

Conversion of MMDS surplus for 2304 MHz

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Overview

- Surplus S band Microwave Multi-point Distribution System equipment
- Used for cable TV and data transmission
- 2 Transmitter versions currently available, Model 5574 and 1750A
- 5574 Designed for 64 QAM modulation with Feedforward high power amplifiers
- 1750A used for Analog TV with video and audio carriers. Currently available on EBay. (No RX chassis- no LNA)

6 Primary Steps to Convert to 2304

- Change LO to new frequency
- Install TR control
- Tune amplifiers to 2304
- Install TR relay
- Install receive components
- Mechanical modifications

Mechanical Modifications

- Remove unnecessary boards, electronics, and cables.
- Add connectors as required to rear panel.
- Many other mechanical options can be considered, for example:

Add TR relay in or out of chassis

Add RX components to xmit chassis

Use switches and functions to front panel

Some examples are shown.

LO Description

- Multiplied crystal, available from International crystal. ICM has xtal cataloged under ITS Transmitter
- Phase lock is a option, but not necessary
- LO is usable for other frequencies and bands.
- Auto switch if 10 MHz is not available.
- Filtered LO output to mixer, excellent spur performance.

PLL and UHF Oscillator,

The Xtal osc and multiplier chain is rather straight forward. When referring to frequencies assume a 144 IF with a final LO of 2160 mhz

The UHF Oscillator

Power is regulated +12

The xtal is at 90 mhz and in a oven. There are 3 doubler stages to get to 720 mhz. The doublers are MiniCircuits doubler blocks with Mimic gain blocks. There are 2 outputs, one at the xtal frequency, one at 8 times. There is an AFC input from the PLL board.

The output @ 720 mhz is about +5dbm

The VHF Generator Control Board

Power is regulated +12 and -12

The PLL board provides for a lock to a 10mhz (or 5mhz) reference such as a GPS Frequency reference. The design is based on standard PLL Frequency Synthesizer parts. The basic step is 781.25 hz, so programming for typical xtal frequencies is achievable, We have the switch settings (see below) for use with a 145 and 145 IF, others are easily calculated if needed. There is also a failover provision to provide a fixed bias (AFC voltage) if there is no reference signal.

For those that do not have a 10 mhz reference , this bias control can be used to tweak the xtal to the proper frequency, easier then trying to use the trimmer cap.

Tuning the UHF oscillator is easily done w/o a spectrum analyzer, though one is recommended to ensure there are no spurs. Each stage has a TP (simple diode detector) that measures the signal at the input of each doubler and the prior stage adjusted for max voltage.

A check for close in spurs needs to be done as we have seen being off a slight bit in tuning at the oscillator stage will result in a spur / double oscillation.

Following the UHF output is a varactor tripler to get to 2160 mhz, This can be tuned using the spare RF detector or, easier, using a spectrum analyzer

