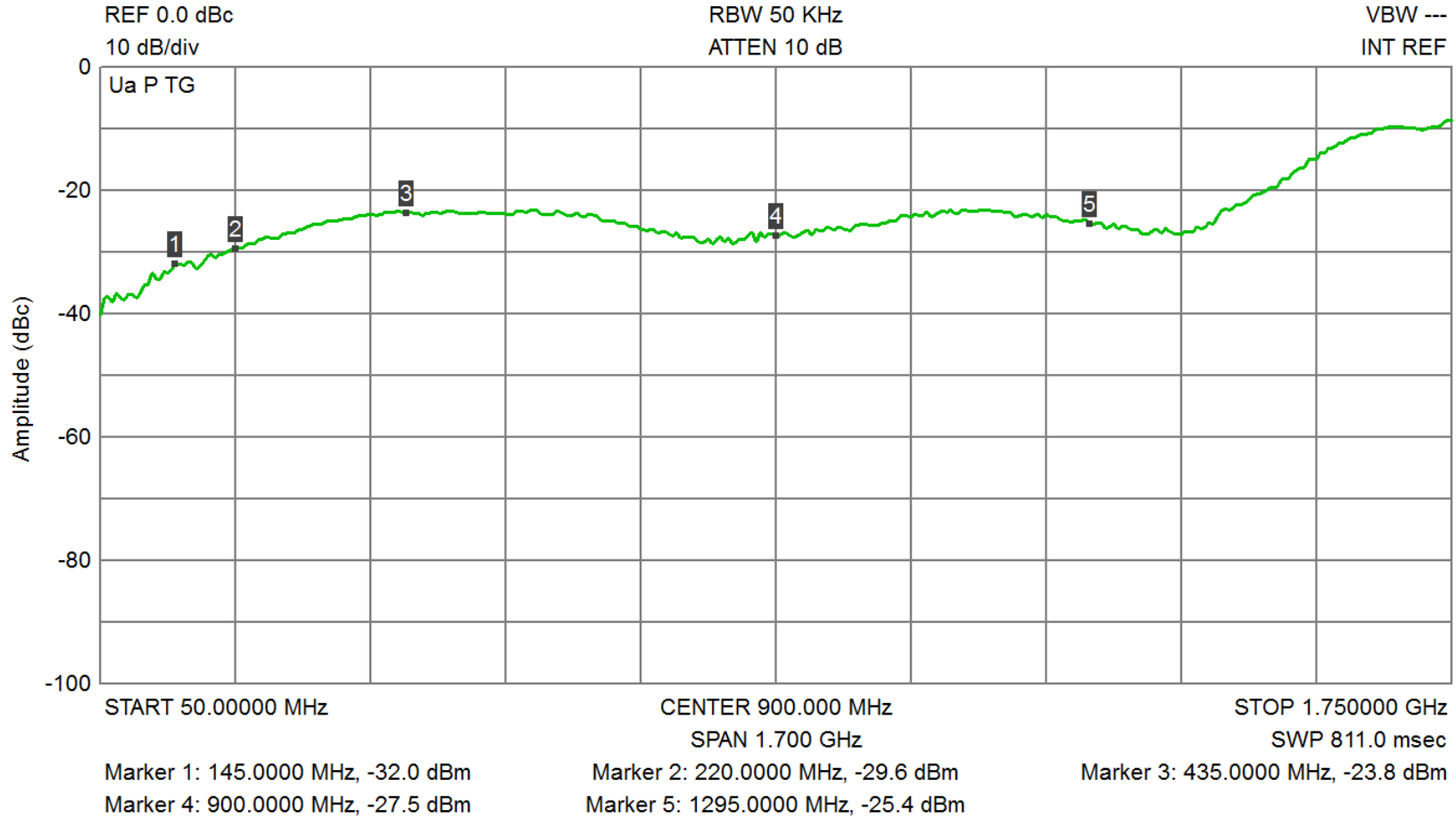
Relay Measurements (CX600NL)

insertion loss



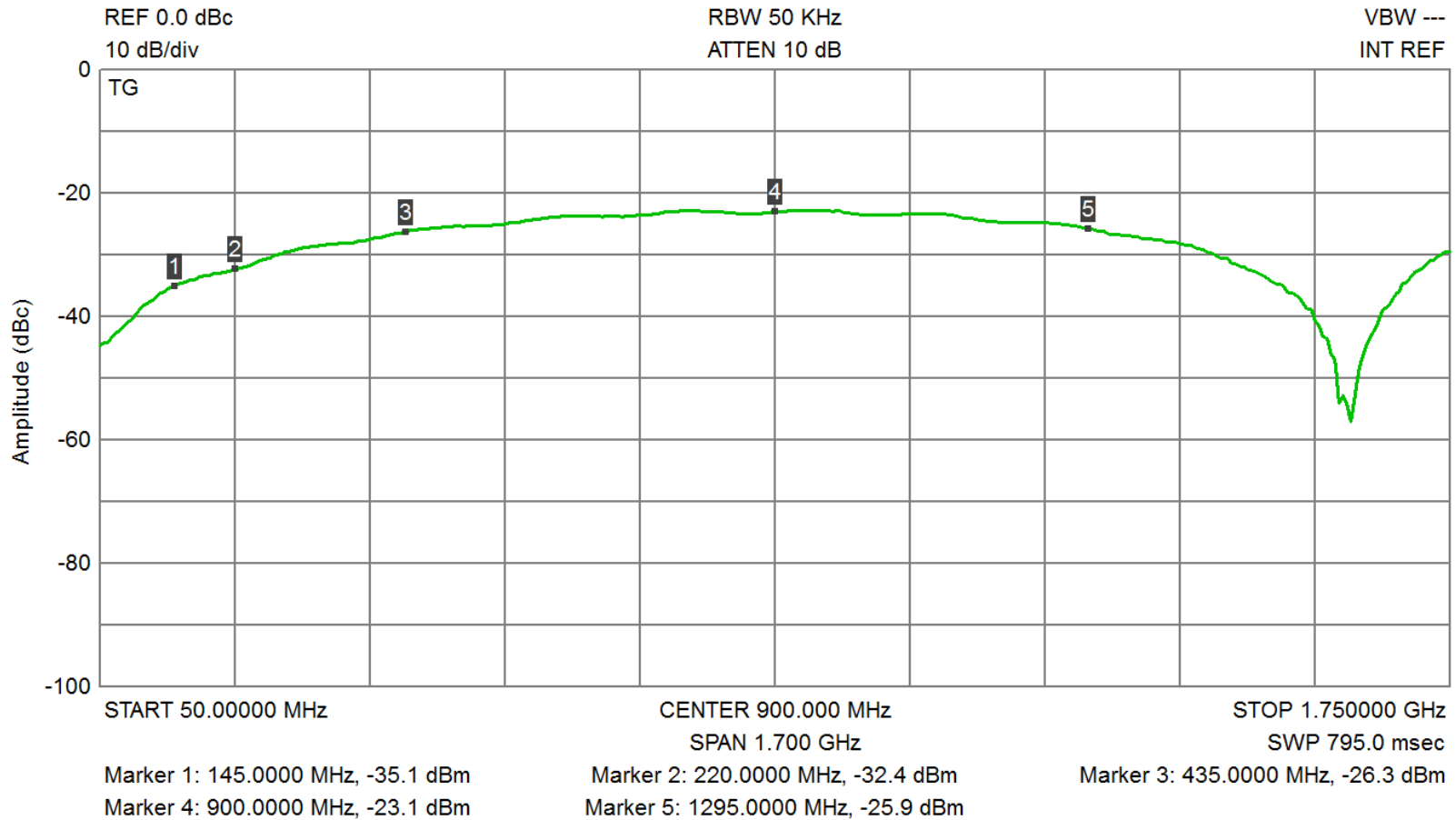
Relay Measurements (CX600NL)

return loss

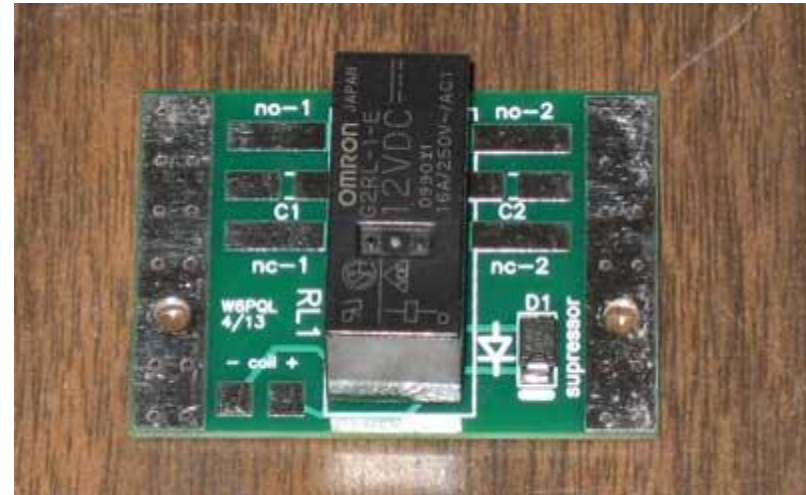


Relay Measurements (CX600NL)

