



2N2/20

**A 20-Meter Discrete Component
CW Transceiver built
Manhattan-style**

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Discussion Topics

- **Background**
- **Transceiver Features and Performance**
- **Design Overview**
- **Construction Overview**
- **Q and A in remaining time**





Background

- **2N2/20 derived from 2N2/30**
- **Overcomes weak areas in original 2N2/40 design**
 - **2N2222 contest constraints removed**
 - **New circuits for RF T-R, RF Amp, Mixers, Xtal Filter, Audio Preamp, Rx Mute, & Final Amplifier**
 - **Revised circuits for VFO, Rx Mixer Amp, & IF Amp/Roofing Filter**
- **Project driven by builder interest**





Features and Performance

● Receiver

- **Electronic attenuator/T-R switch**
- **Double-tuned input filter - 400 KHz BW**
- **“Noiseless” Norton RF Amp**
- **Commercial level 7 DBM**
- **4+2 pole crystal filters ~ 500 Hz BW**
- **JFET audio mute**
- **3 audio stages**
- **Varicap tuned VFO - drift < 200 Hz**
- **RIT**





Features and Performance

- **Receiver (continued)**
 - **Sensitivity (MDS) = -130 dBm**
 - **Blocking Dynamic Range = 107 dB**
 - **Intermod Dynamic Range = 99 dB**
 - **3rd Order Intercept (IP3in) = 16 dB**
 - **IF Rejection = 91 dB**
 - **Image Rejection = 73 dB**
 - **Opposite Sideband Rejection = 75 dB**
 - **Rx Current = 185 ma**





Features and Performance

● Transmit

- **Commercial level 7 DBM**
- **Double-tuned Cascode RF Amp**
- **2SC2166 Final Transistor**
- **Settable Output Power - 7 Watts Max**
- **Spurious Output < -50 dBc**
- **Solid State QSK Keying**
- **Tx Current = 735 ma (3.5 watts output)**