Crystal and PLL settings

144 IF = 2160 lo = 90 mhz xtal

VHF board divisor settings

N = 675 1010100011

A = 0

145 IF = 2159 lo = 89.958333 xtal

VHF board divisor

N = 674 1010100010

A = 44 101100

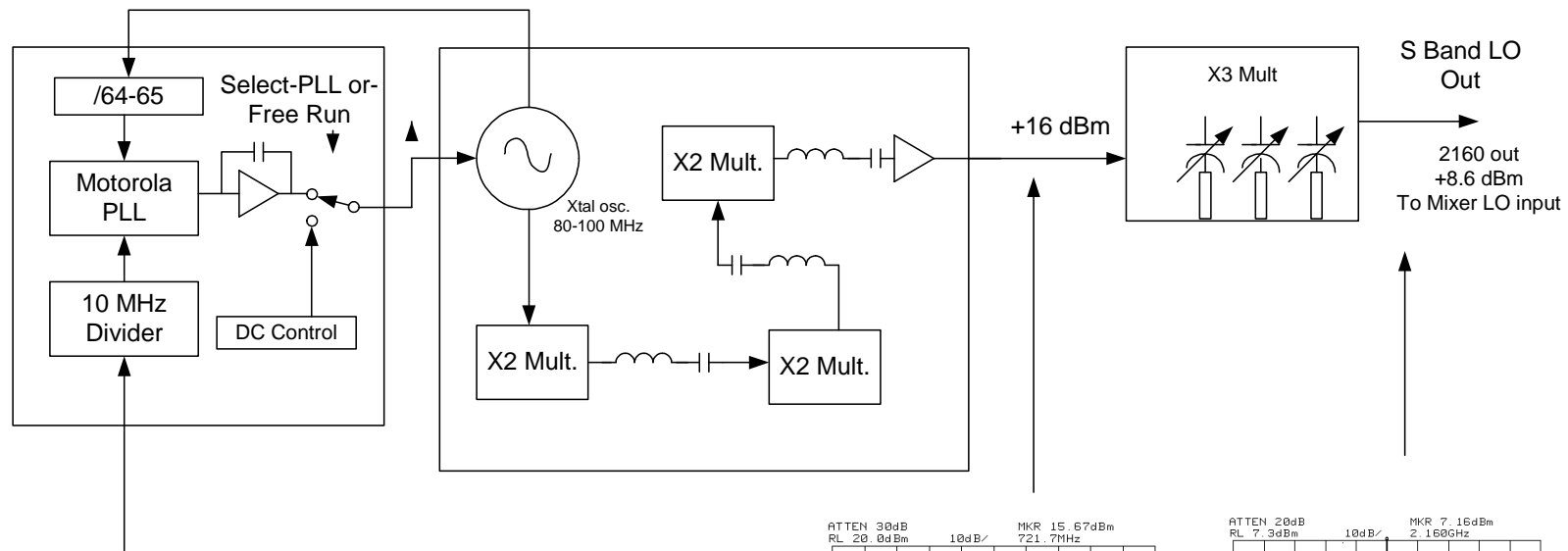
The dip switches are set to ON for a logic zero, OFF for logic one.

LO Conversion

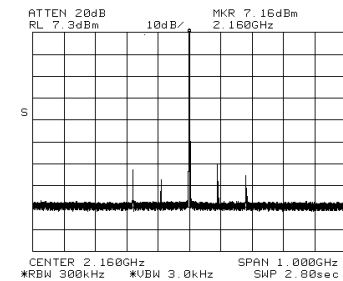
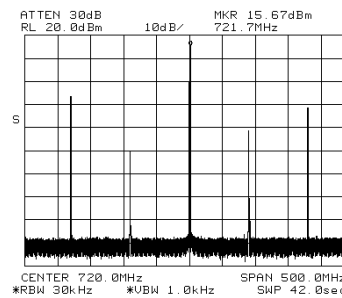
- Change crystal- use insulator on bottom!
- Tune crystal osc., & multiplier stages.
- Spectrum analyzer helpful but not necessary.
- Set PLL divider switches for new LO Freq.
- Tune x3 Multiplier
 - That's it!