isolation

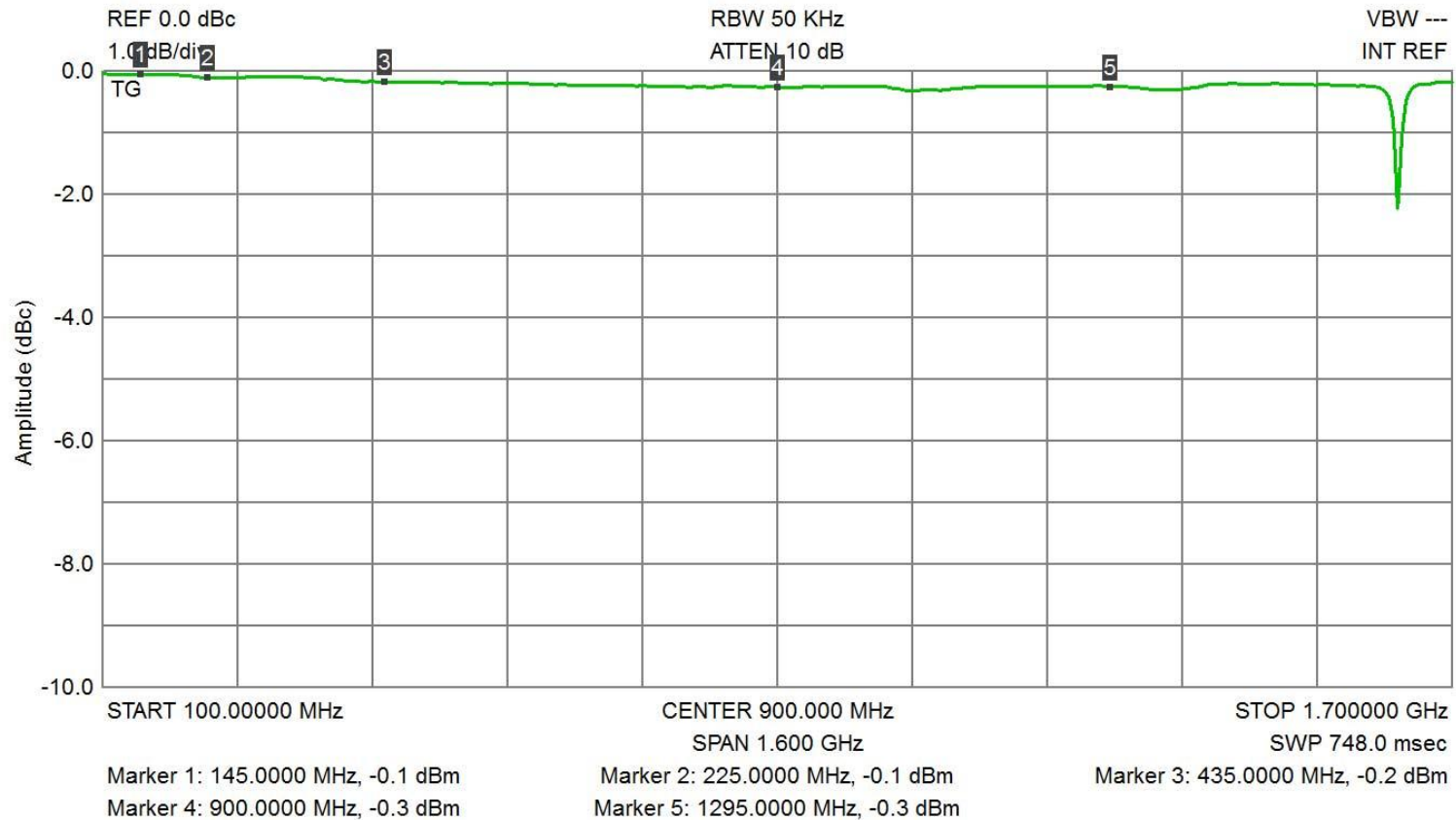


Antenna Relays (input)



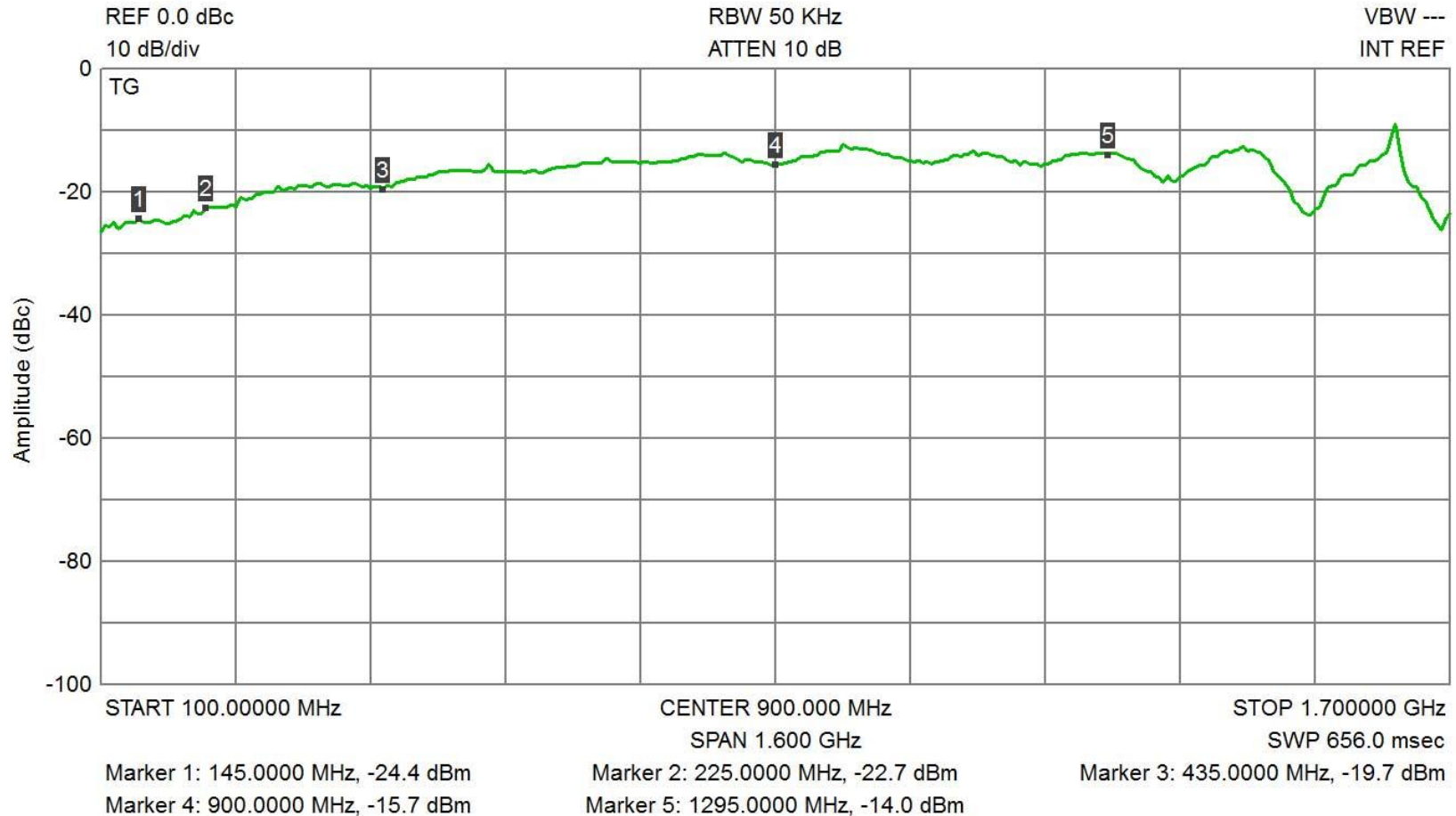
Relay Specs (CX120A)

insertion loss



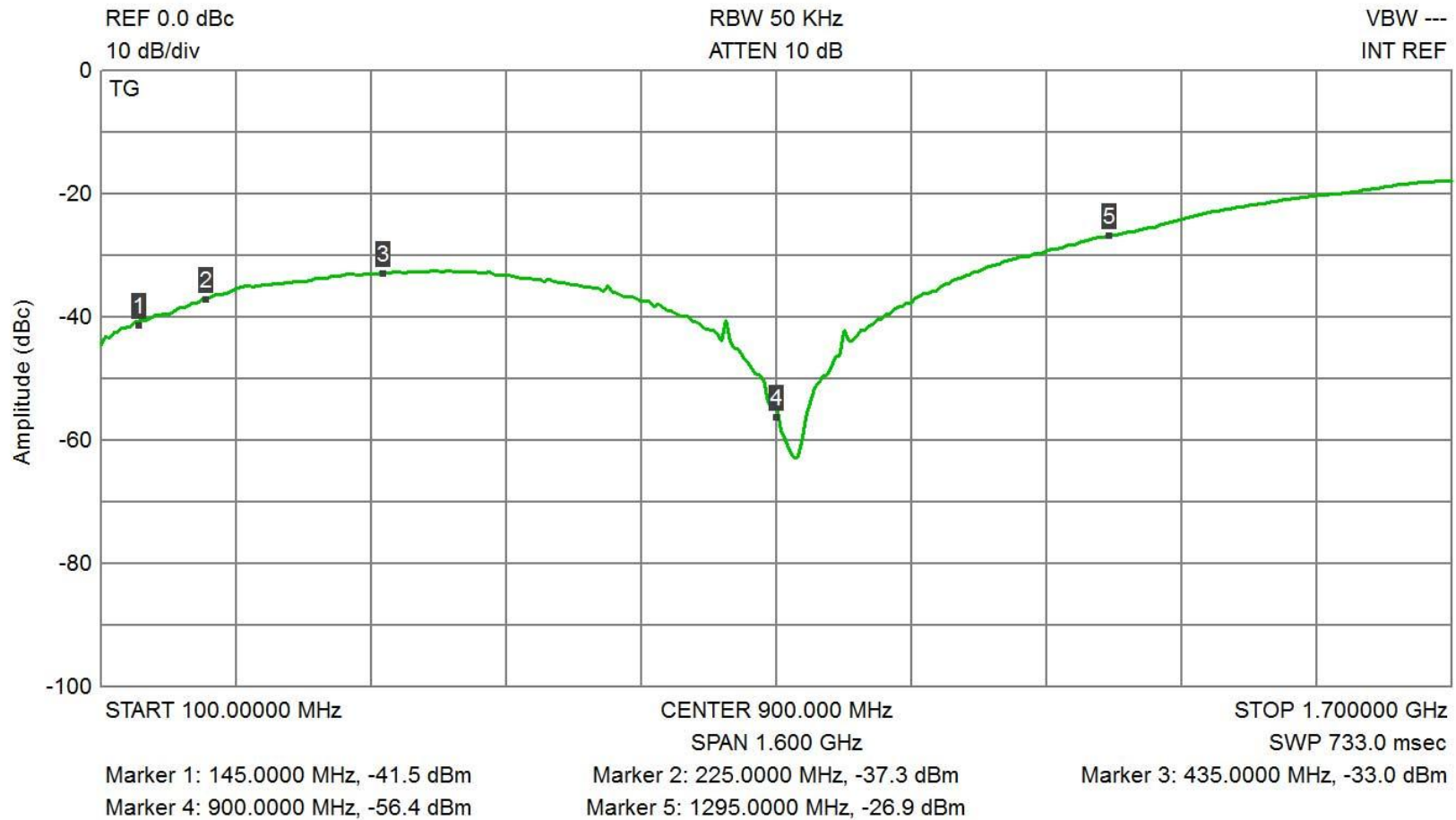
Relay Specs (CX120A)