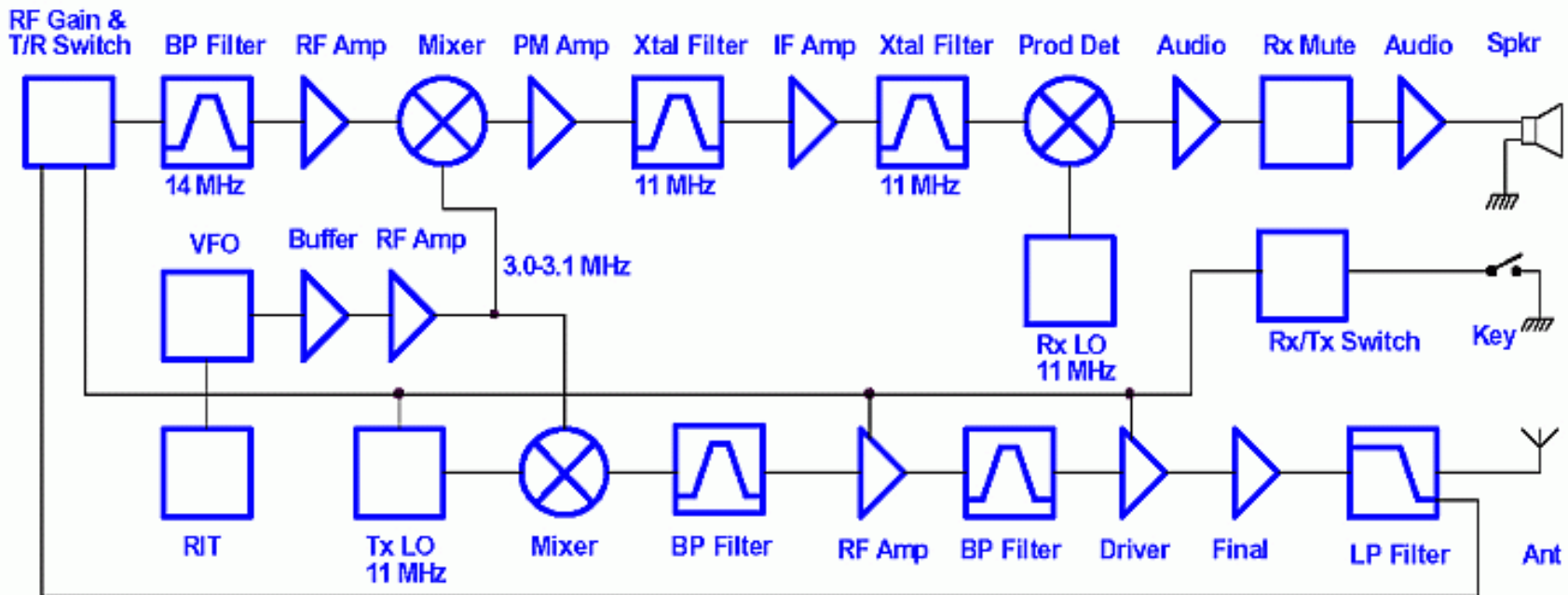




Design Overview

2N2/20 Block Diagram

Receive Strip



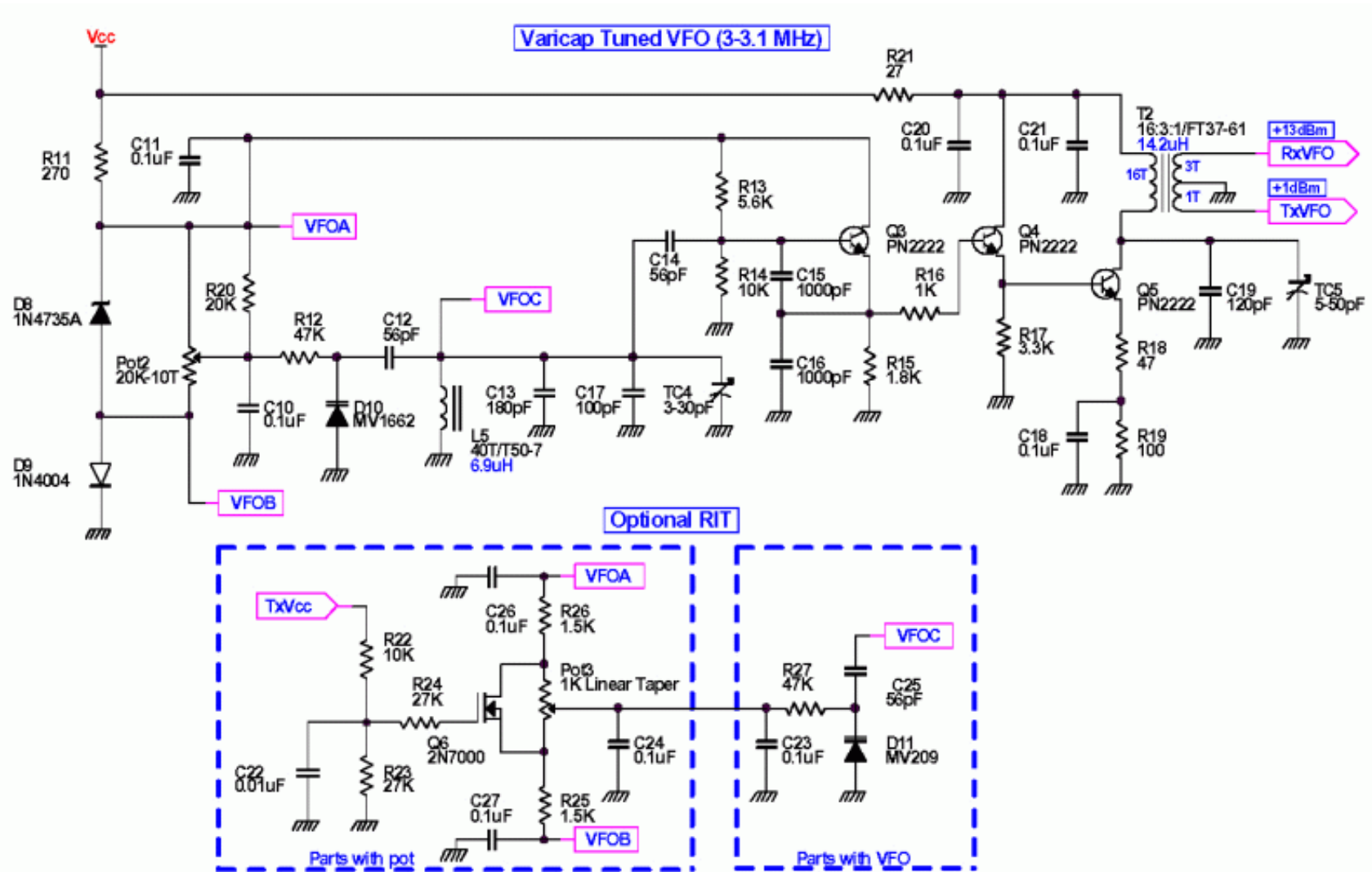
Transmit Strip

Jim Kortge, K8IQY
Mar 8, 2005 - Sheet D1





VFO Schematic





VFO Output Spectrum

2N2/20 VFO Output
REF 14.0 dBm
10dB/

ATT 10 dB

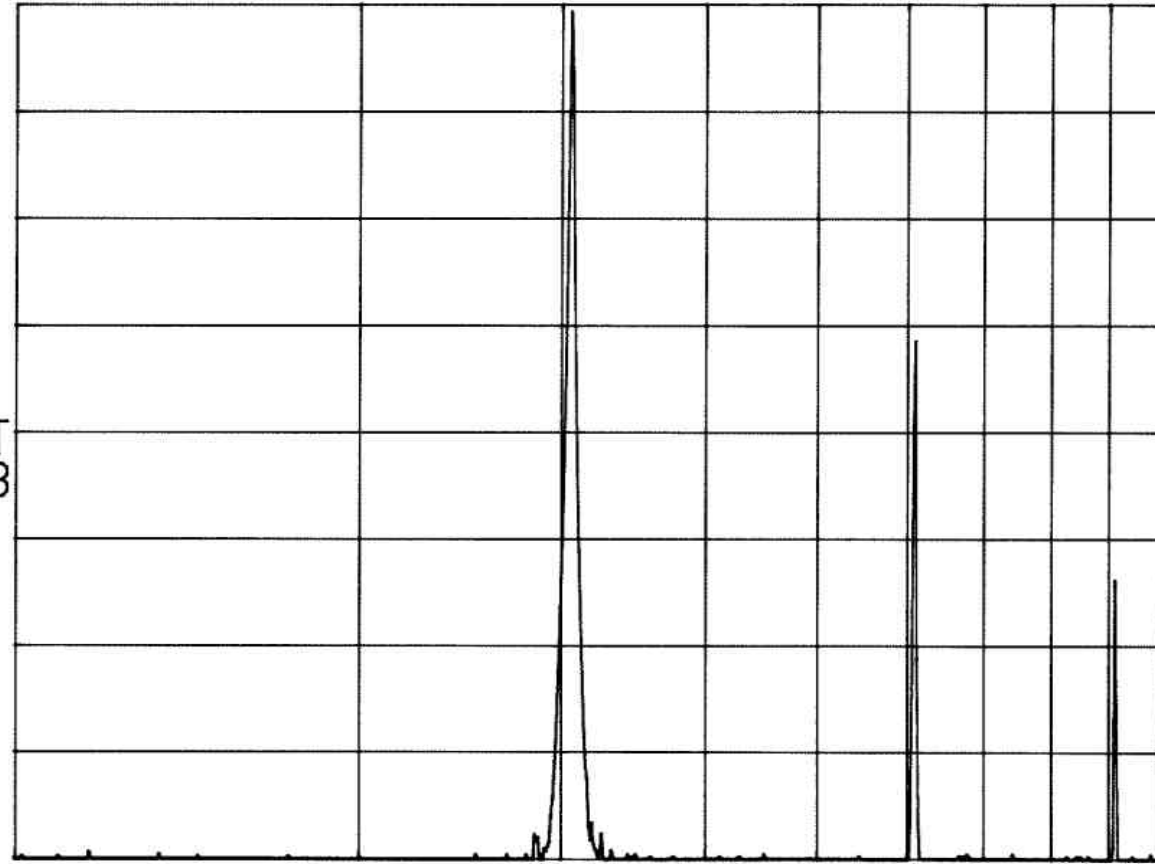
A_view B_blank