LO Block Diagram

Converted Local Oscillator
Simplified Block Diagram

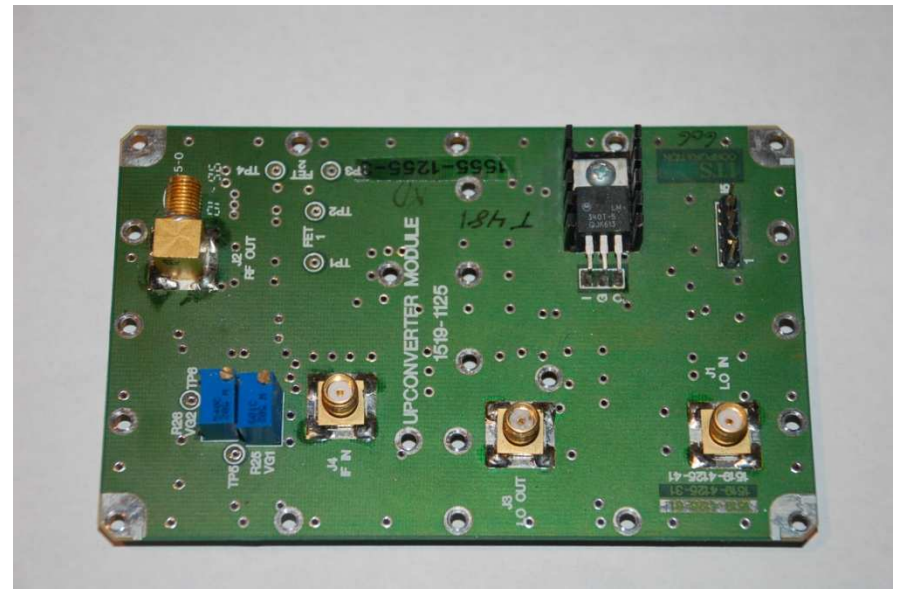


10 MHz in

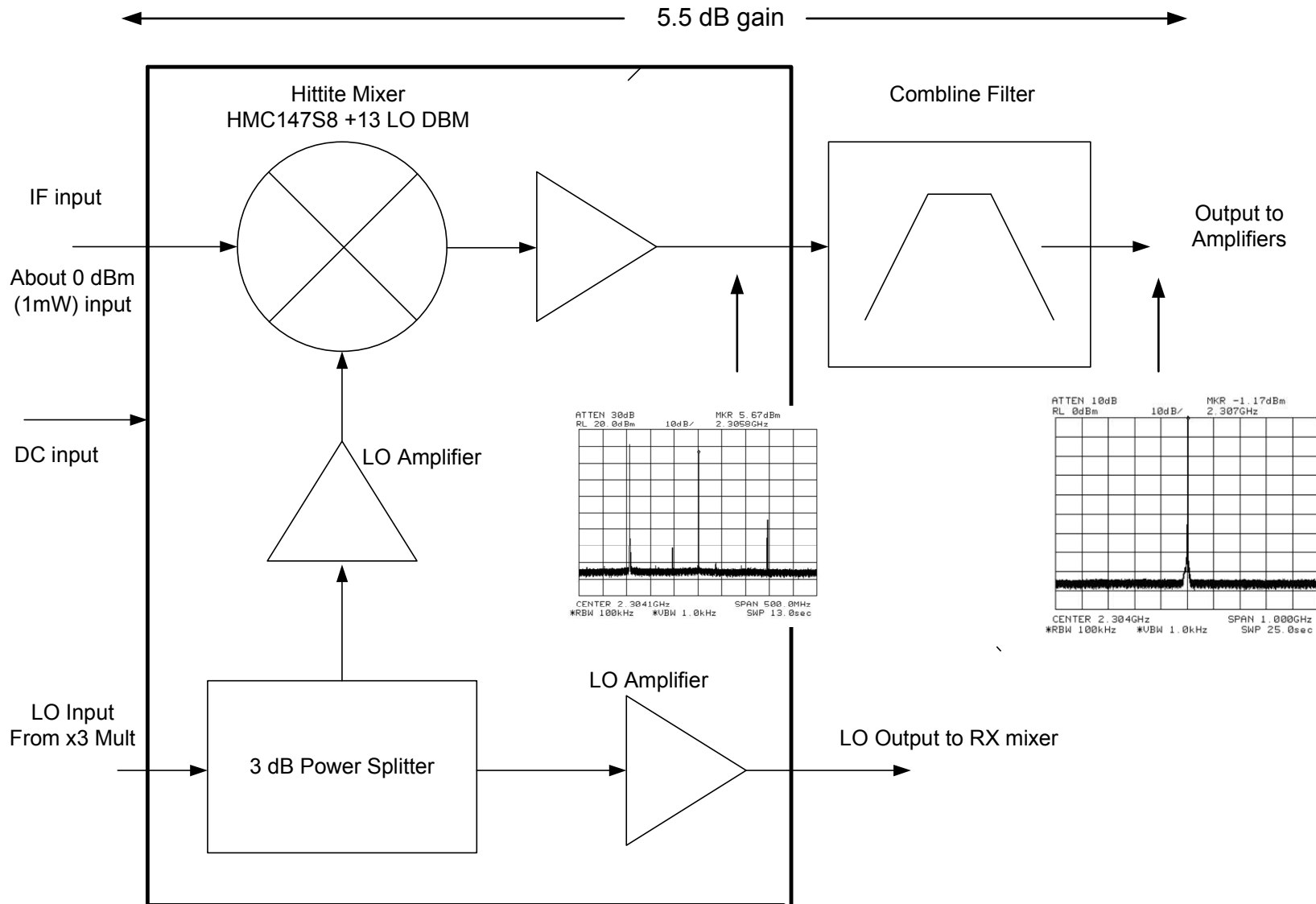


Mixer-Filter

- Mixer- No Conversion necessary. Use as is!
- LO splitter built in for RX mixer
- Filter will tune to 2304
- Narrow filter, 2 meter LO > 80 dBc



Mixer – Filter MMDS 2304 Conversion



Receiver Conversion

- Use Mixer as is. RX Mixer is a MC ZFM-4212 . +7 dBm LO
- LNA is usable as is, can be tuned for better performance. Needs + & -12V which is available in xmit chassis, easy to install.
- 4 pole Interdigital filter will tune to 2304 from RX chassis.

RF Amplifiers

- RF power amplifiers will need to be tuned to 2304
- As built the amplifiers are on 2.5-2.7 GHz
- FET devices used, - bias must be applied at all times when the +10 V is on.
- Bias is controlled with a bias protection board
- Feedforward components can be removed
- Extra 10W amp in chassis after modification (not in model 1750A)