return loss



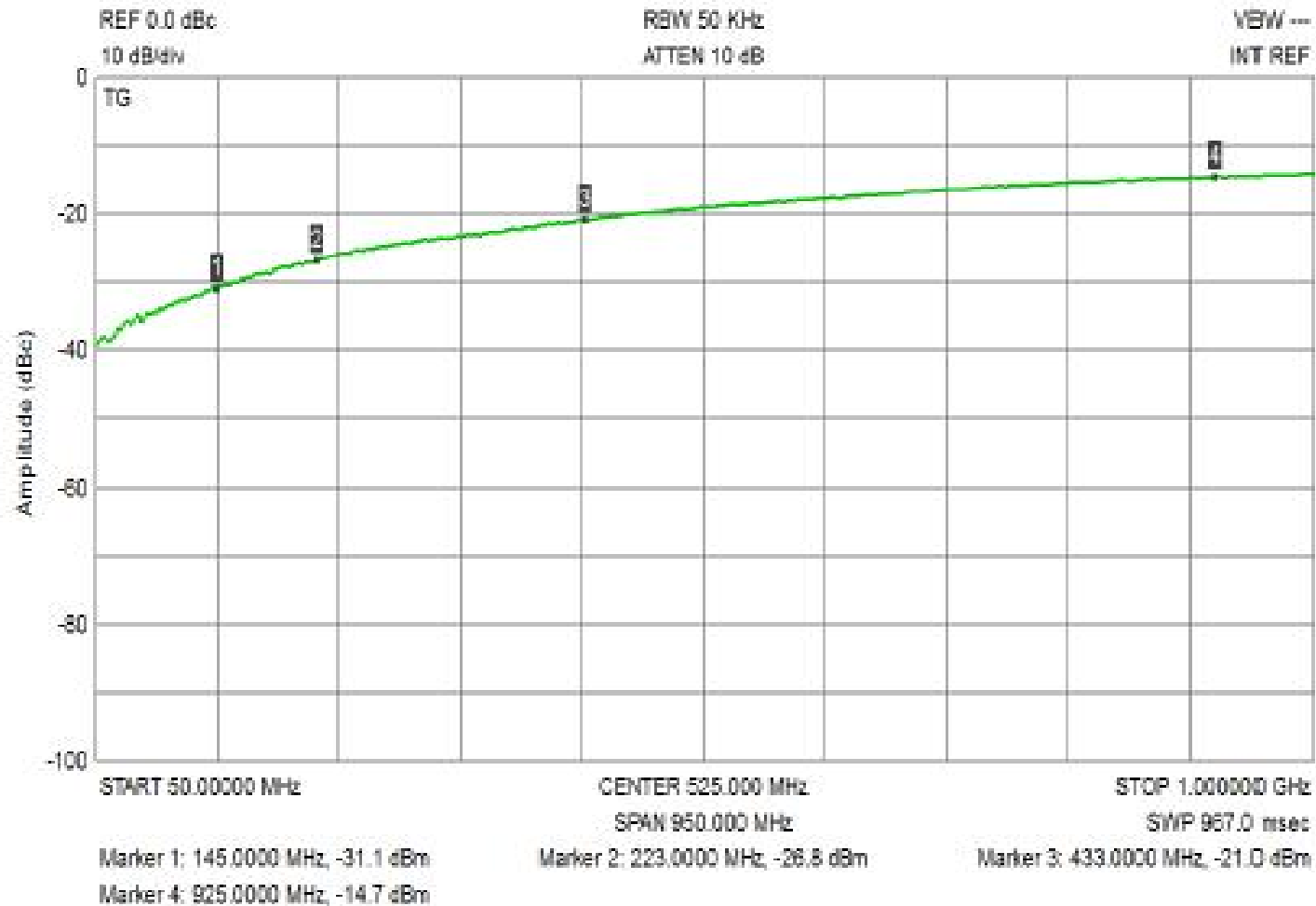
Relay Specs (CX120A)

isolation



Relay Specs

isolation (G2RL series)



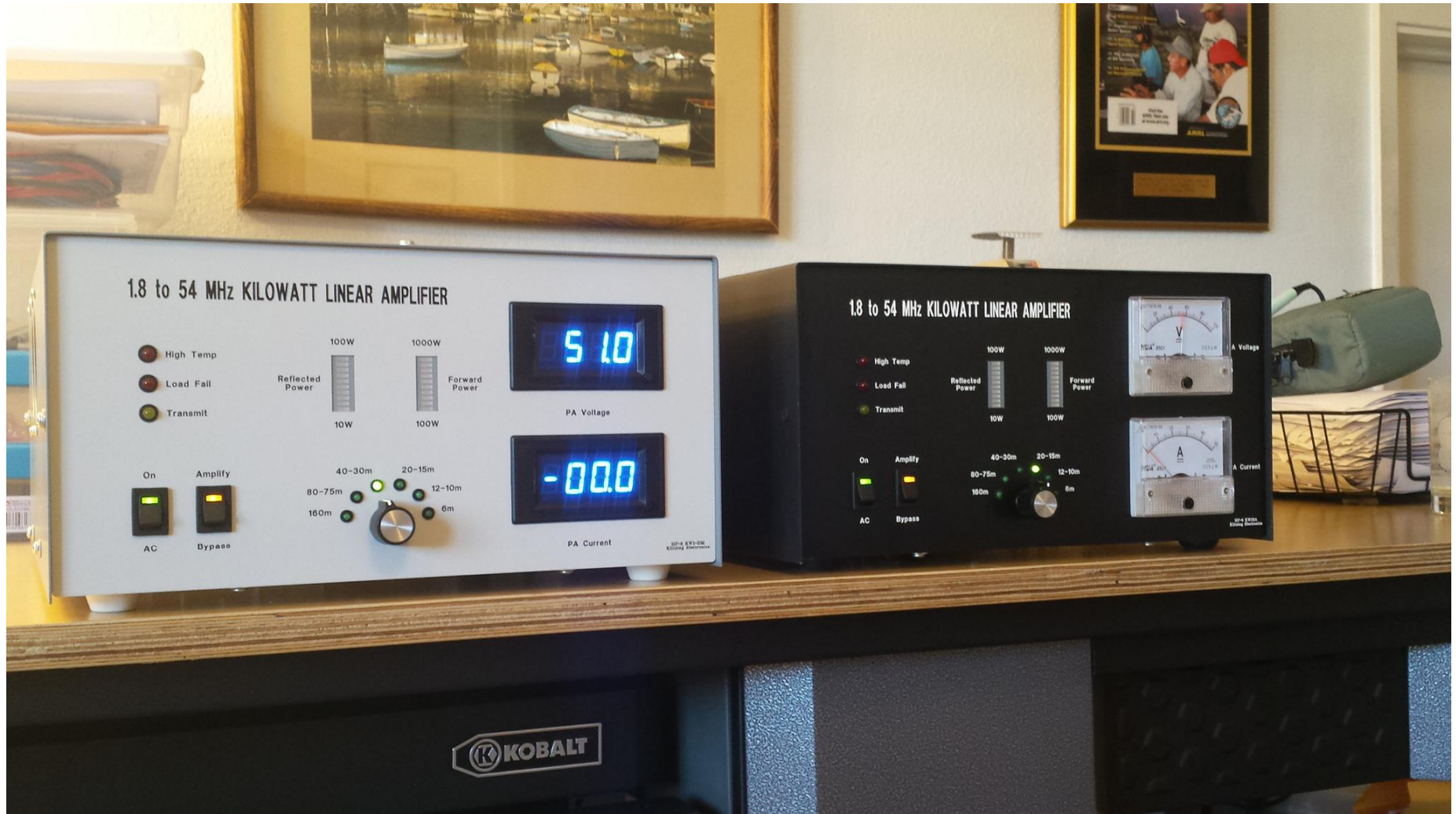
Control Board Functions

- Sequencer
 - Prevents hot-switching the antenna output relay
- DC power gate
 - VDD and bias (event 2)
- Fan control
- Reverse power lockout (high VSWR)
- Over-temp lockout
- Sequenced LNA power feed and drive power gating if required (event 3)

HF Amplifiers which include 6M

- W6PQL
 - 1kw on 160m thru 6m
 - 1.5kw+ version
 - 850-1000w/1500w on 6m
 - Broadband transformer design
- Other suppliers (many)
- Very complex switching and filtering, as you can imagine
 - Harmonic content is as high as -11dbc on some bands
 - Thus, a complex output filter is required
 - LPF or Combination LPF and diplexer