REF OFST
20.0 dB

RBW
10 kHz

VBW
10 kHz

SWP
200 ms

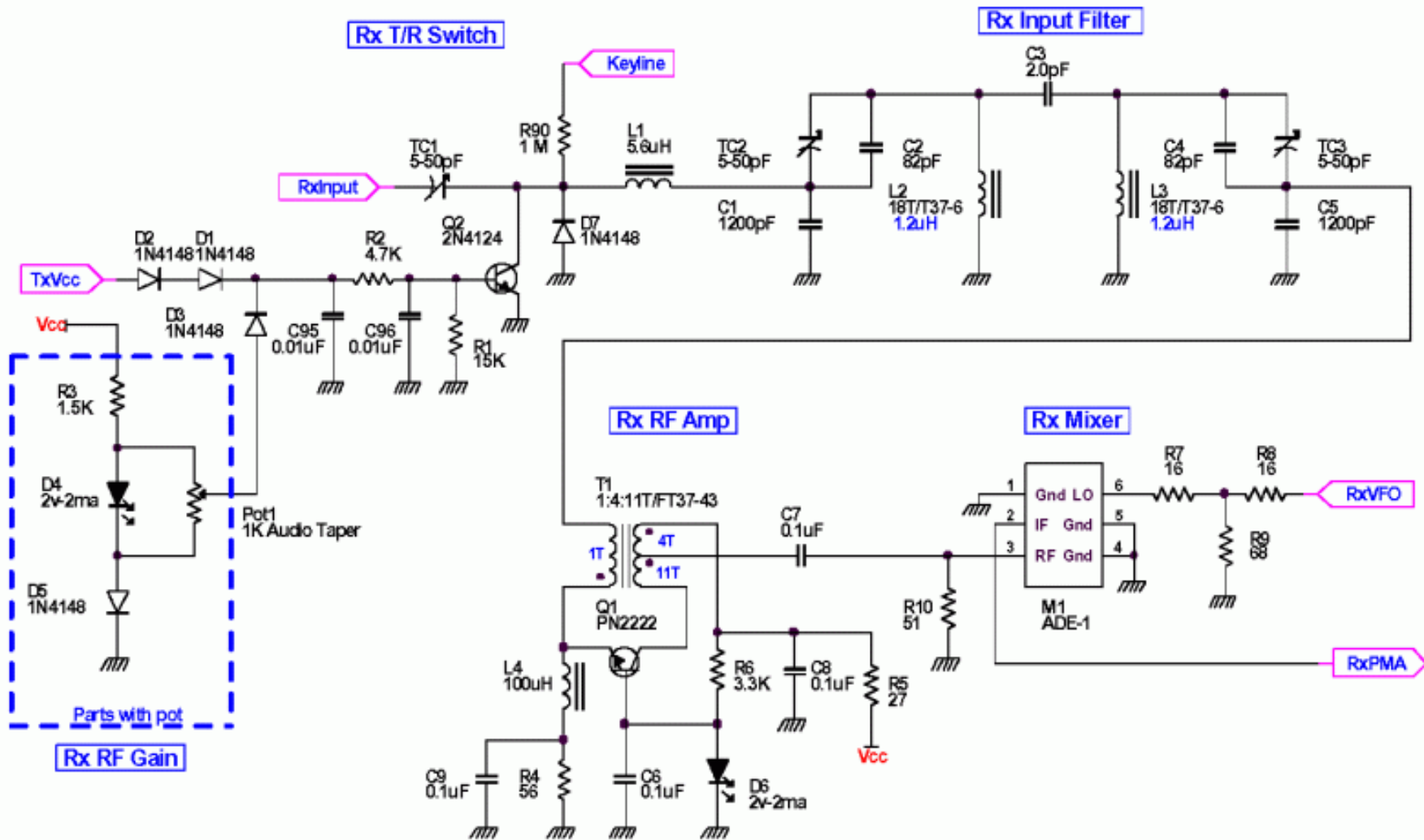


START 1 MHz

STOP 10 MHz

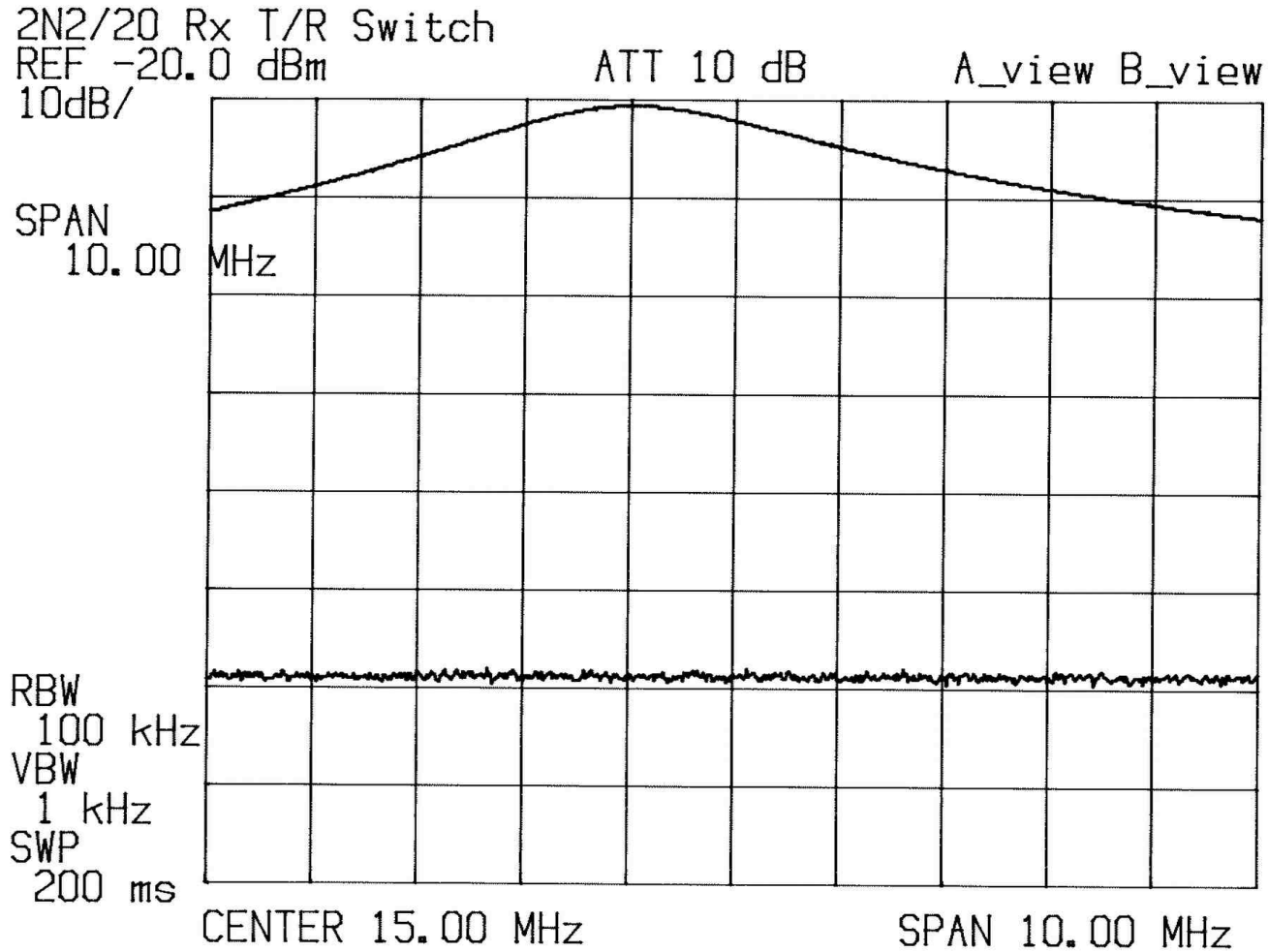


Rx Input Stages



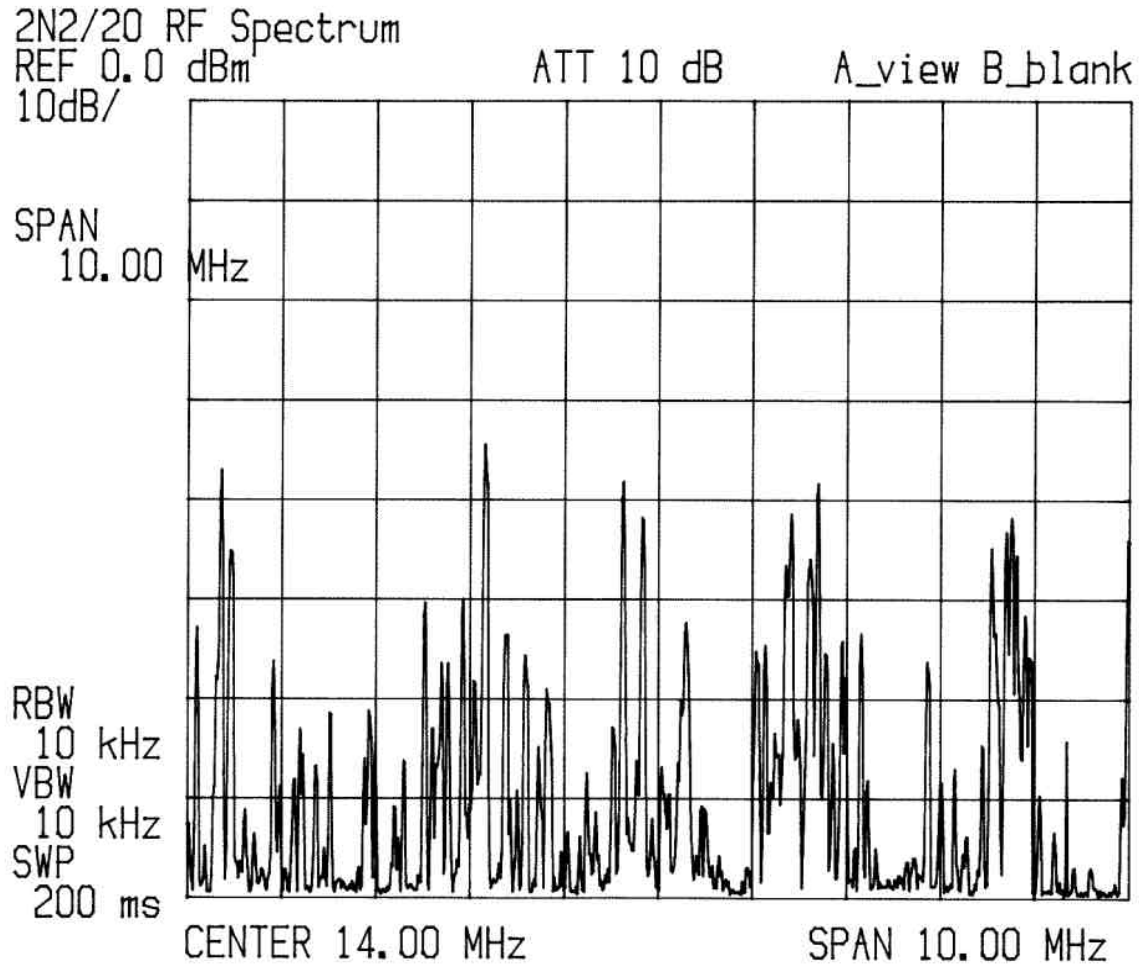


RF Gain/T-R Switch Resp



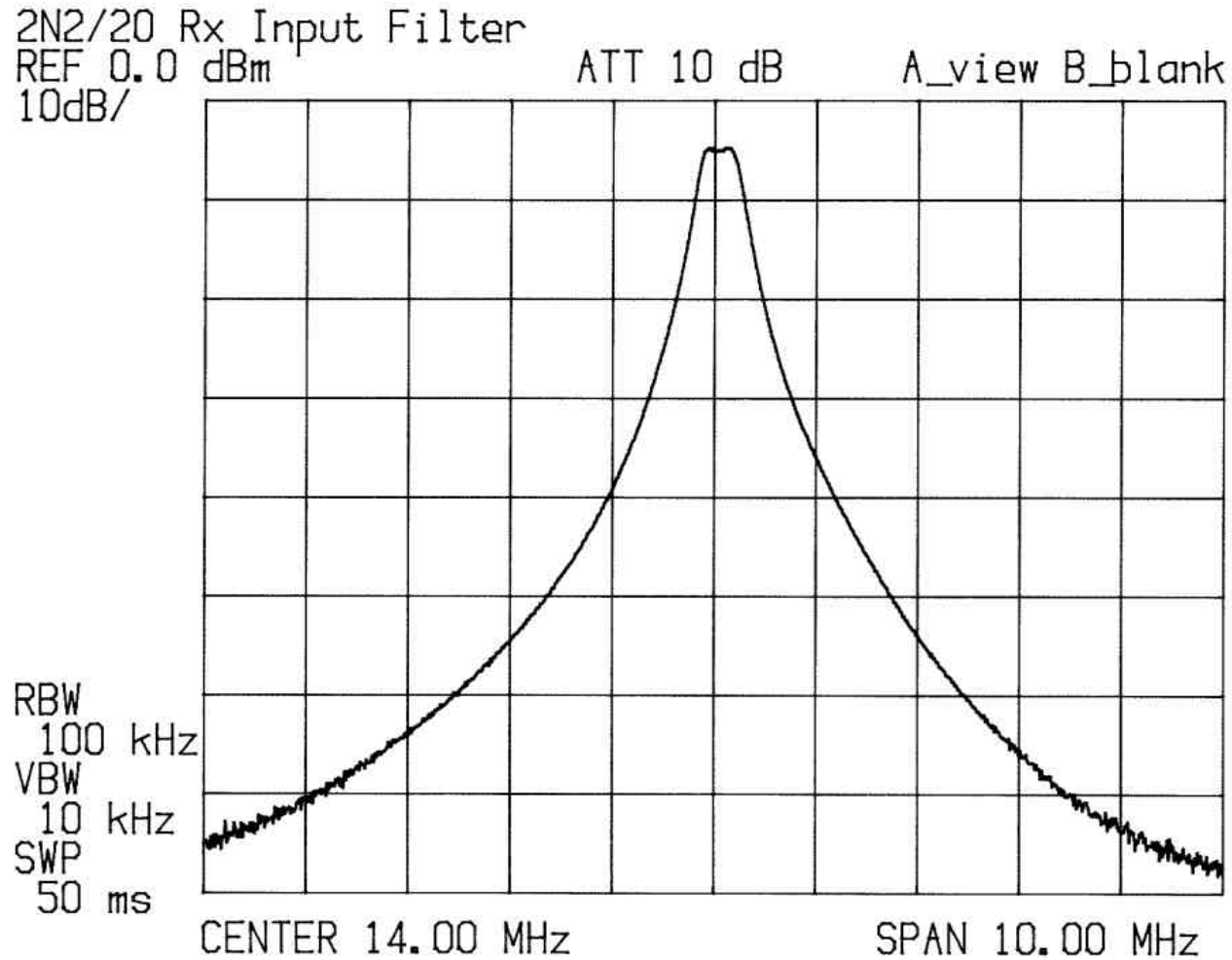


20 Meter RF Spectrum



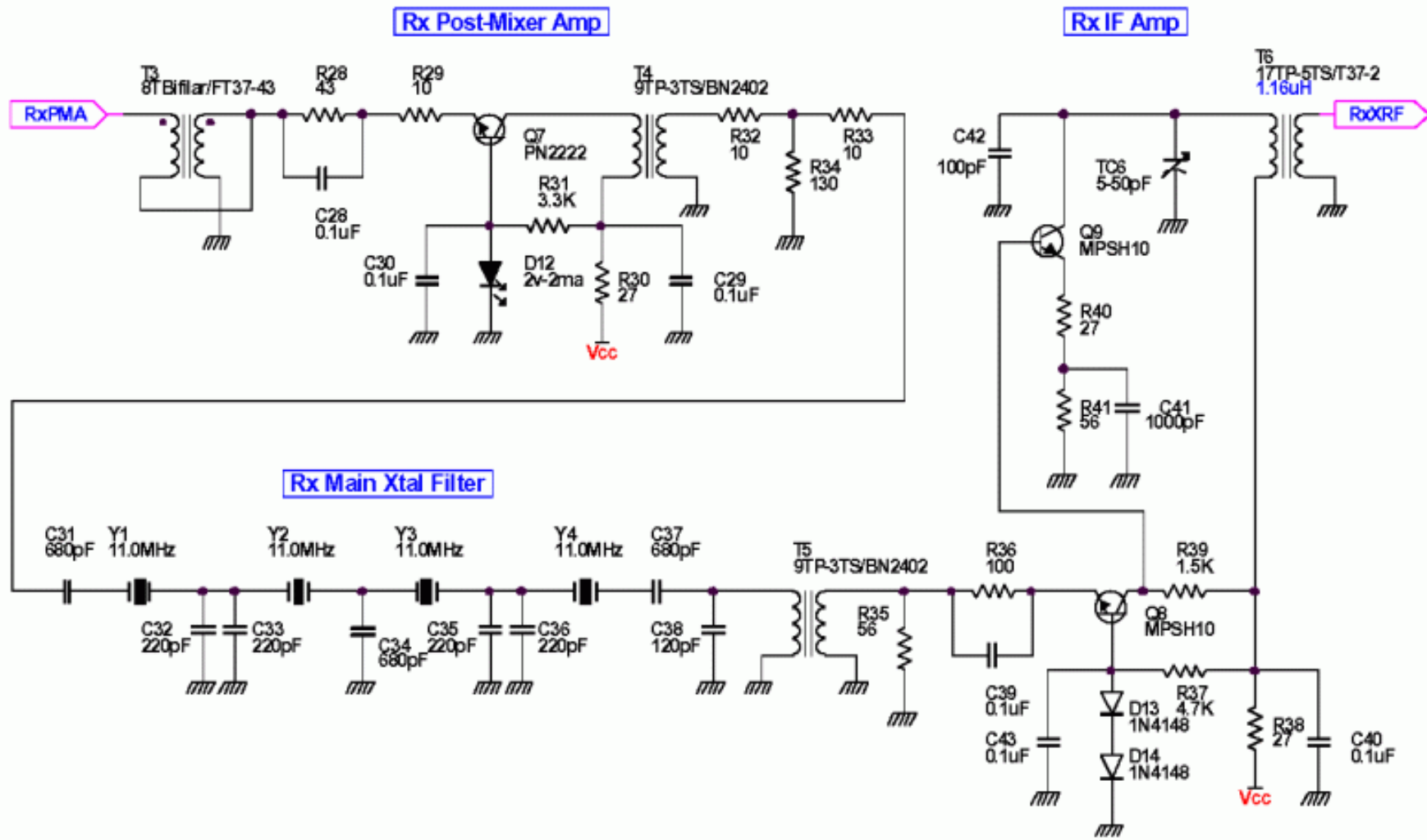