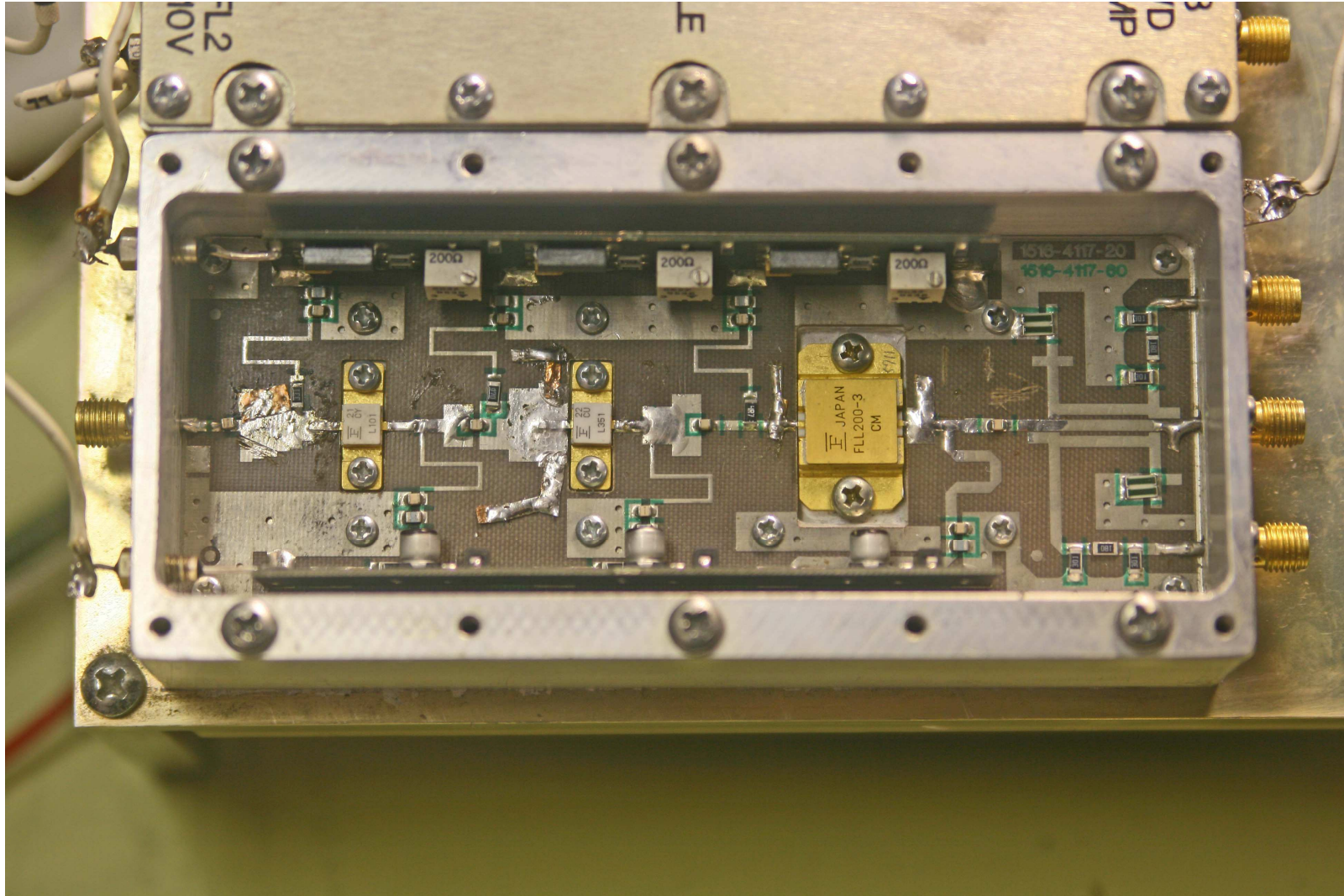
RF Amplifier Cont'd

- Rf tuning and performance was checked before and after modification to 2304
- Attenuator required between stages to prevent overdrive of power amplifier

10 Watt driver Amp

- 10 W driver starts to compress at 9 W
- 12 -14 W Saturated Power out
- 38-40 dB Gain depending on tuning.