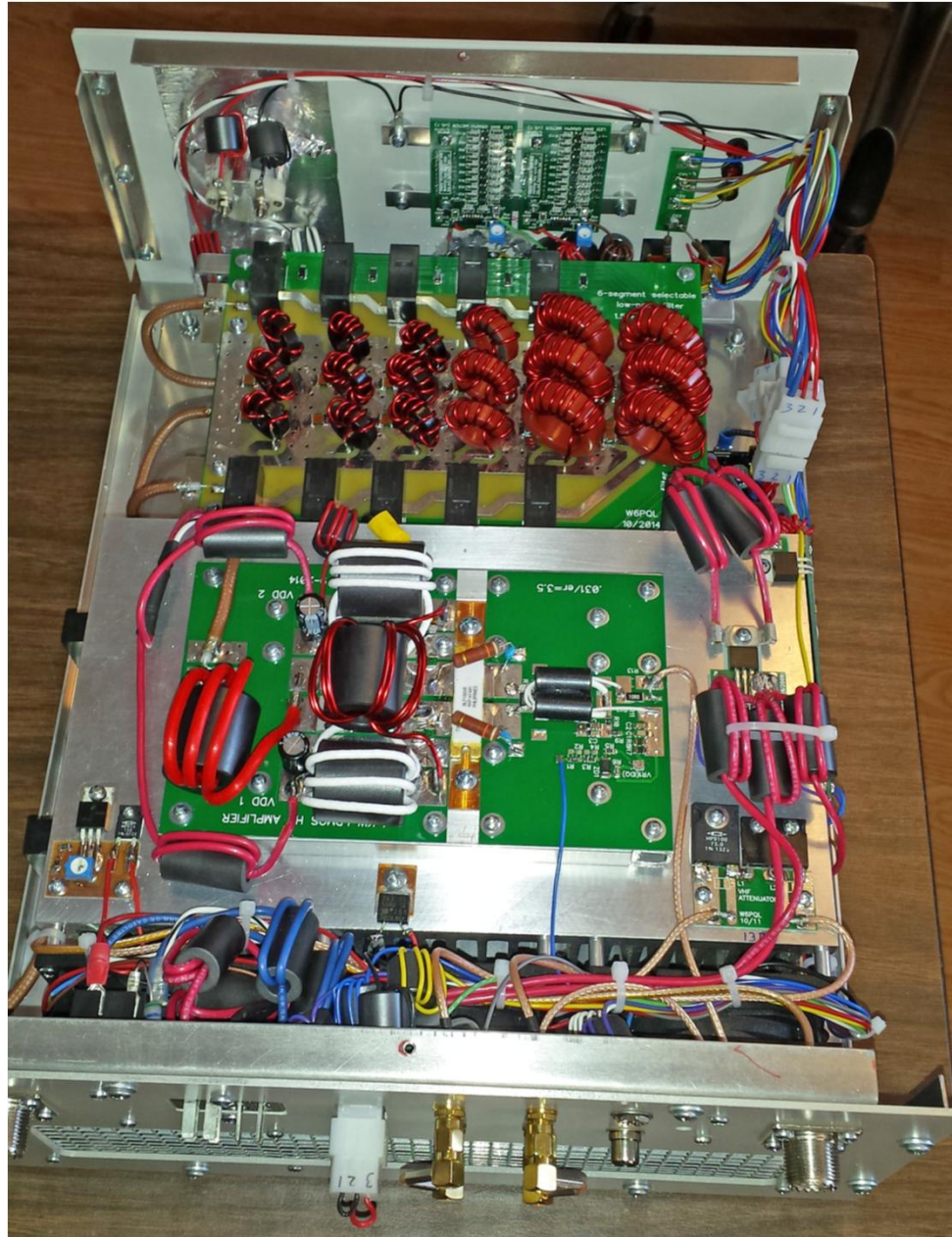
1KW 1.8-54 MHz HF Amplifiers



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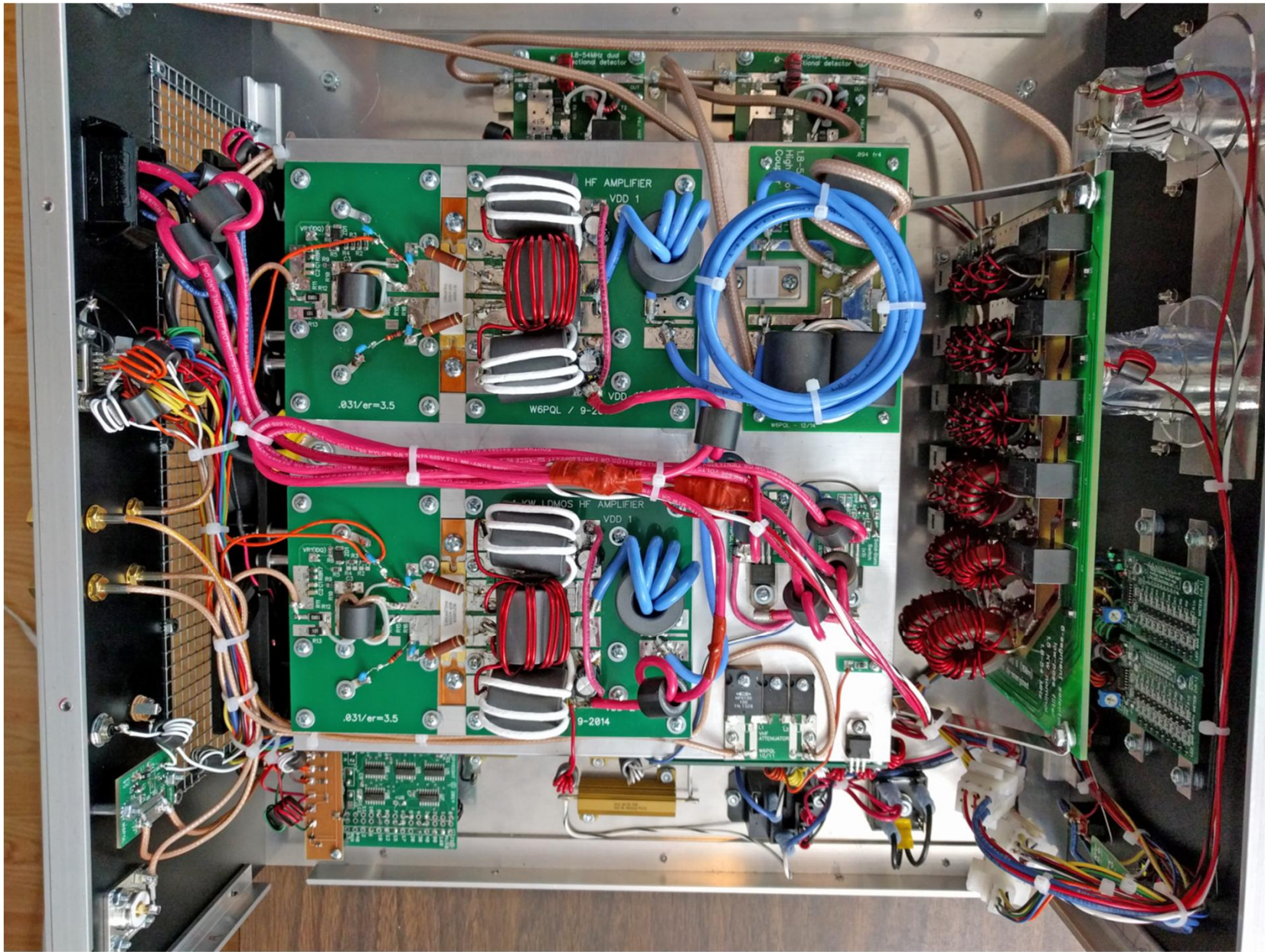
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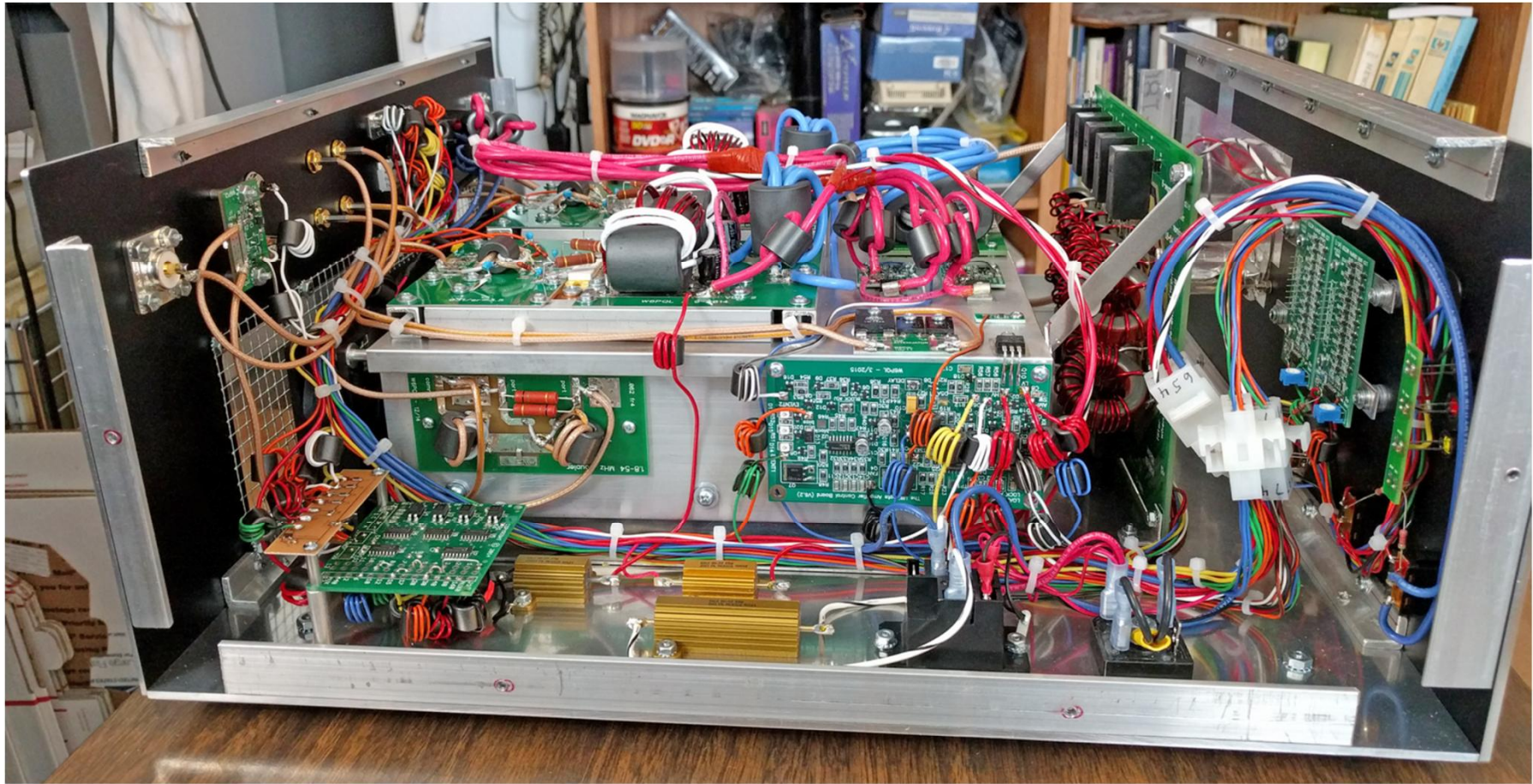
Legal-Limit (+) versions