Input BP Filter Response



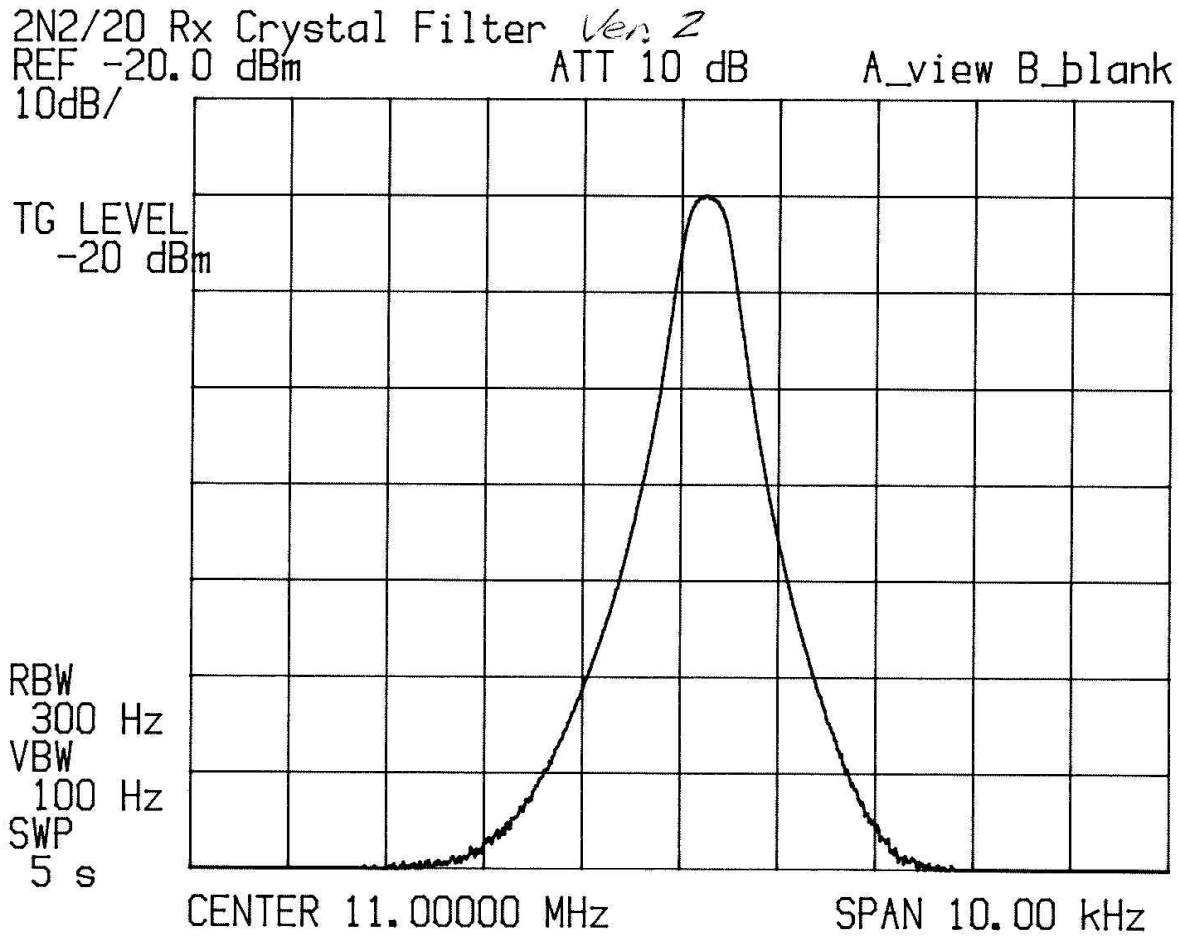


Rx IF Stages



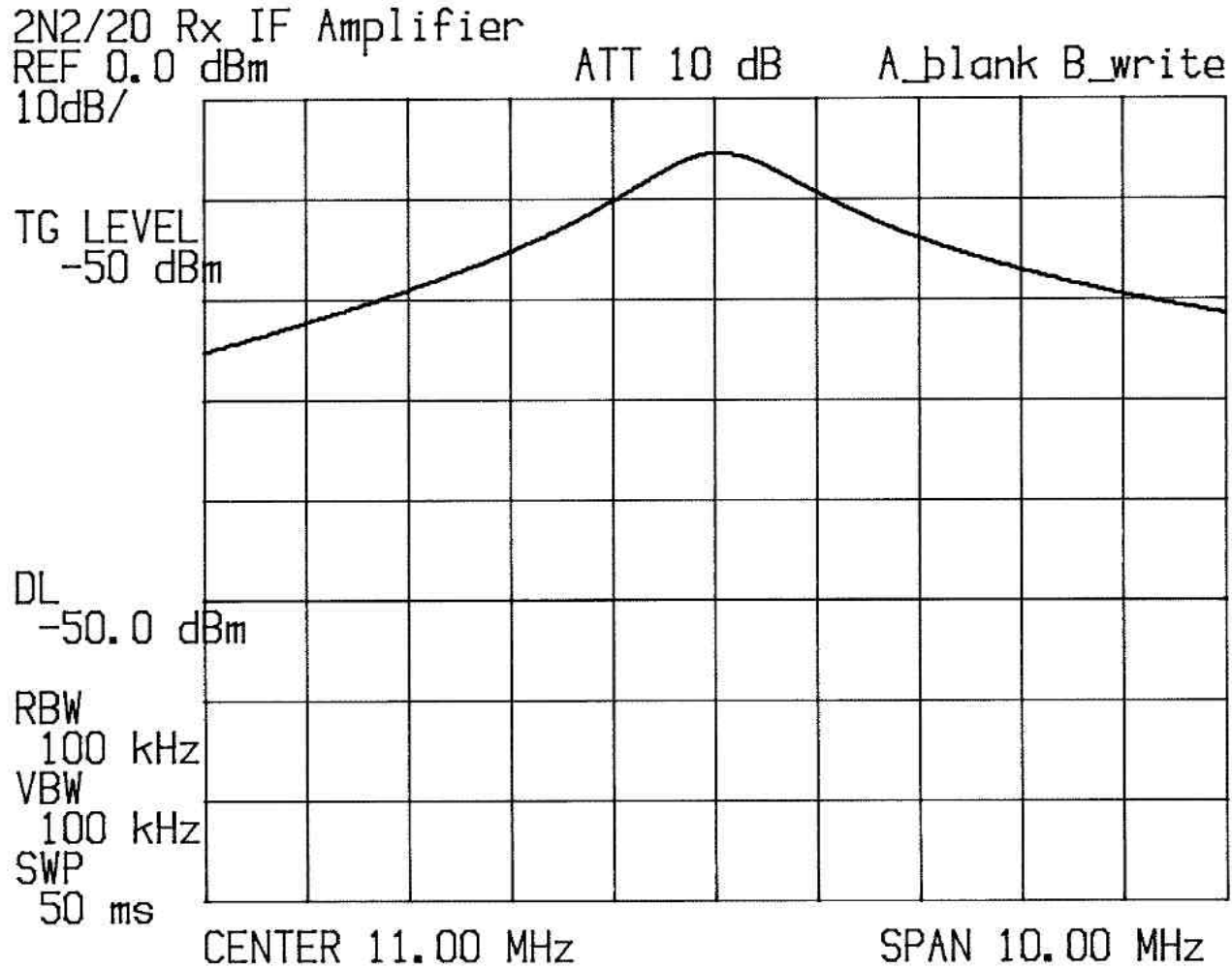


Main Xtal Filter Resp

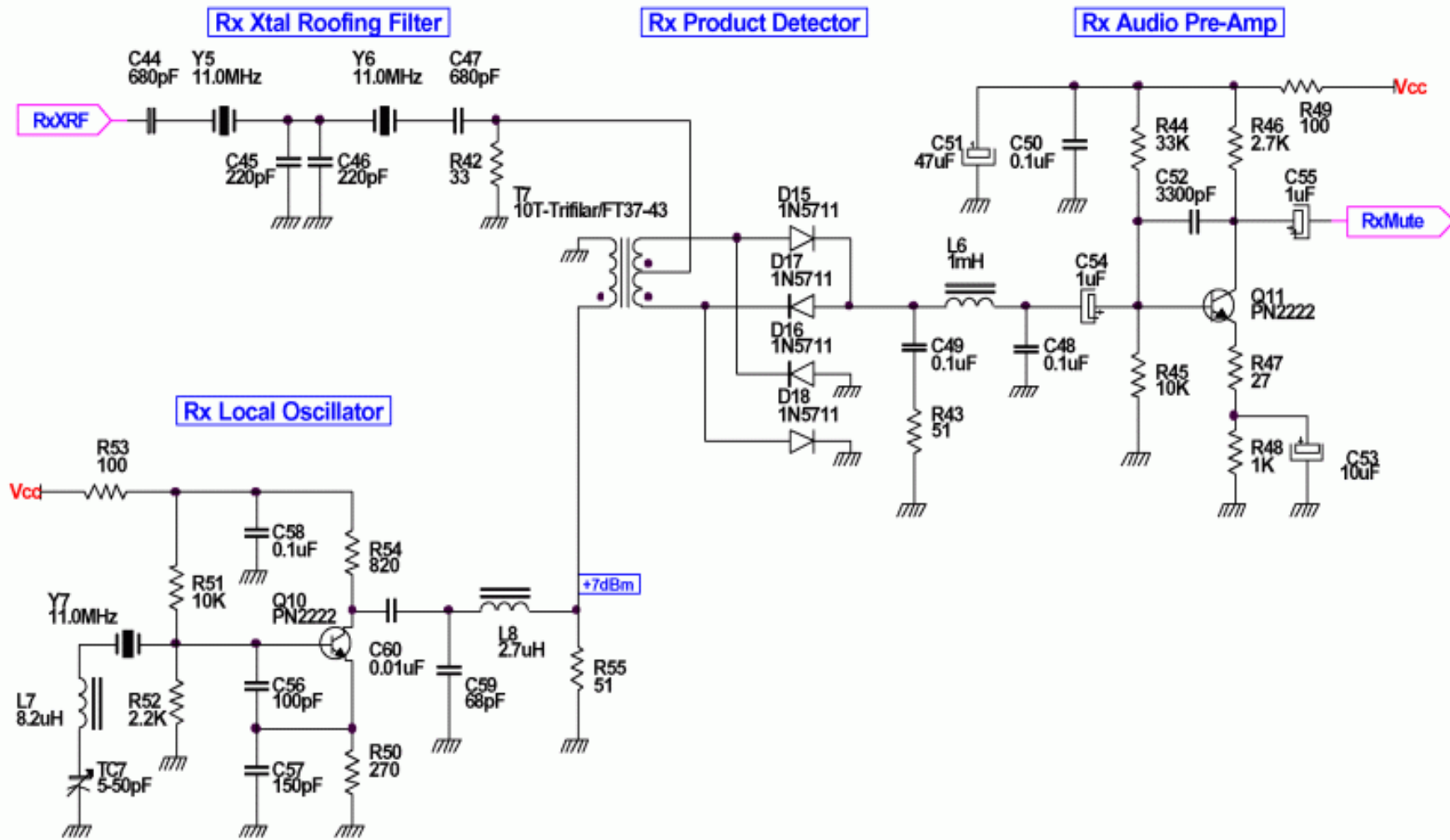




IF Amp Resp

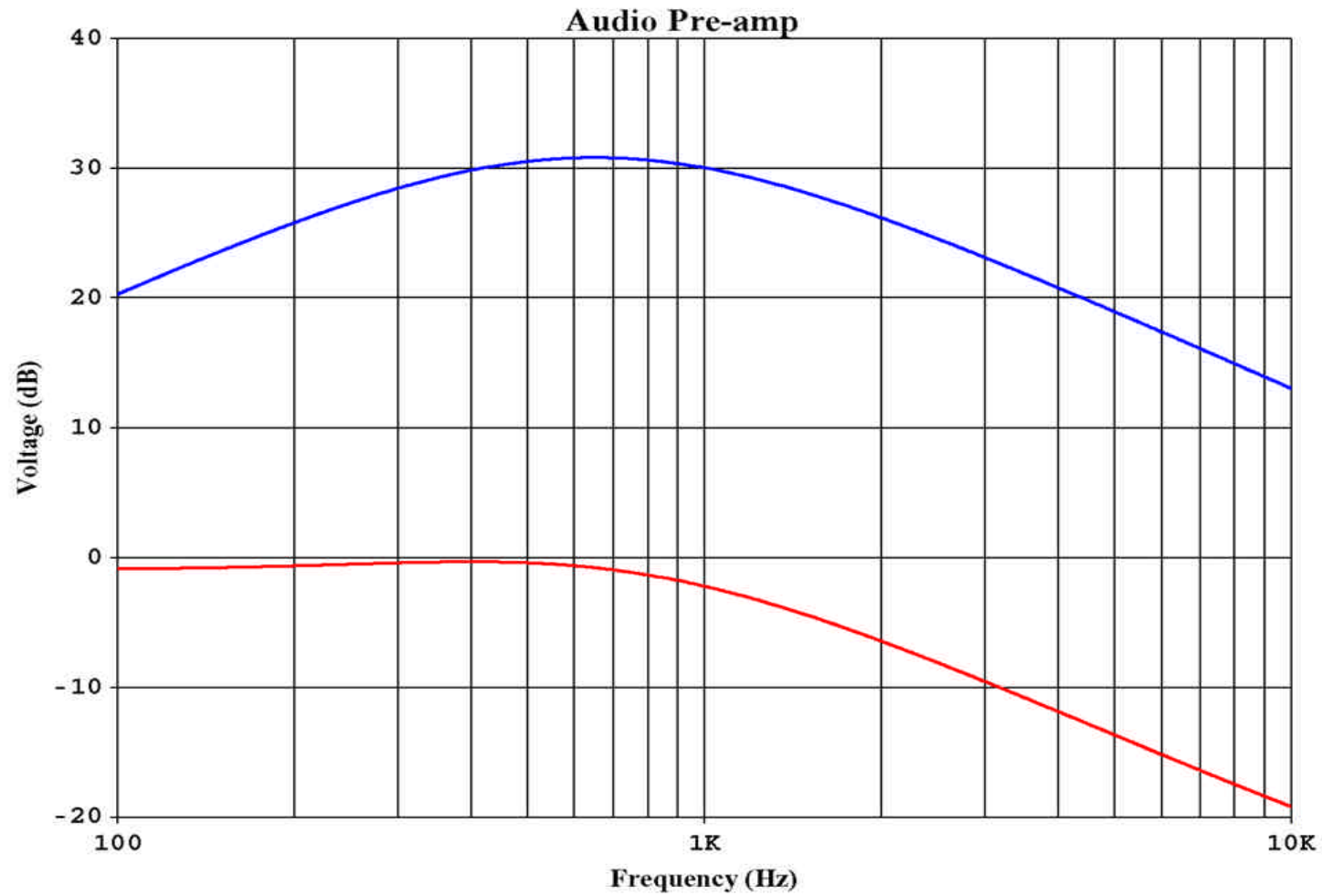


Rx Audio Recovery Stages



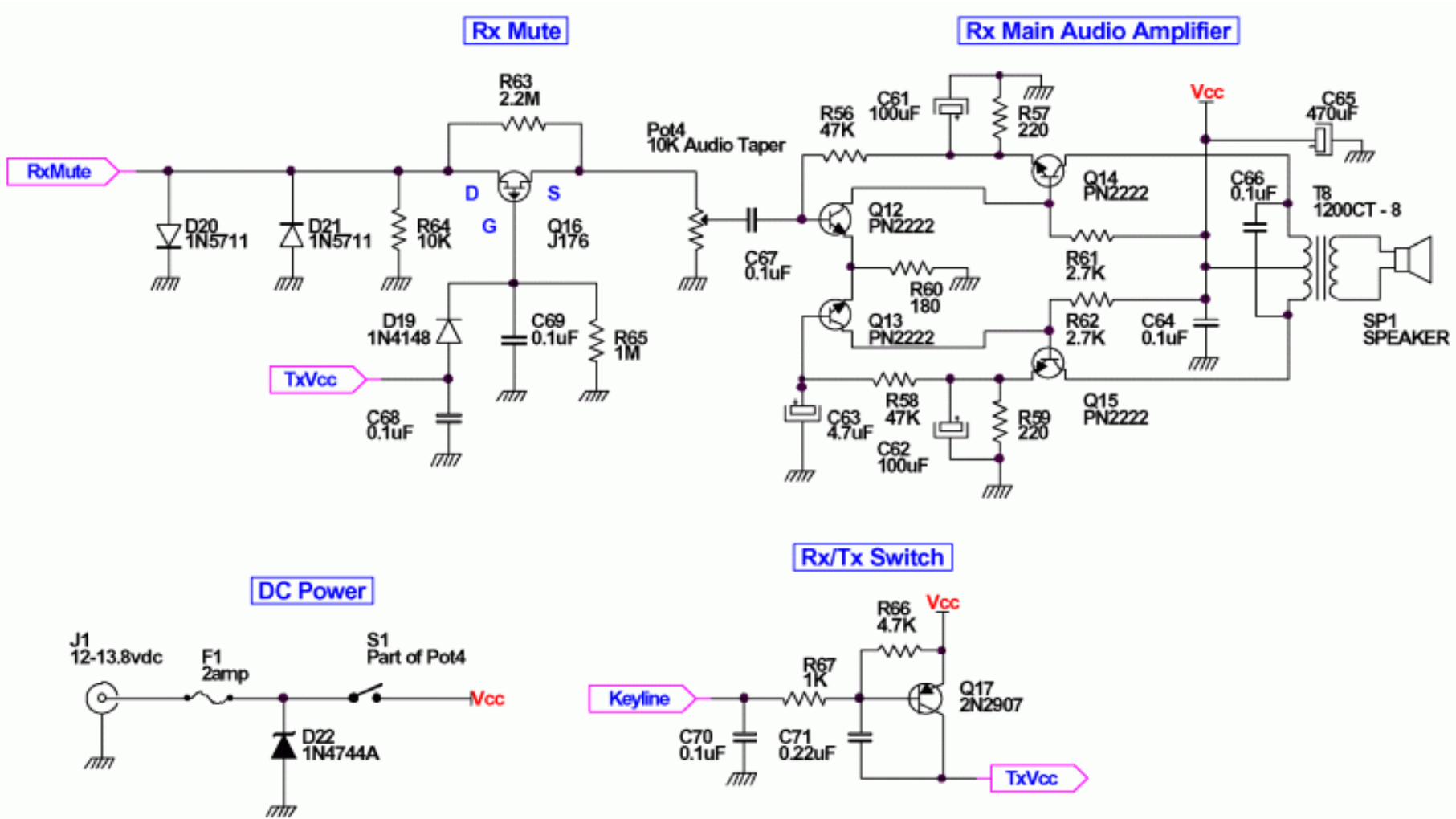