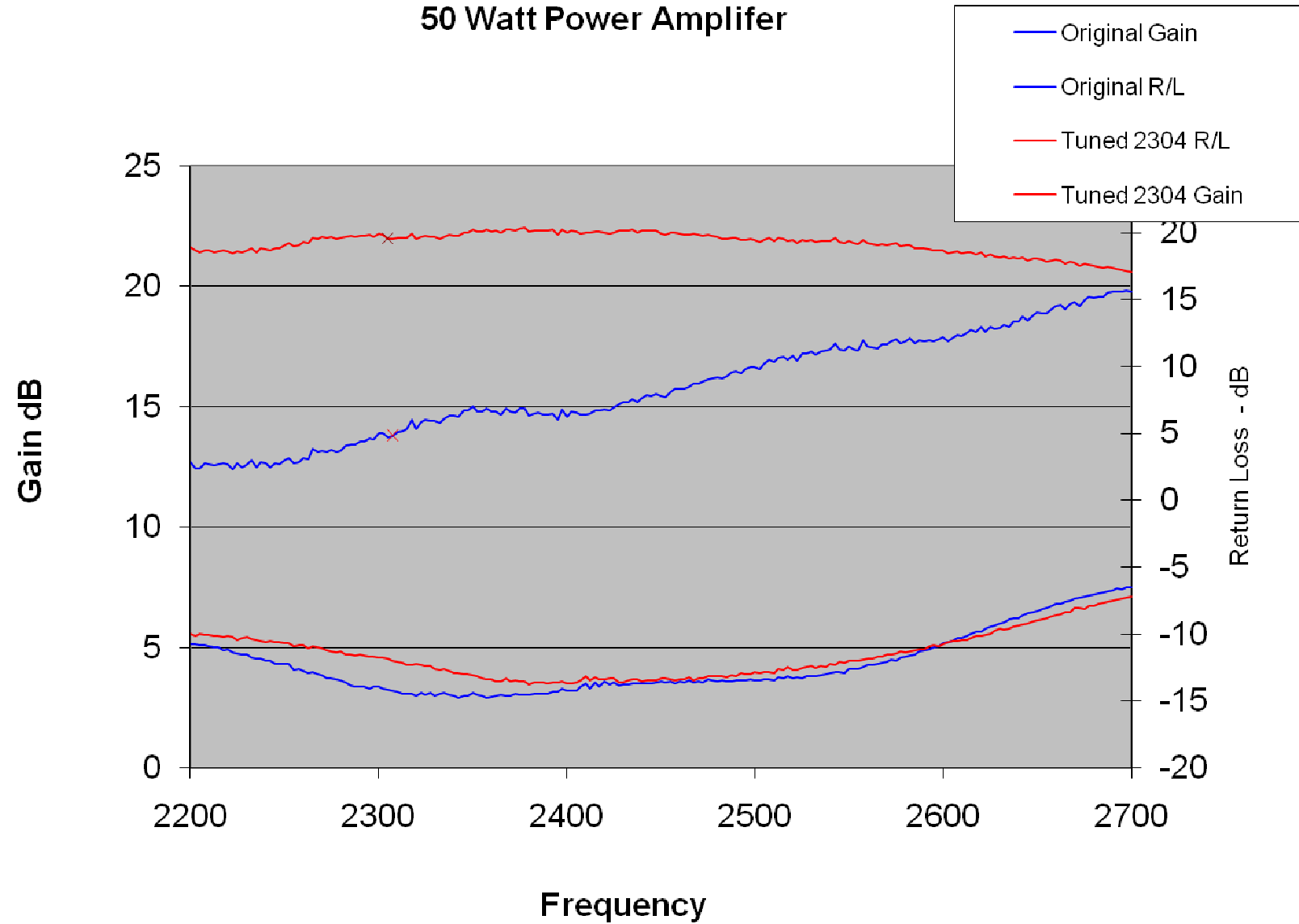
Retuned 10W 2304 Amplifier



50 Watt Power Amplifier

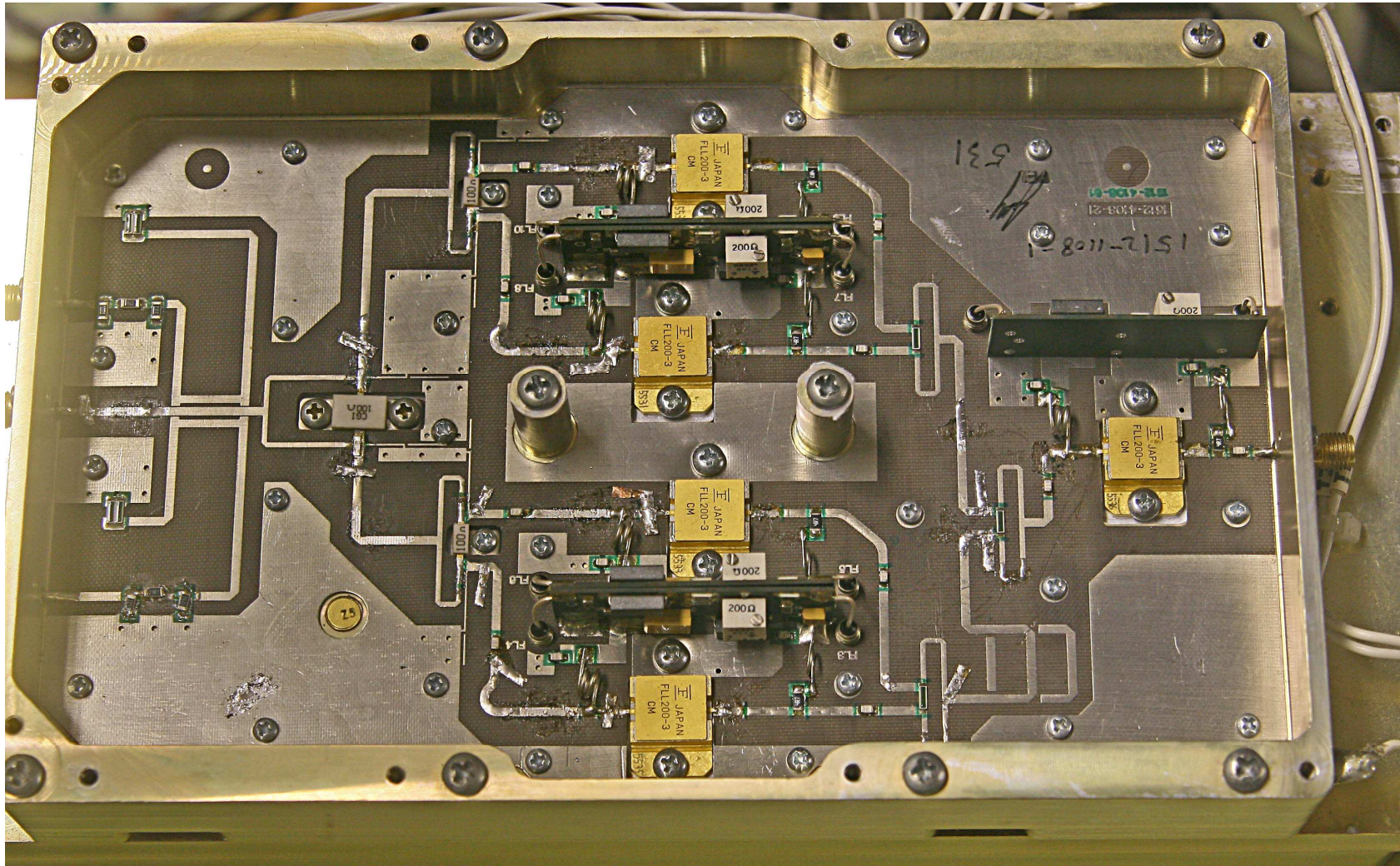
- 17-19 dB Gain, depending on Tuning
- -5V Bias required.
- 10V Drain Bias original design Class A
- Can be run at reduced bias for SSB.
- Needs tuning for best performance at 2304