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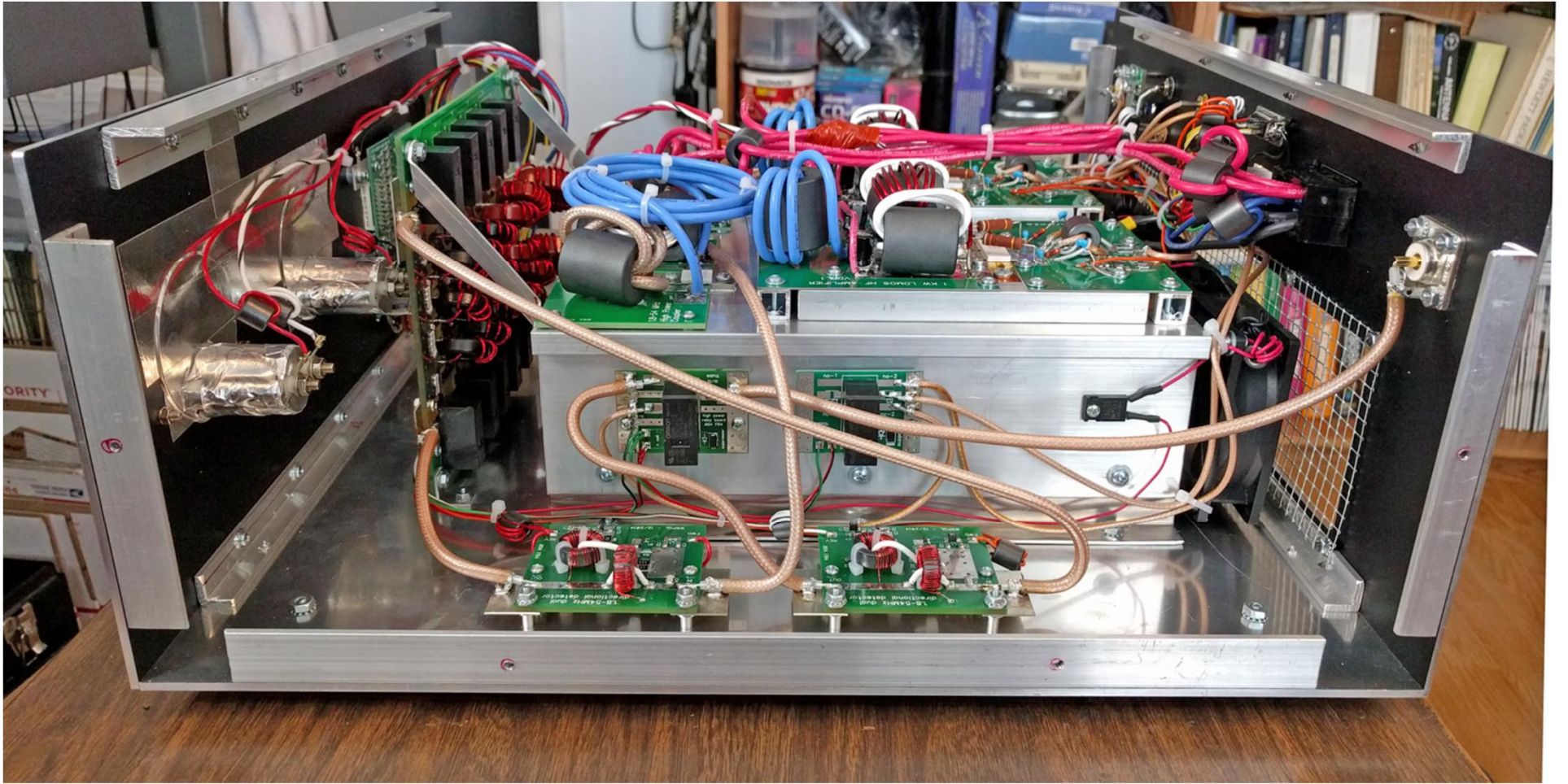
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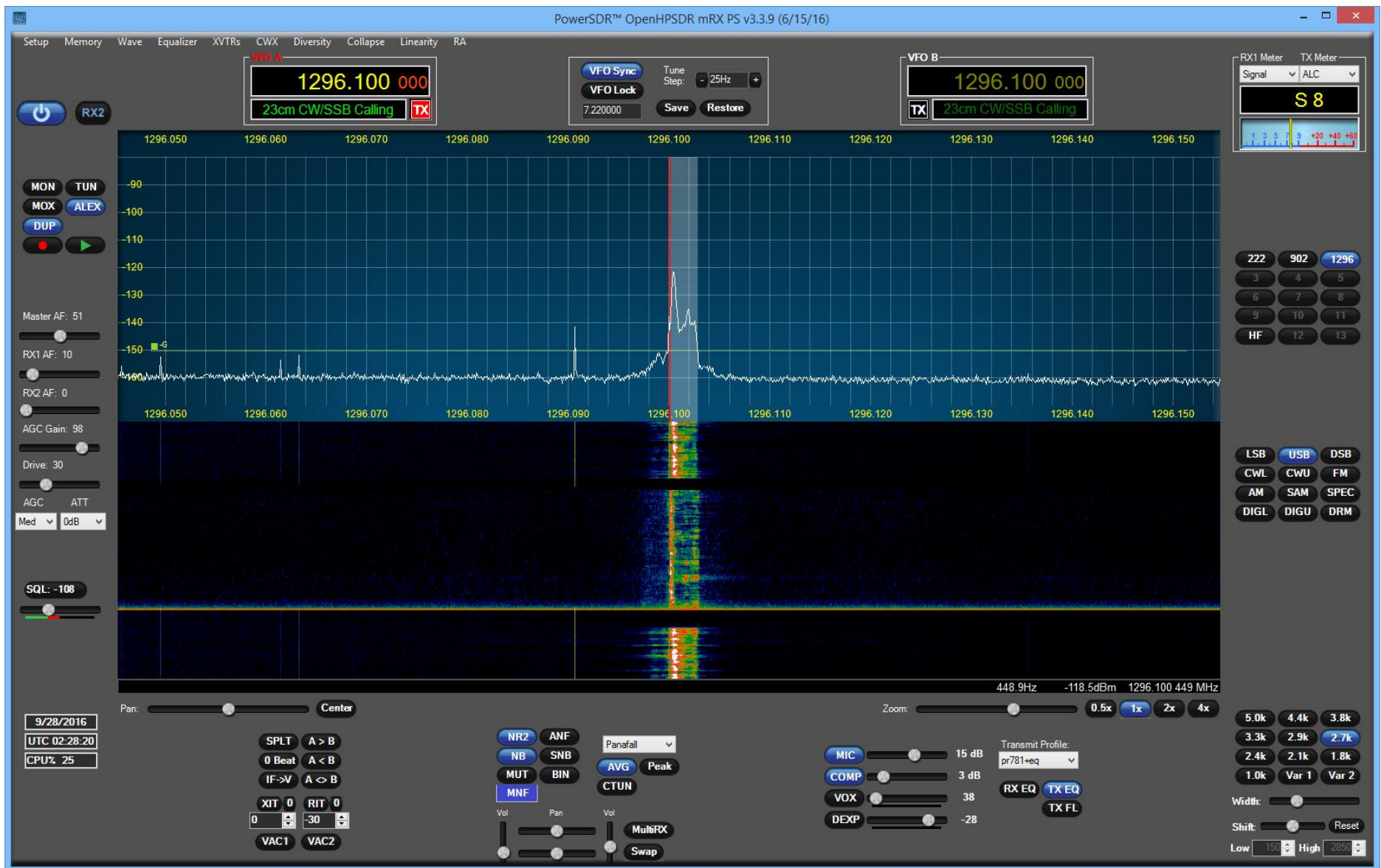
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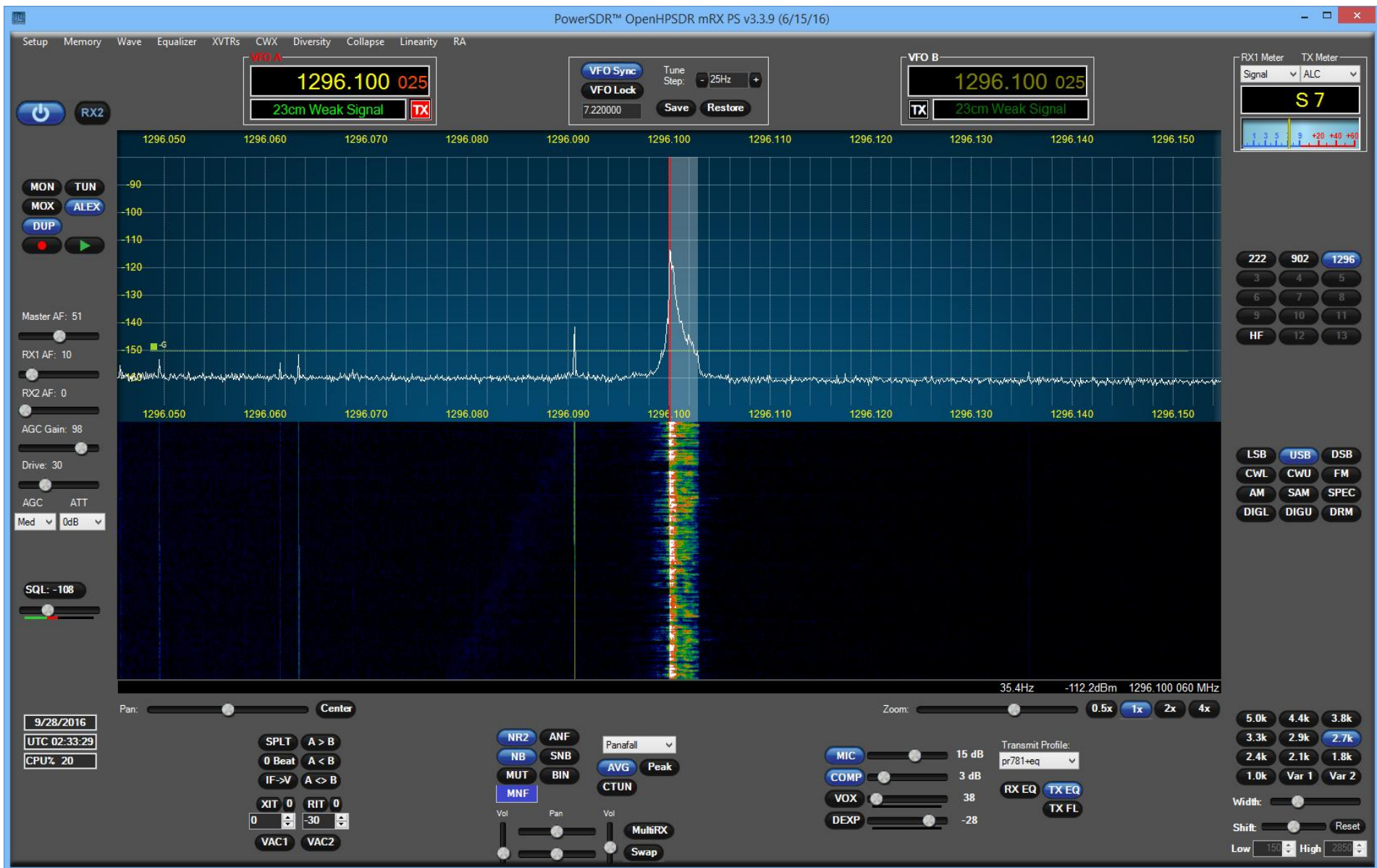
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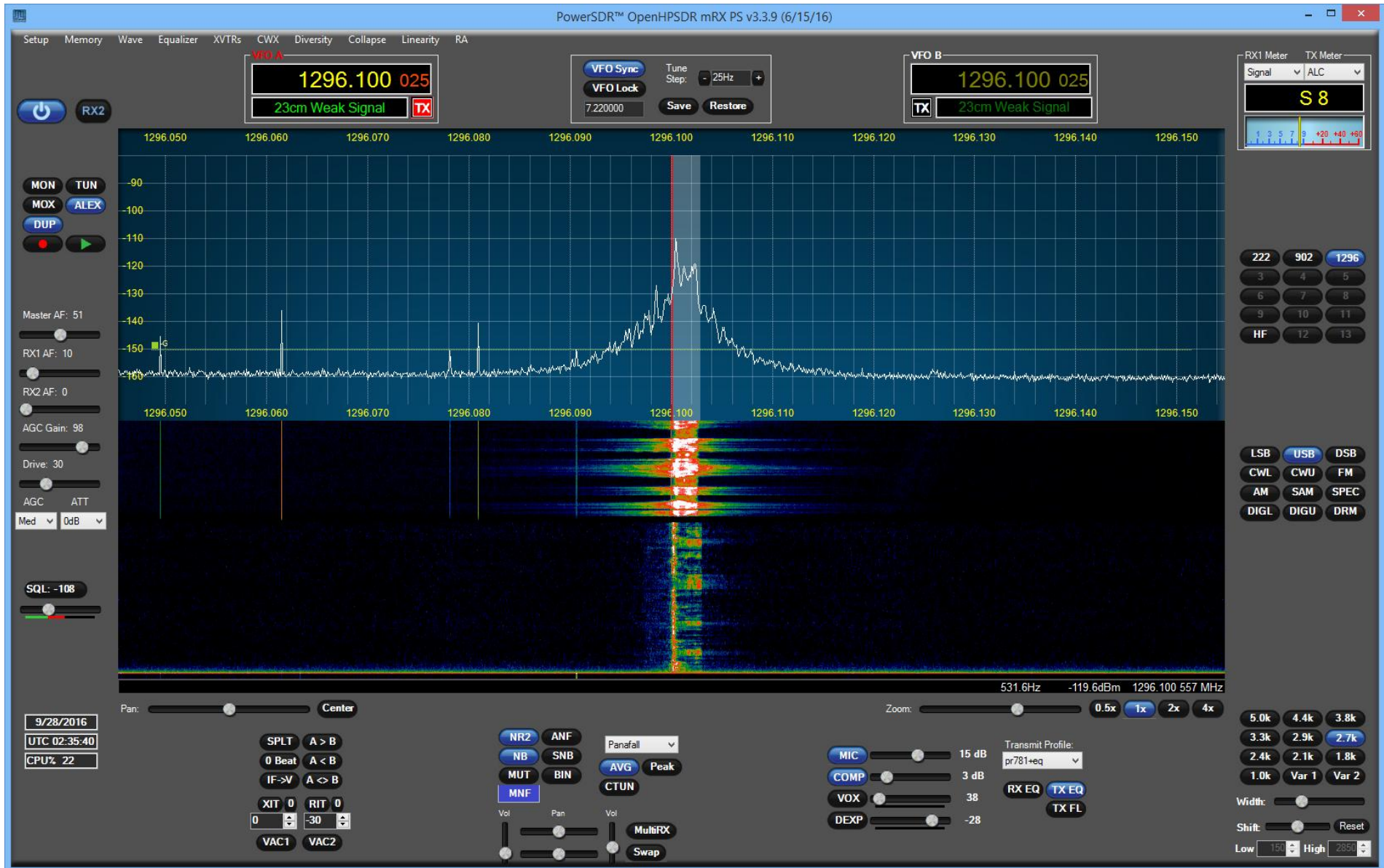