Audio Preamp Res



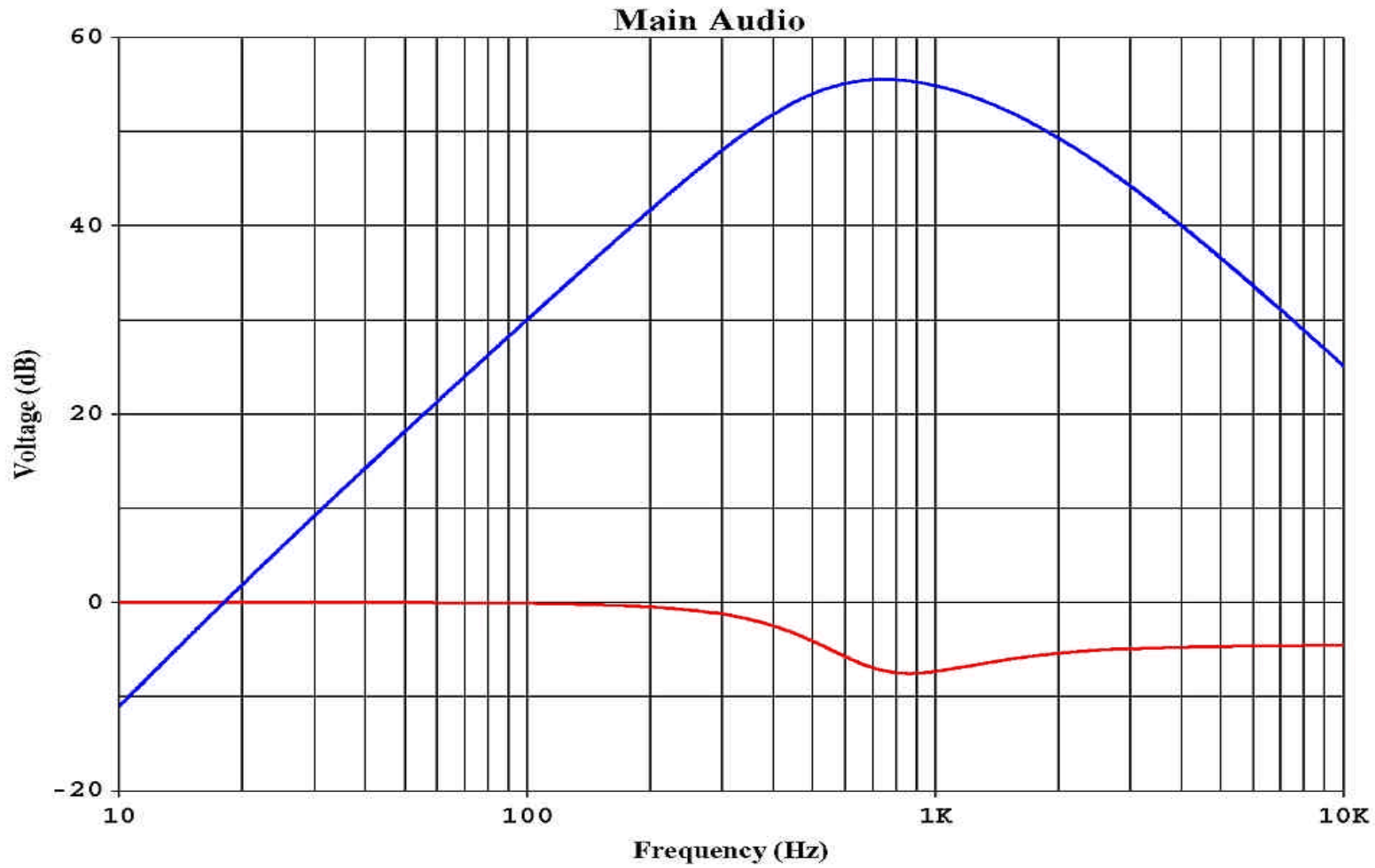


Rx Audio Stages

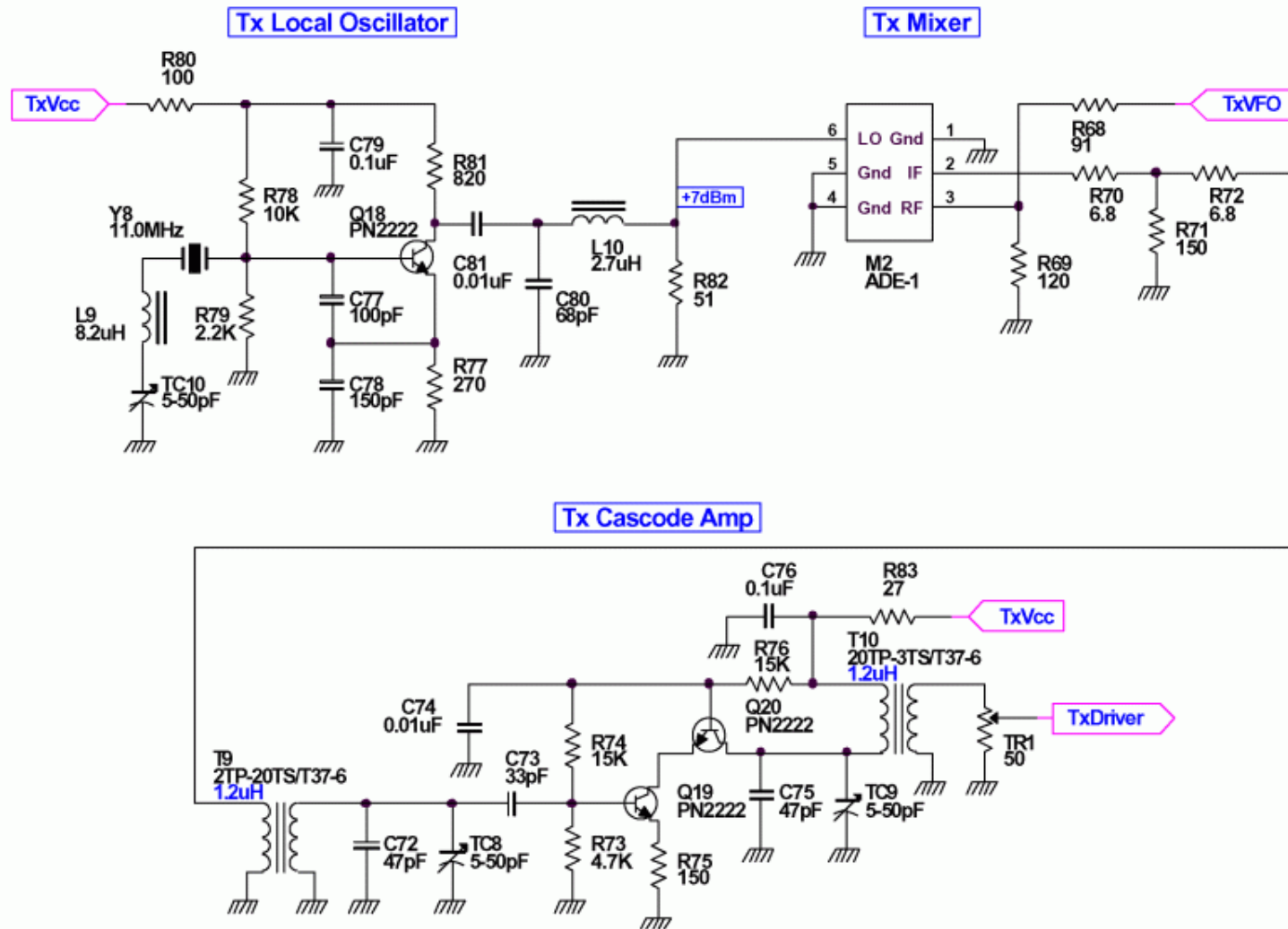




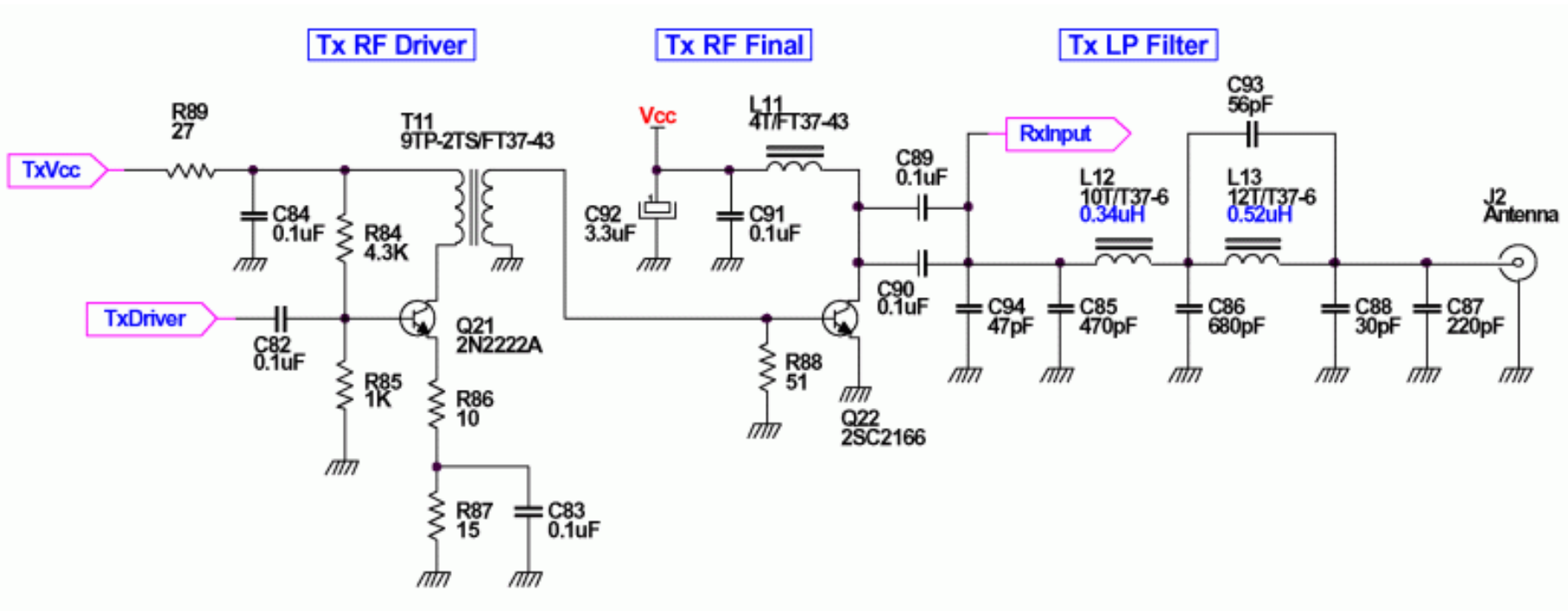
Main Audio Amp Resp



Tx Low Level Signal Stages



Tx High Level Signal Stages





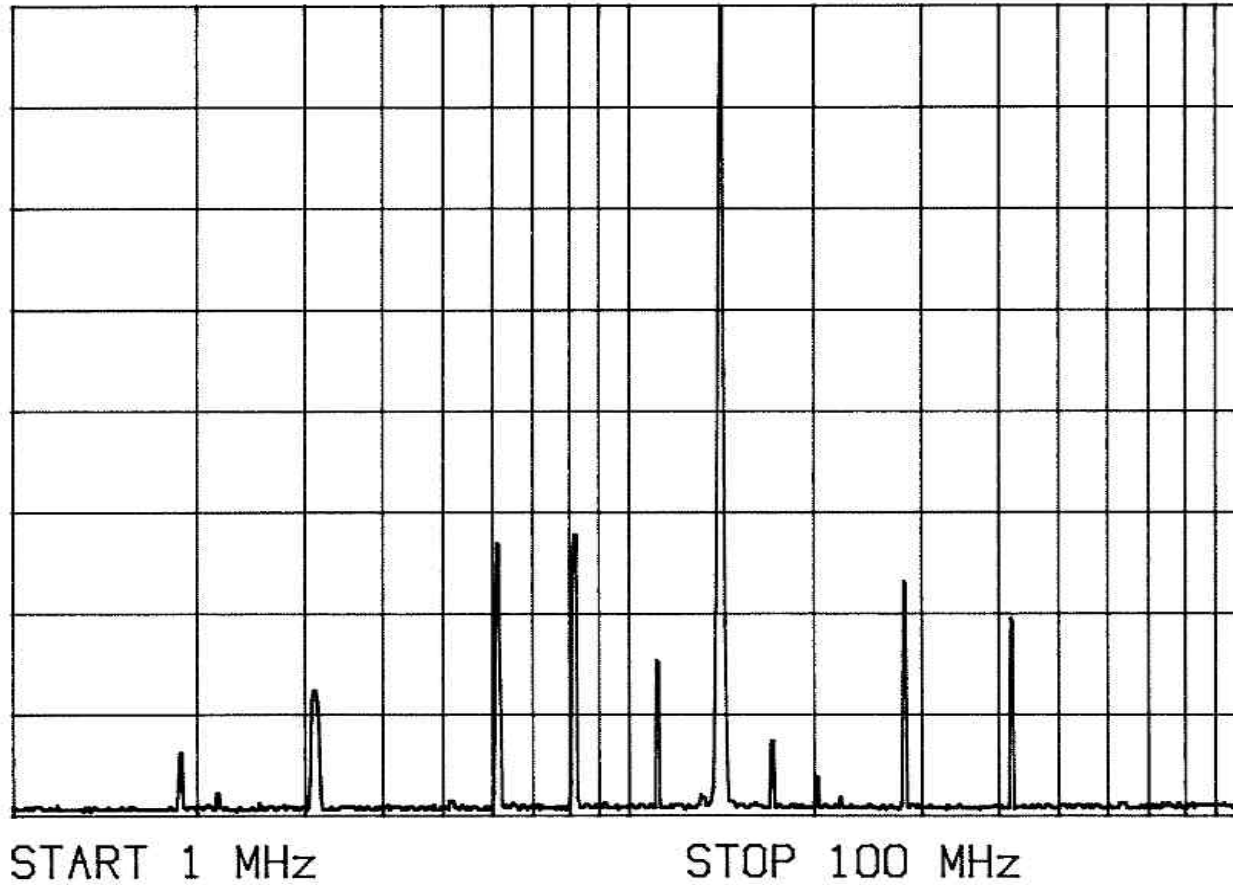
Tx Output Spectrum

2N2/20 Tx Output = 4 Watts
REF 0.0 dBm