50 Watt Power Amplifier



50 Watt 2304 Power Amplifier

Retuned to 2304

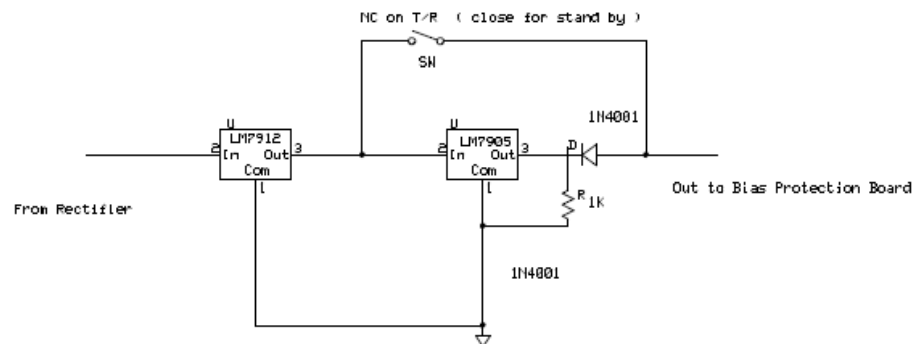


Combined Driver and Power Amplifier

TR Control

- Bias to power amplifiers needs to be increased during receive
- Add connector to rear panel for TR control
- Suggested circuit on next slide.