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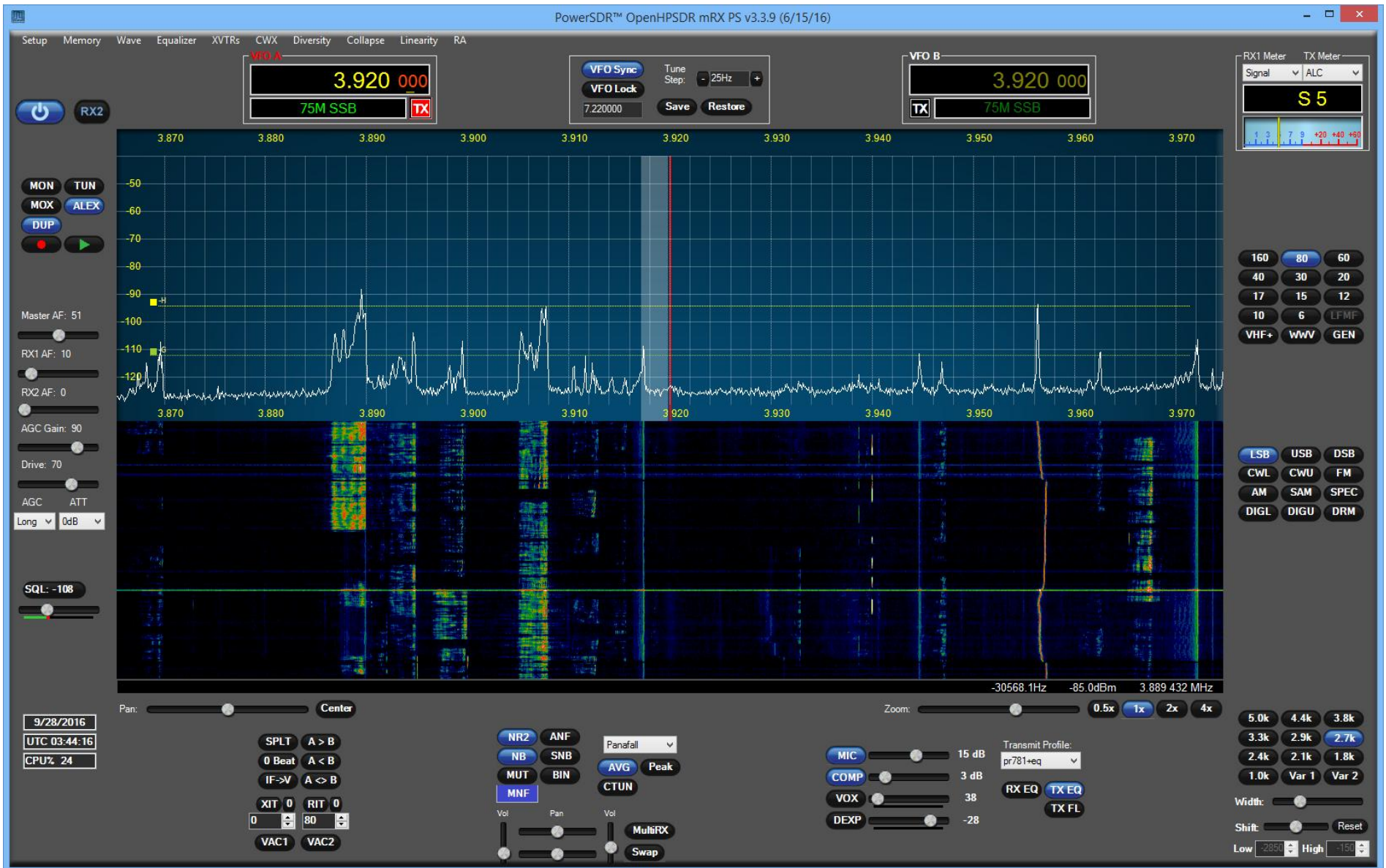
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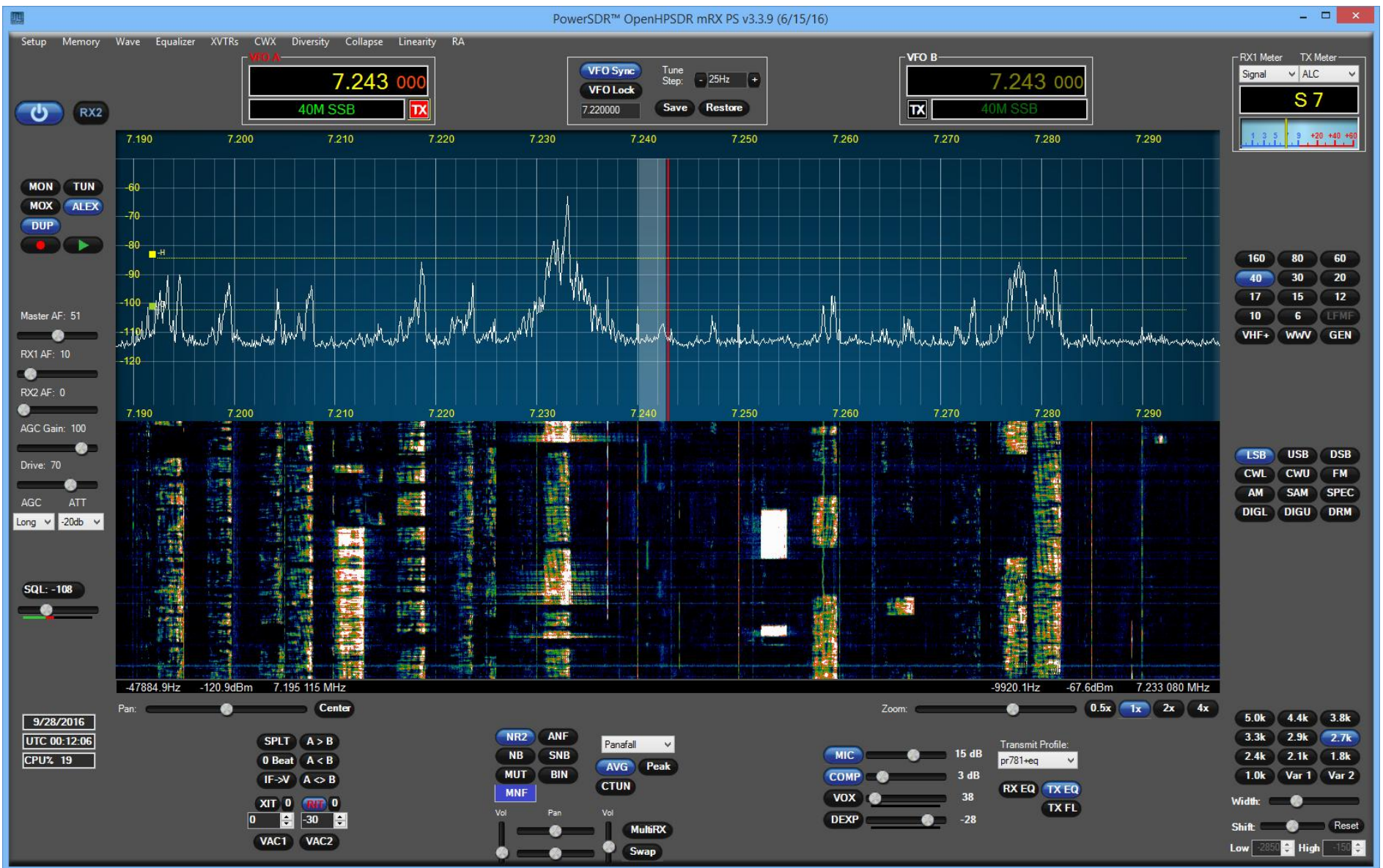
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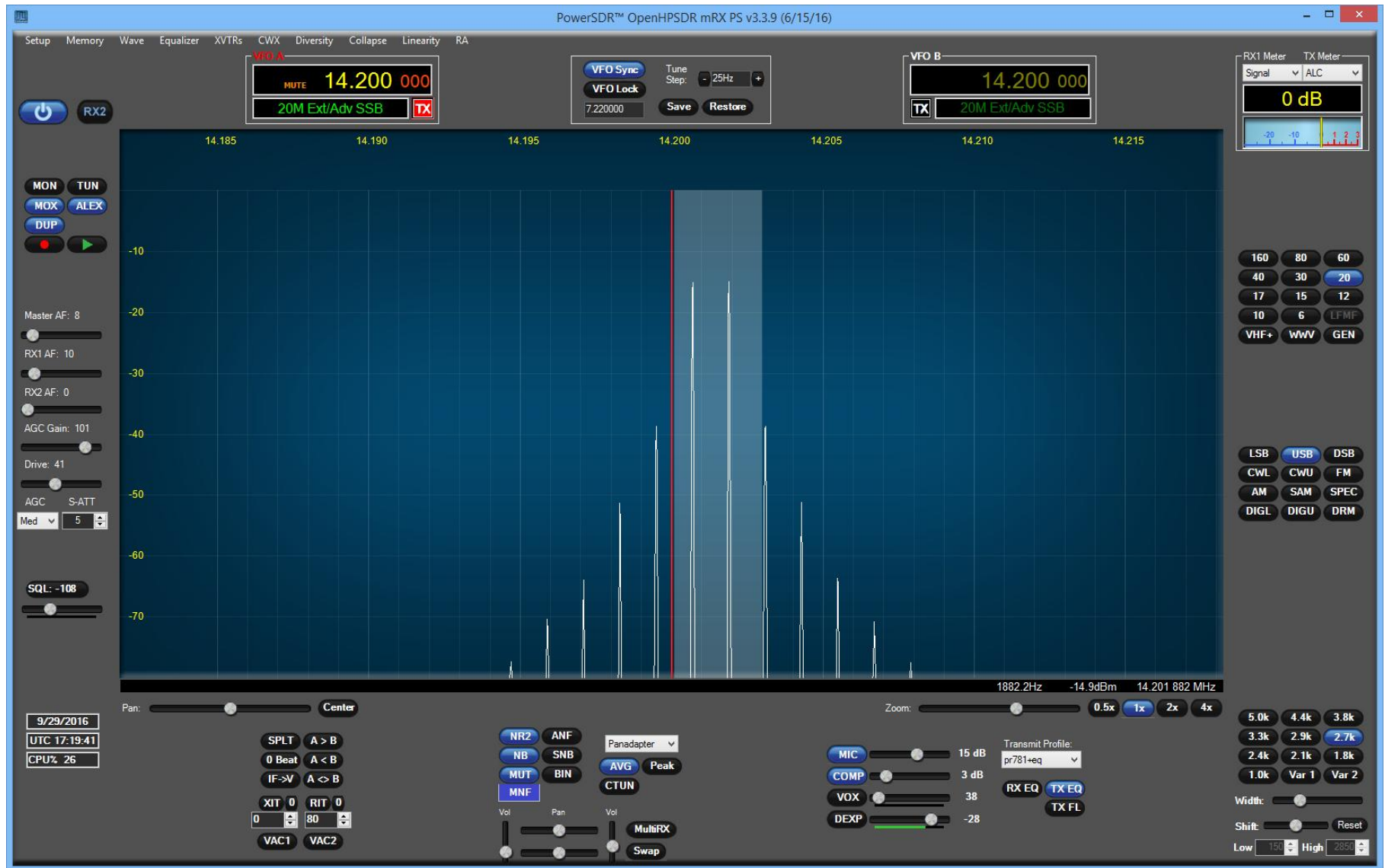