10dB/

ATT 10 dB

A_view B_blank

RBW
30 kHz
VBW
10 kHz
SWP
1.4 s





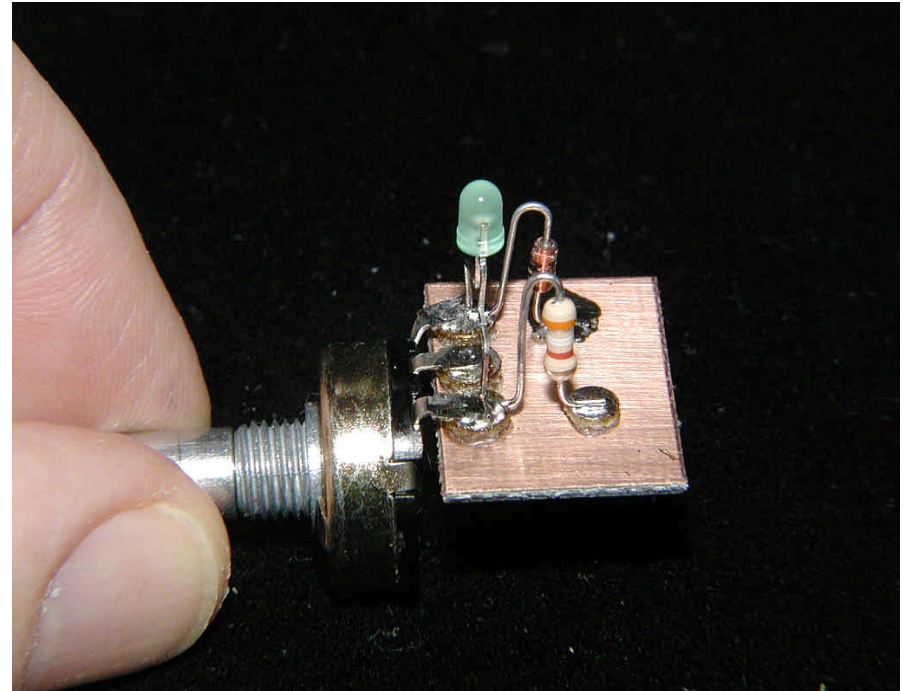
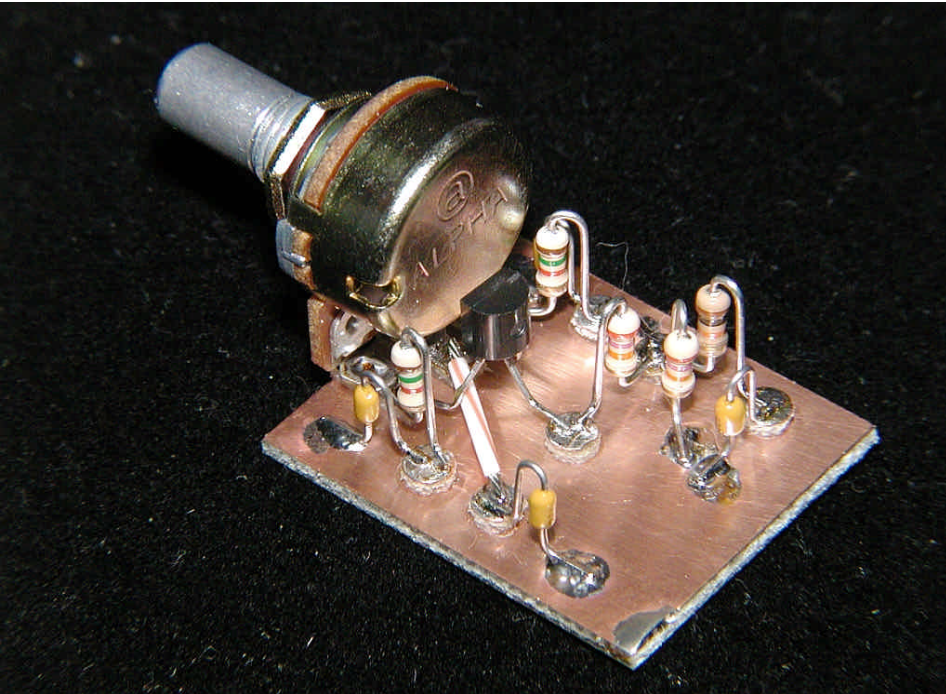
Construction Overview

- Manhattan-style construction
- 5 X 7 inch substrate footprint
- Sub-modules used where advantageous
- Custom case
- KD1JV frequency readout
- Digital photo documentation