TR Bias modification



NOTES :

1. This change requires re-adjustment the bias for all amp. stages. This best done before hand to reduce the possibility of excessive drain current that can damage (destroy) the FET's typical gate voltage is 1 vdc, recommend increasing this 0.15 to 0.2 vdc before performing this mod to the bias supply. Which will result in almost the same gate voltage after this mod. It is also recommended that the drain current for each stage be checked after this change (0.245 vdc across test points)
2. This change results in the standby bias being about 2.3 vdc well within the max gate voltage

MMS Conversion

2304 Bias Standby

WA3YUE - B. Loss

Rev 1.0

9/1/2009

Inside Chassis

Behind front panel

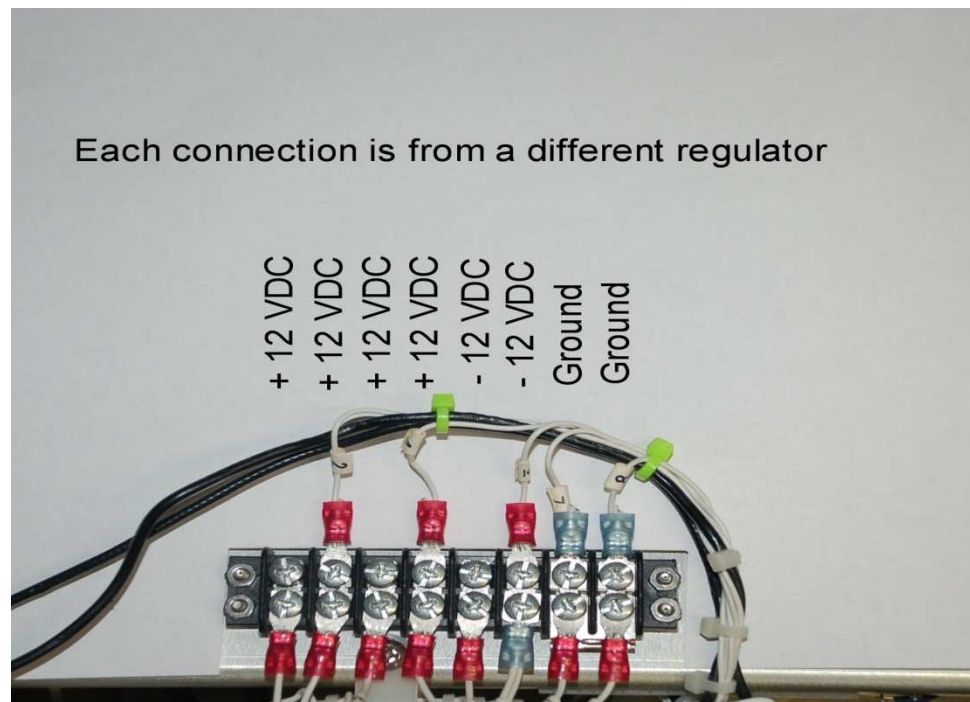


Most of the components in the middle of the chassis are Feedforward parts. These can be removed.

Power Supplies

- 12 V Power One supplies
- Voltage is dropped to about 10V for fet drain use with 2 large diodes.

DC Voltages available on top shelf after boards are removed.
Good for Installation of LNA from receiver, +/-12 is available
Bias protection board should be removed and installed with LNA



Weak Points

- High Current power supplies (under chassis) can fail. MOST failures are the rectifiers.
- Available from Mouser- PN 512-FEP16CT
- P-S PC board must be removed to replace parts.
- Feed through capacitors on amplifier DC connections are brittle, break off.

Be Careful

- Power supply board removed and ready for new rectifiers.



More Details to Follow

- Additional details will be provided and added to this document.
- Work is continuing on power amp bias, tuning and cascade of stages.
- Pictures will be available of complete converted units.