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Barefoot Apache 100D -30 db imd3

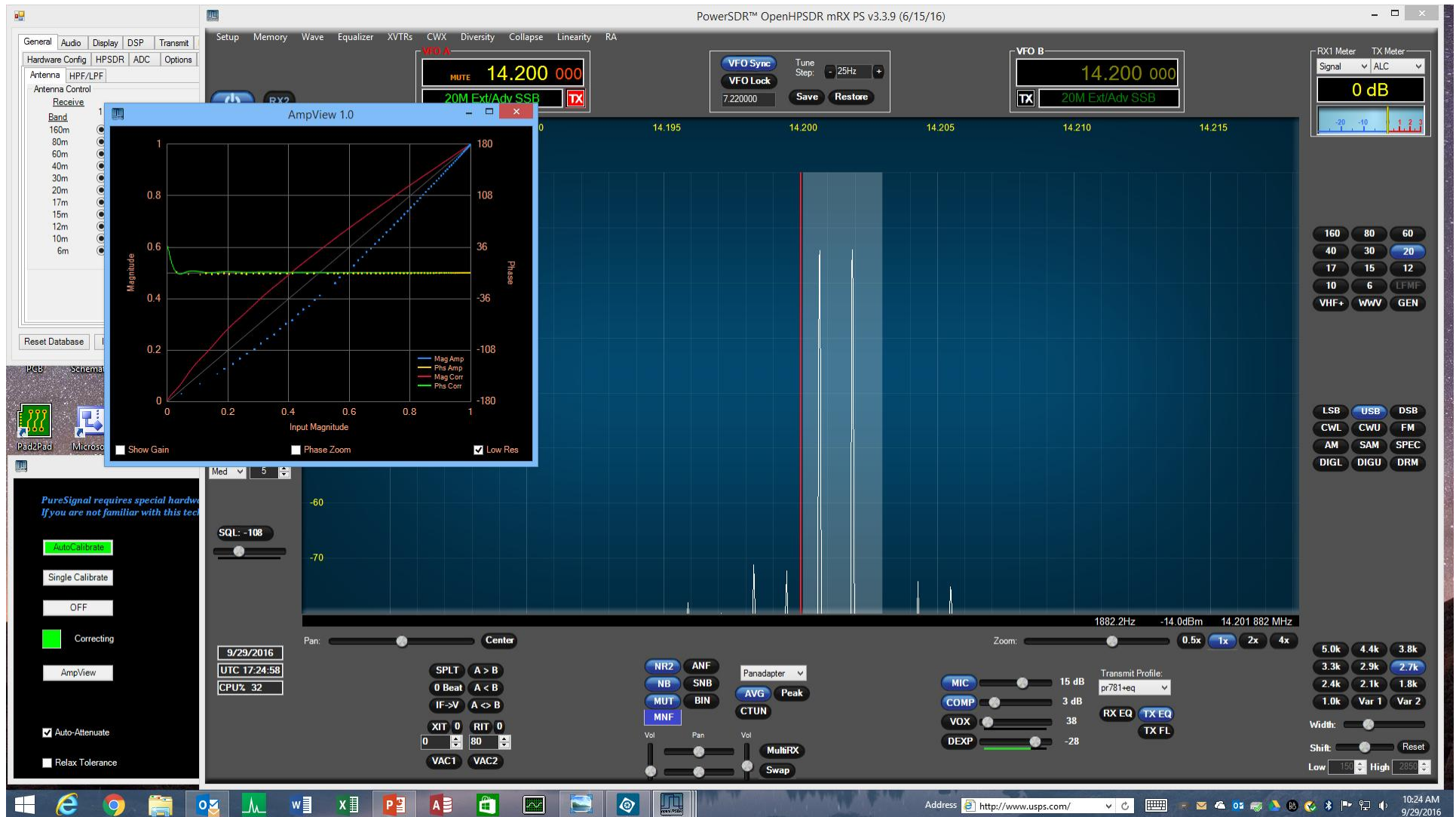


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Barefoot Apache 100d with Puresignal correction -63 db imd3