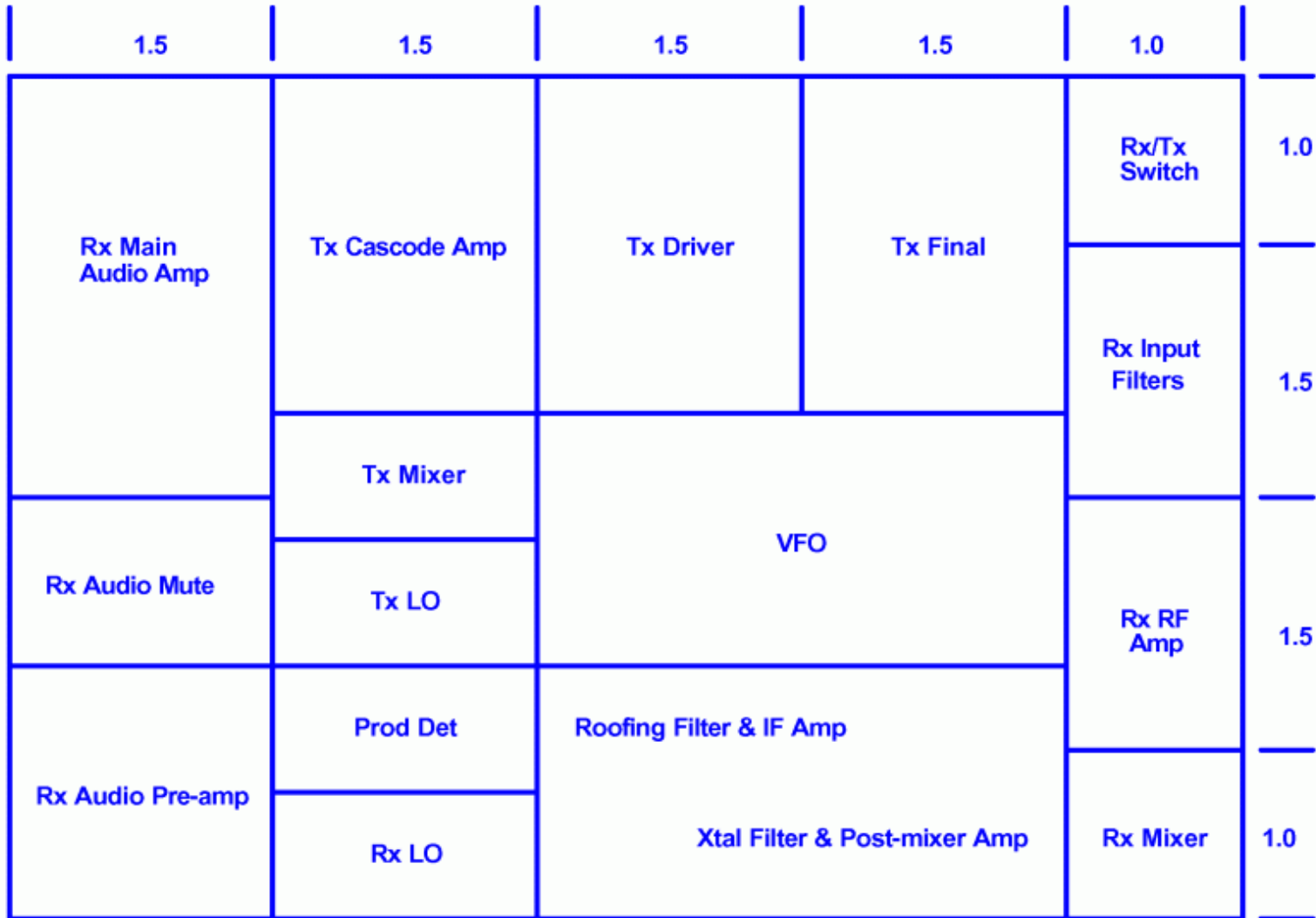


RIT & RF Gain Modules





Substrate Layout





VFO





Rx/Tx Switch - DBM

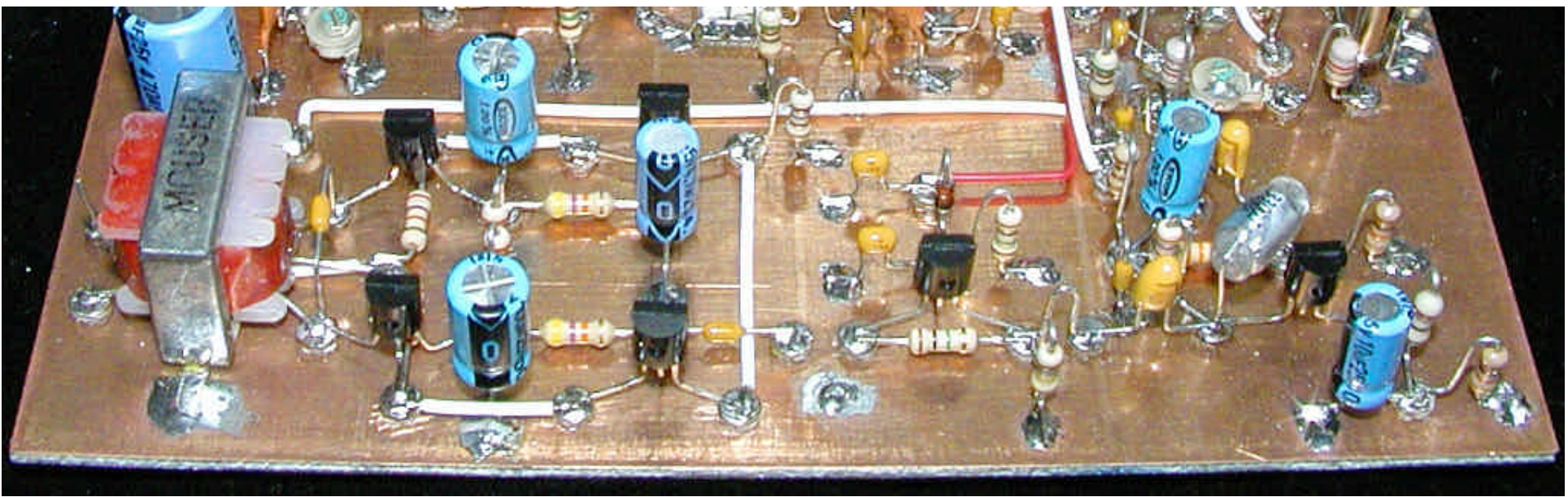




PM Amp – Prod Det



Audio Preamp – Main Amp



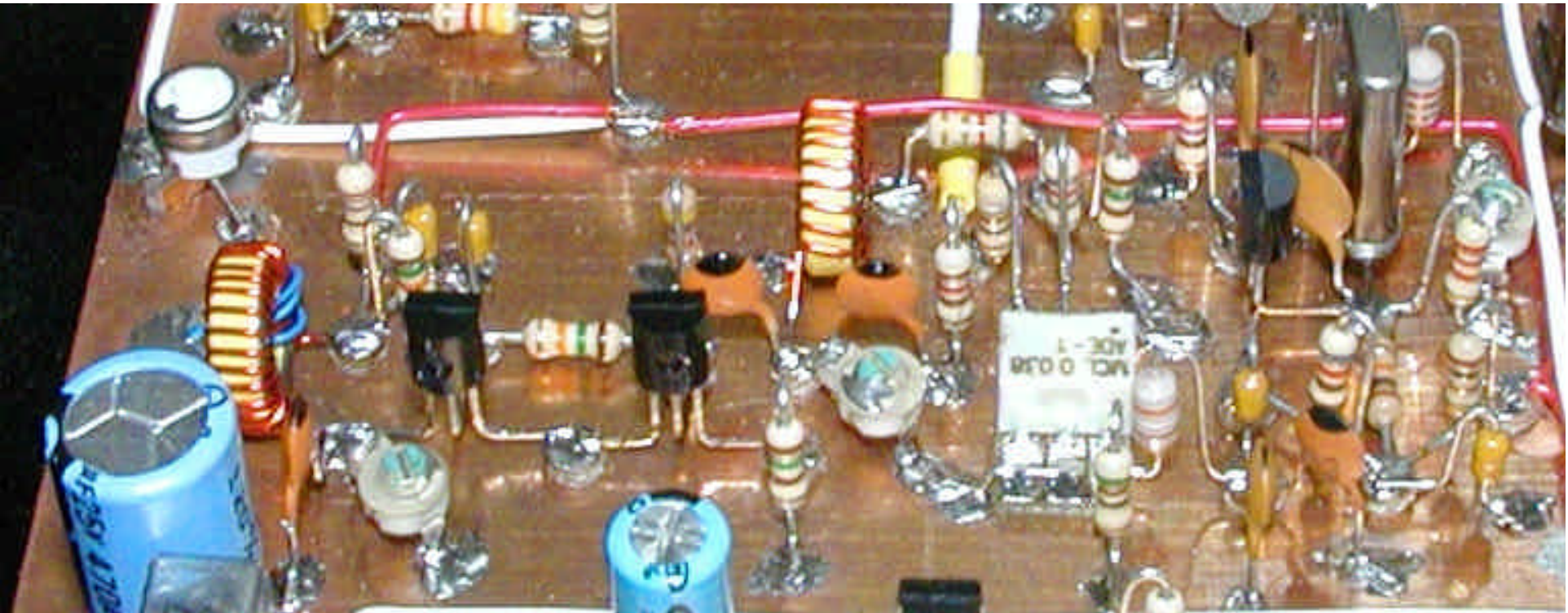


Receiver Overall



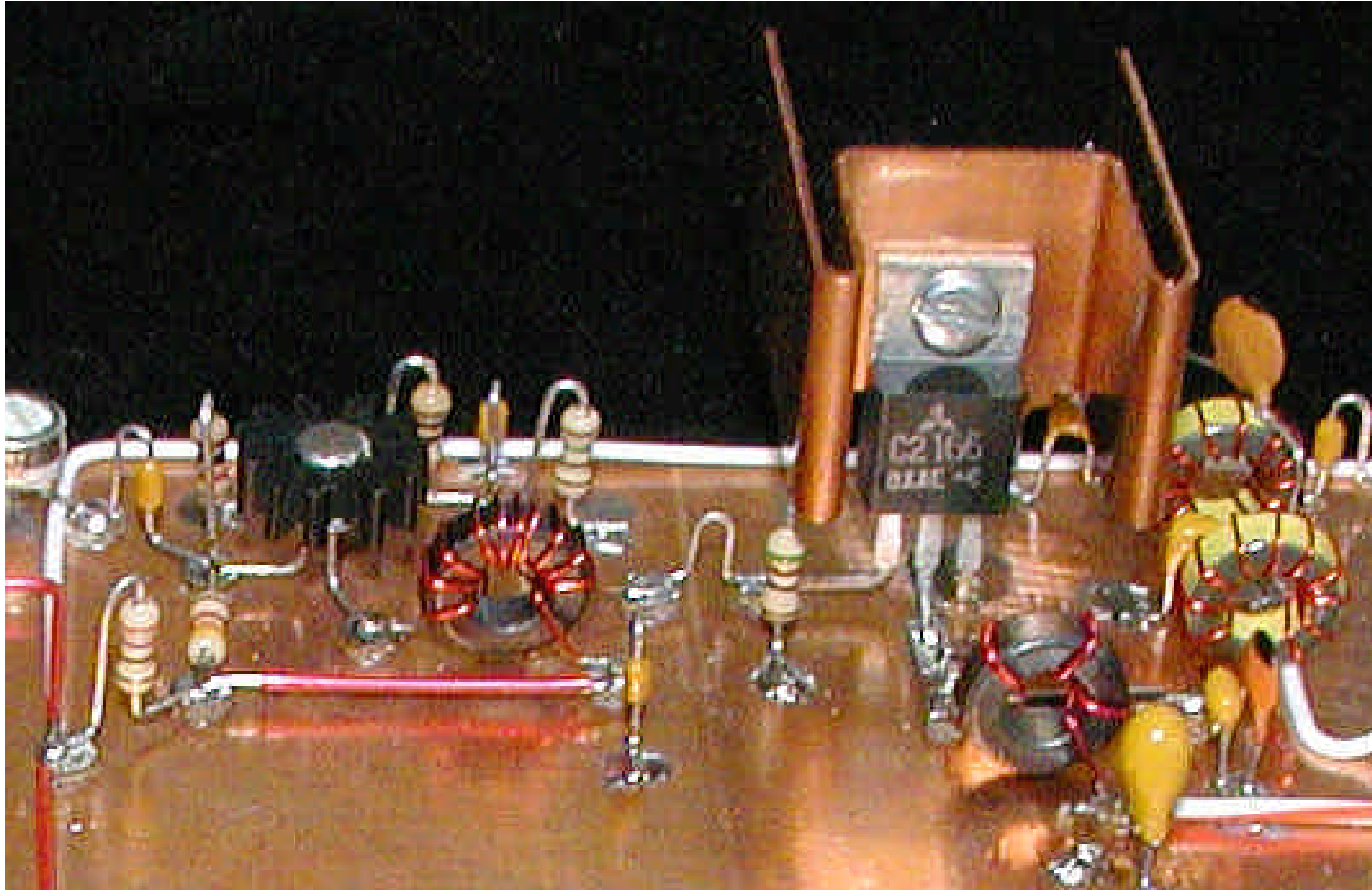