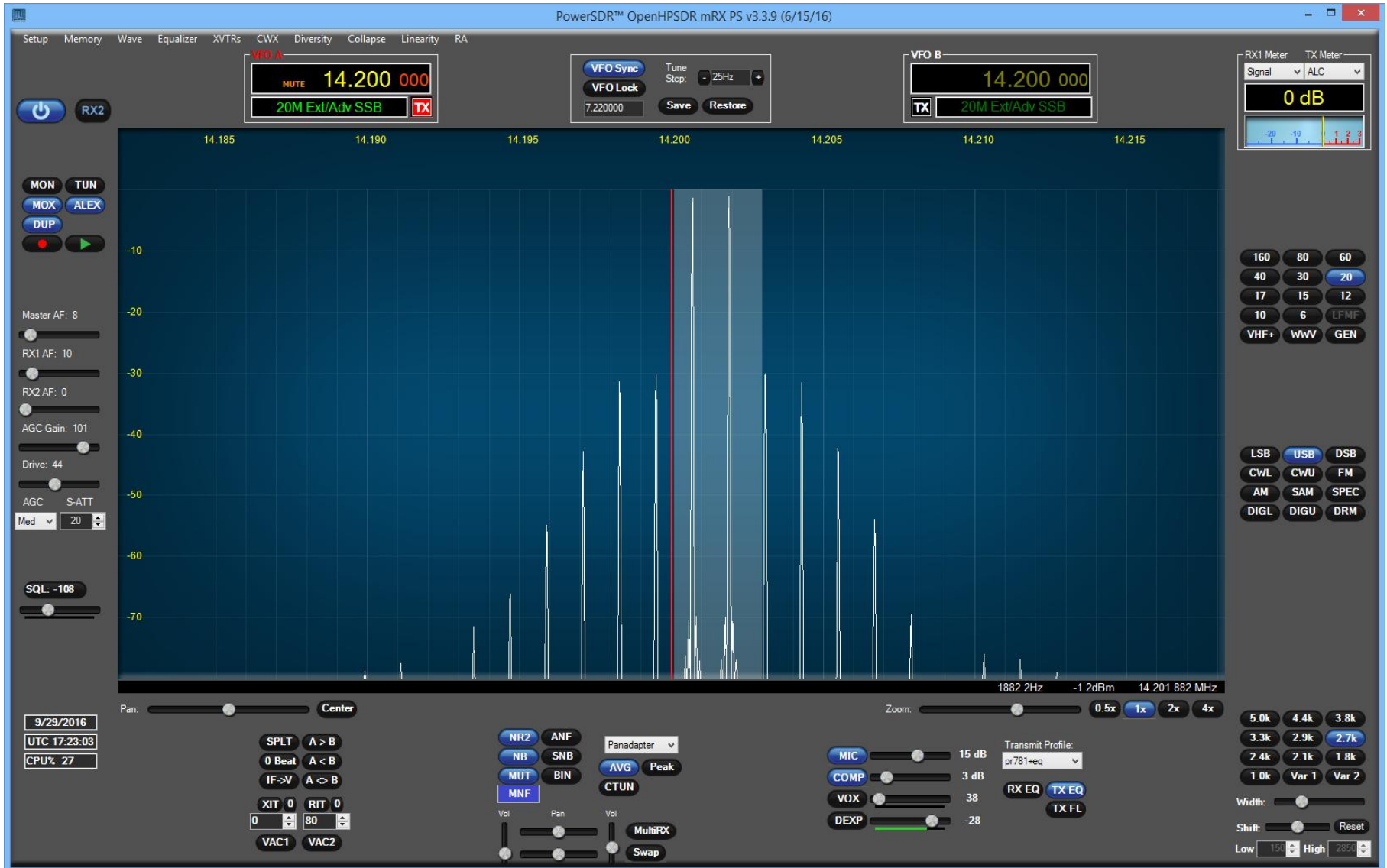


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1KW SSPA -34 db imd3

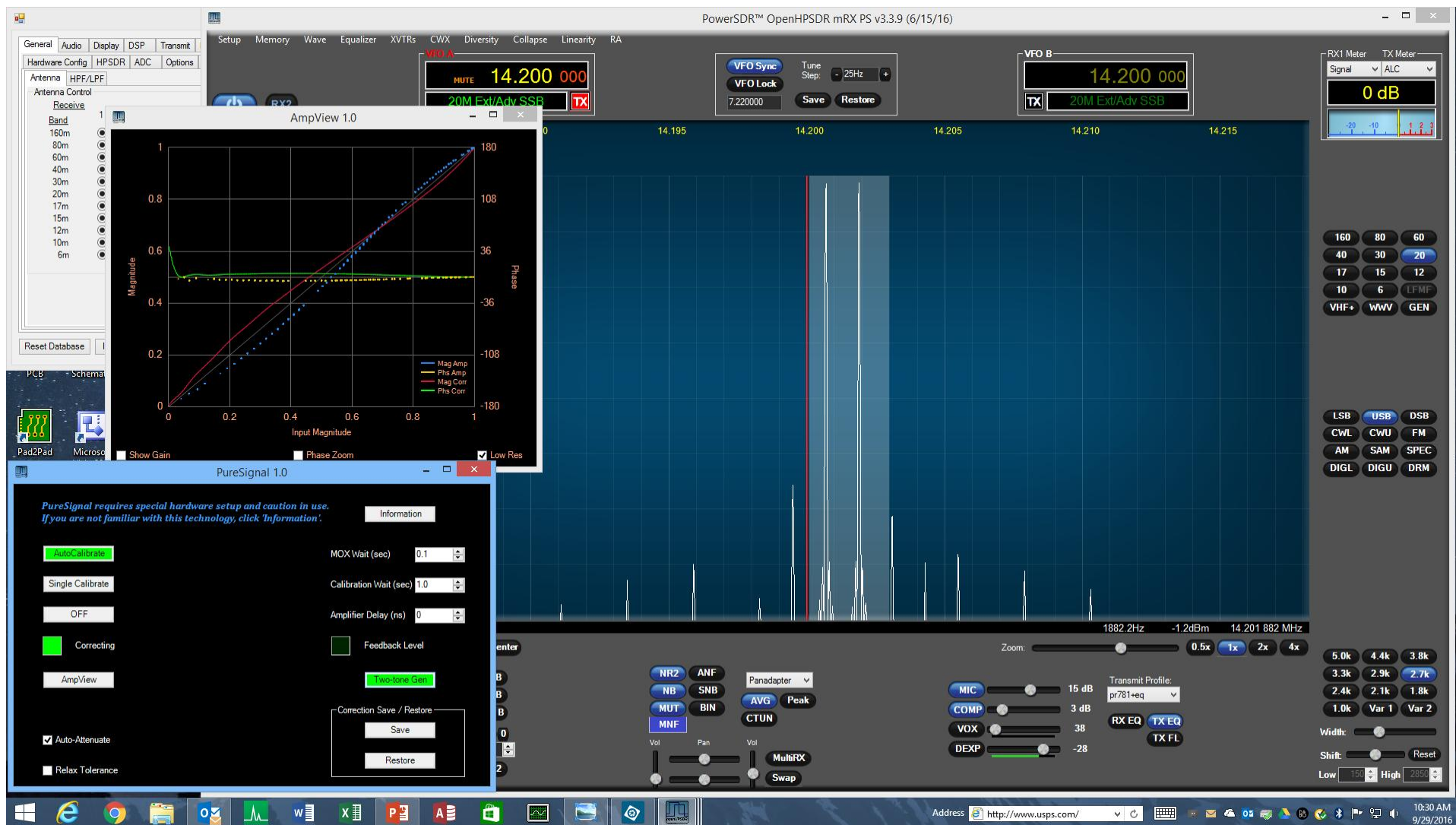


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1 KW SSPA with Puresignal correction -61 db imd3

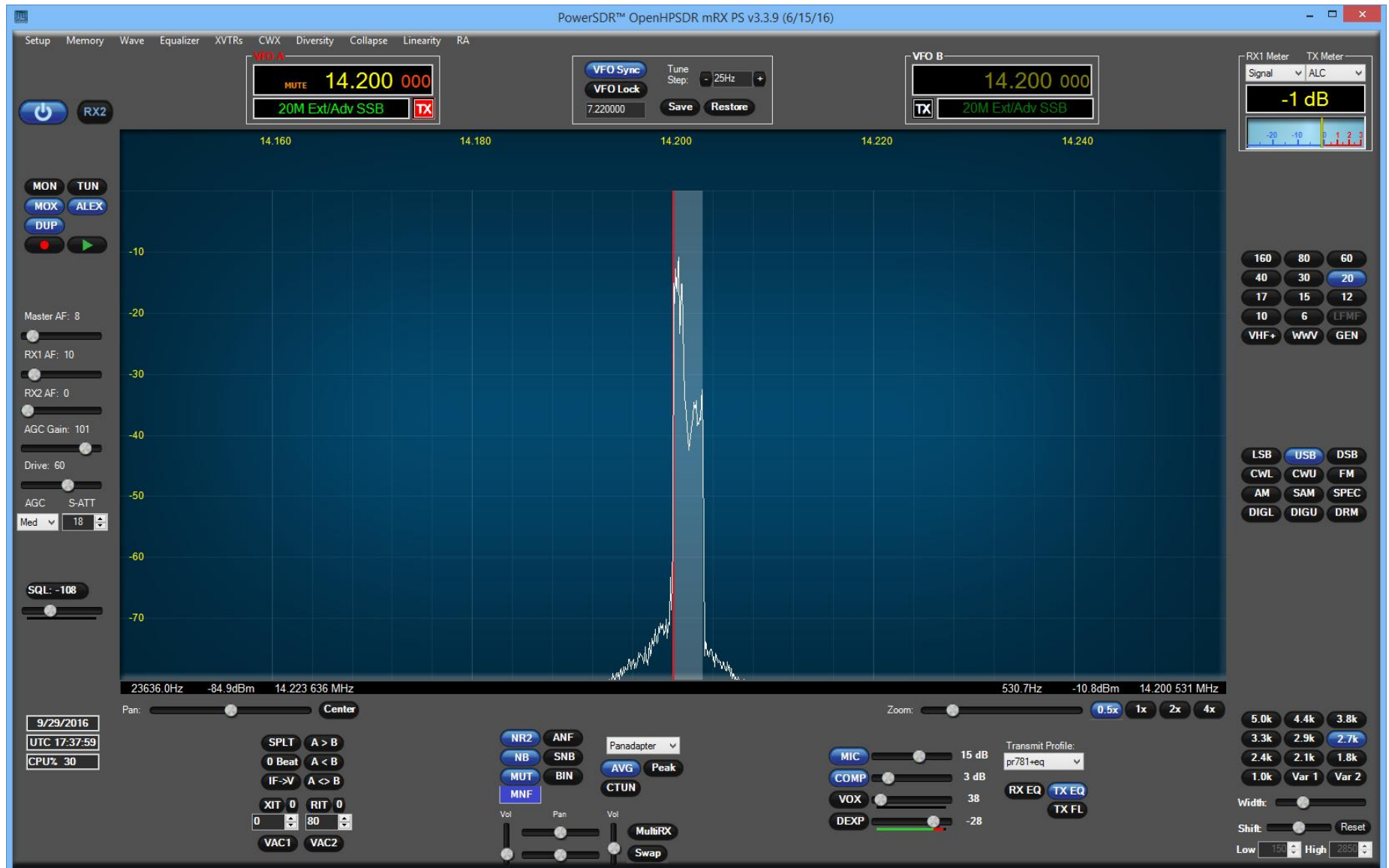


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1 KW SSPA, Puresignal on, speaking the word "hello"



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