Tx LO - Cascode Amp



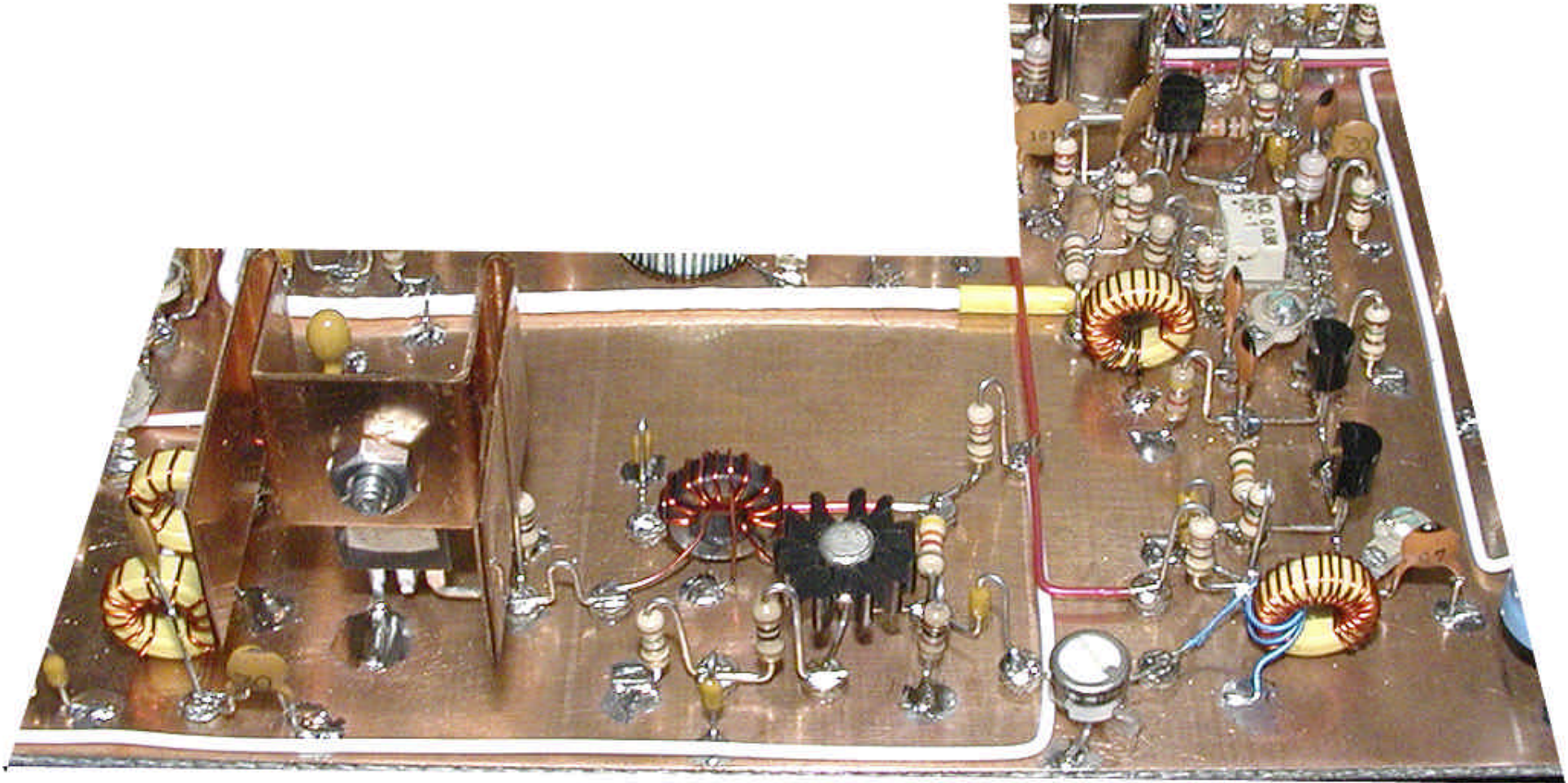


Driver - LP Filter

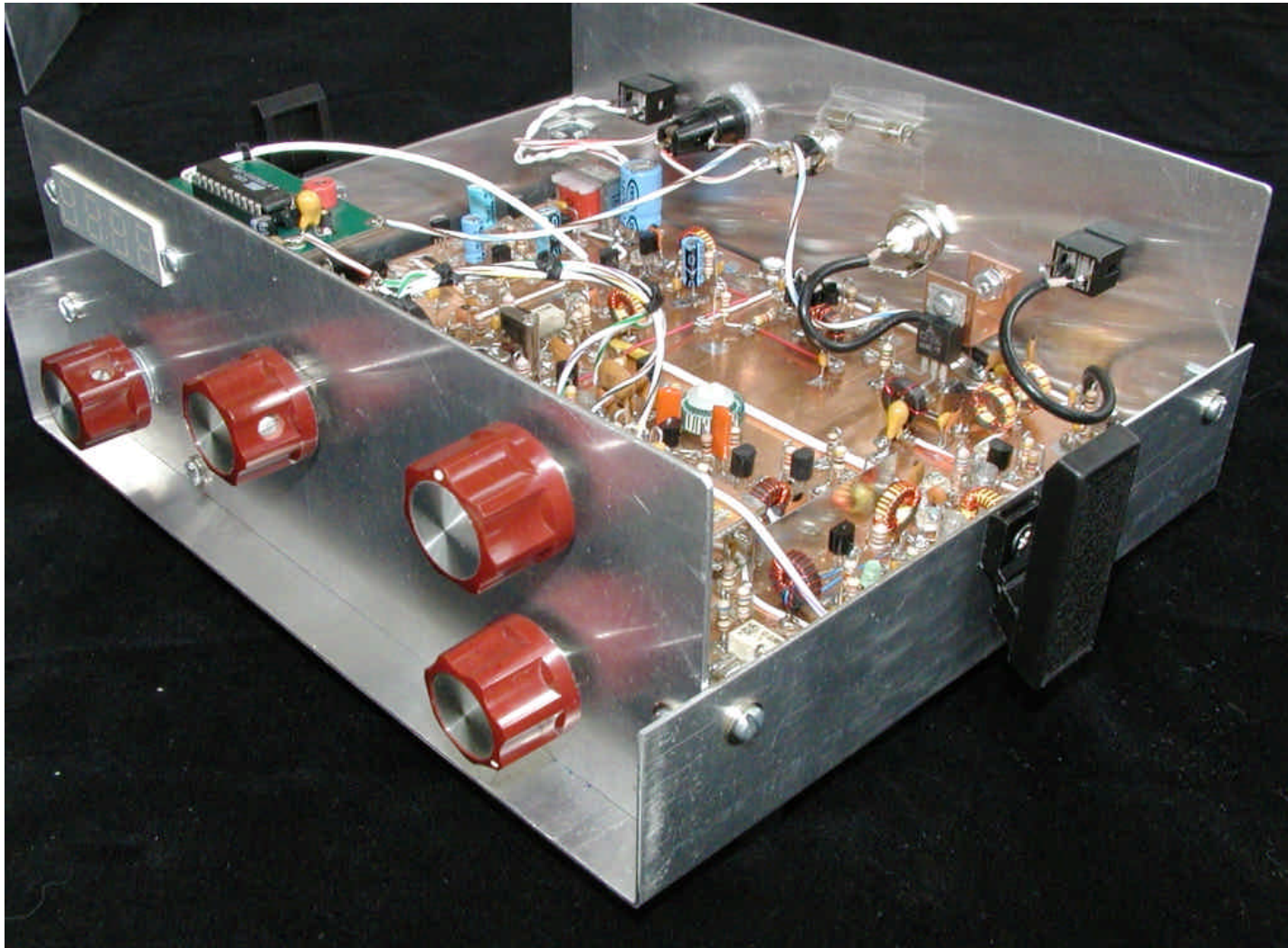




Transmitter Overall

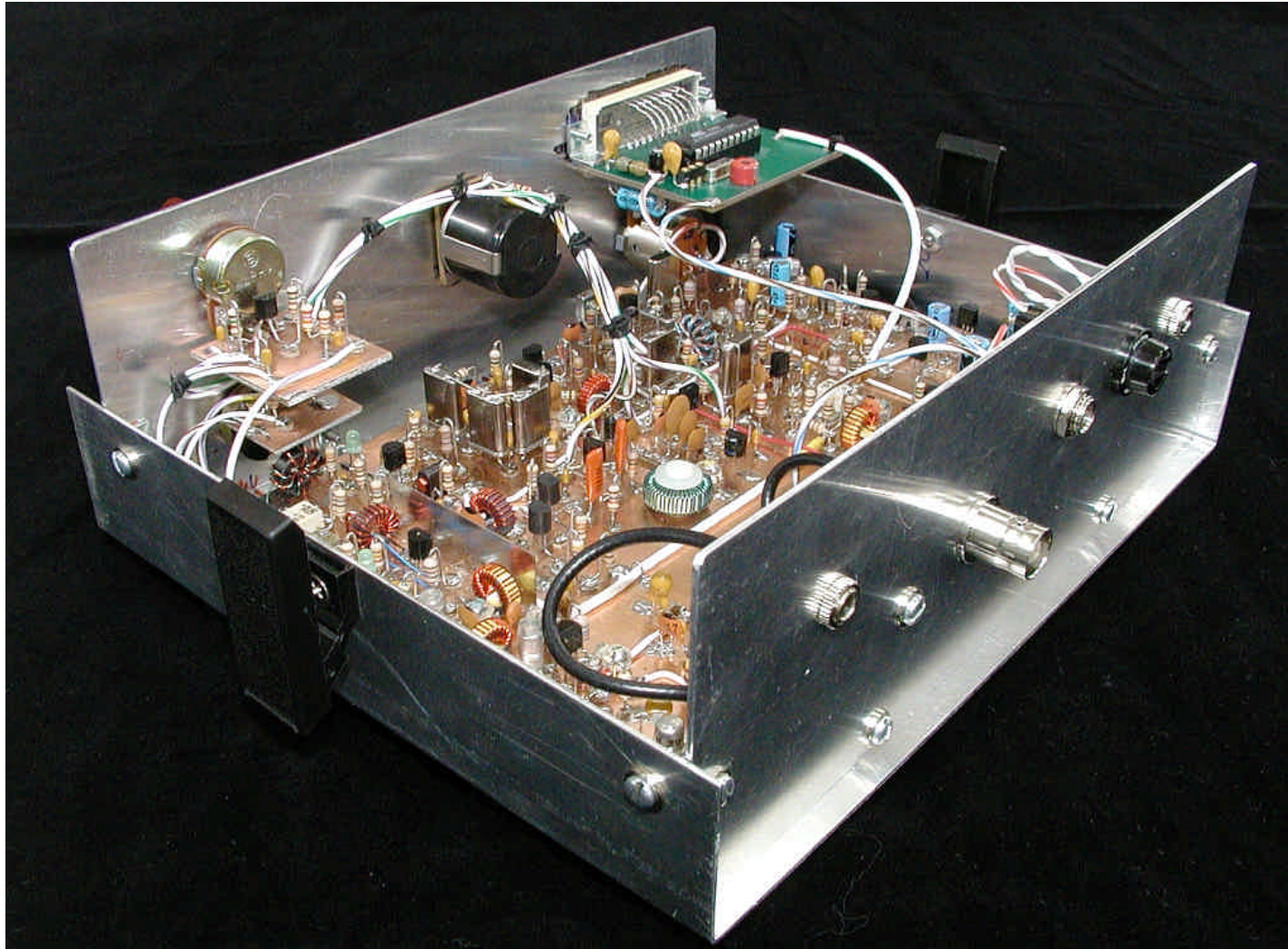


Packaged 2N2/20 - Front





Packaged 2N2/20 - Rear





Question/Answer

- What did you not understand?
- What item(s) need more discussion?

