

222 MHz Transverter

DESIGN AND CONSTRUCTION DETAILS

222 MHz TRANSVERTER

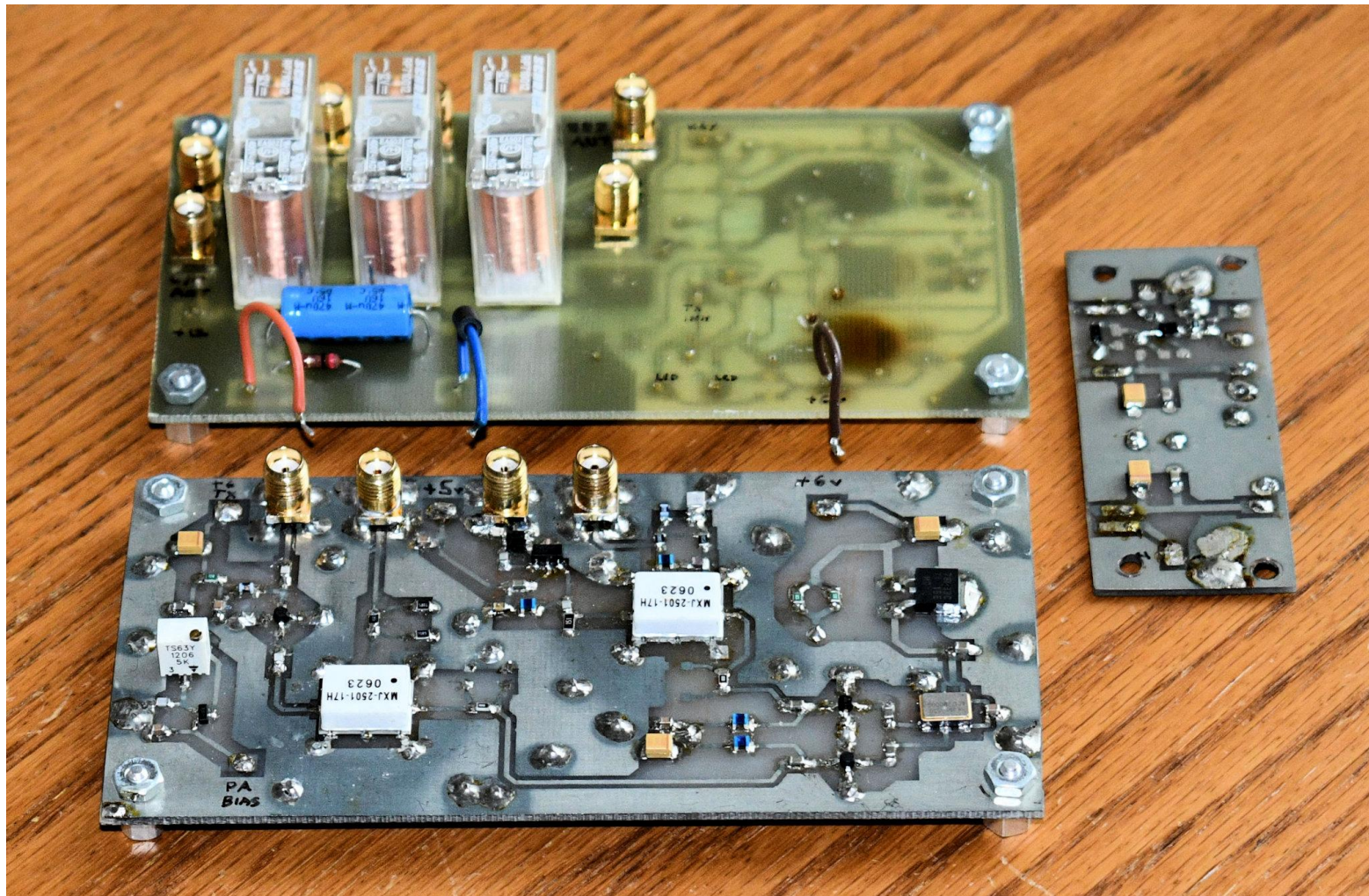


OVERVIEW

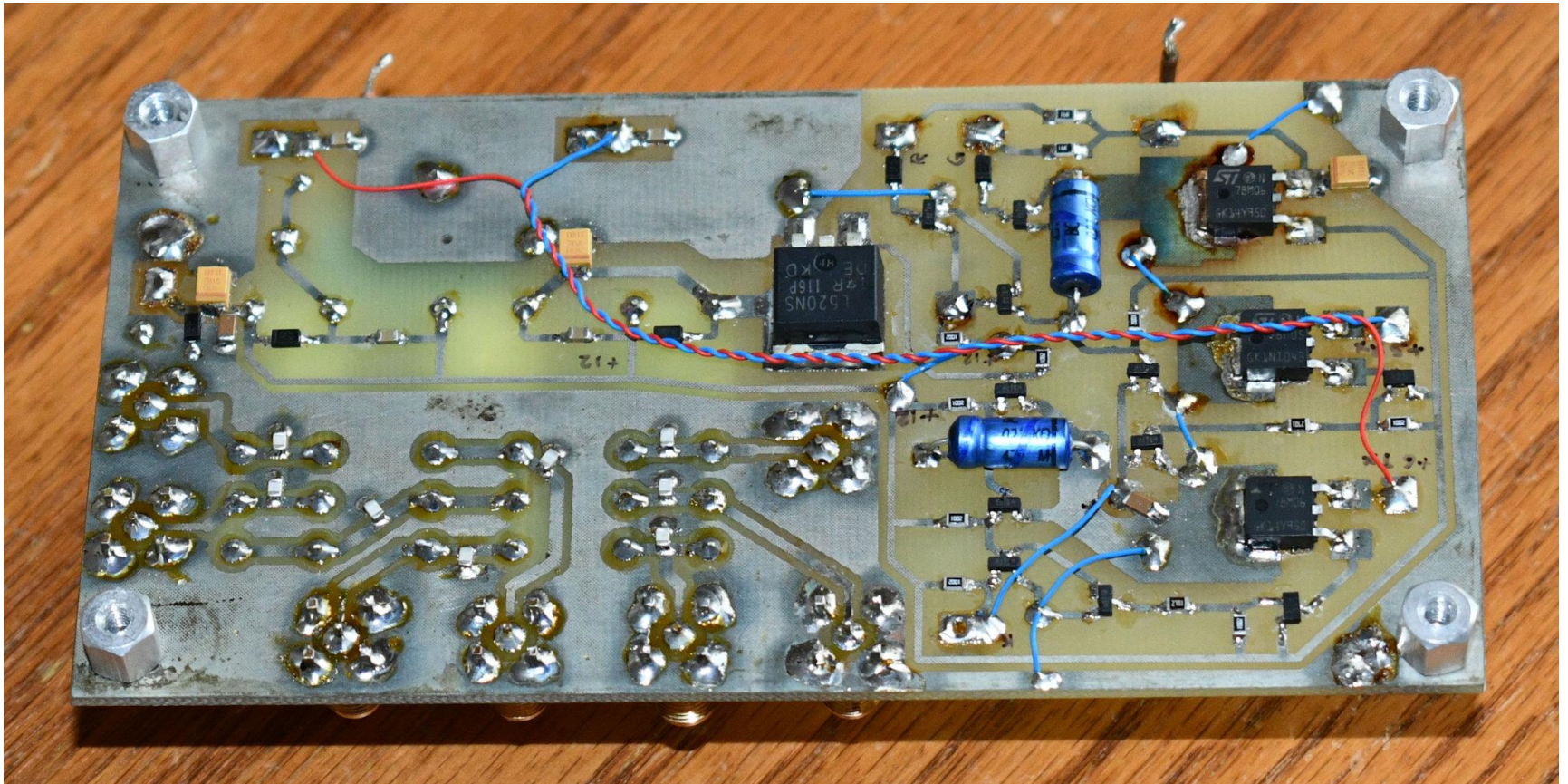
THIS IS AN UPDATE TO THE ORIGINAL 2011 TRANSVERTER THAT HAD HAND ETCHED CIRCUIT BOARDS. THE NEW TRANSVERTER INCORPORATES CIRCUIT IMPROVEMENTS ON COMMERCIALY FABRICATED BOARDS.

- 50 MHz IF
- SSB and CW use (no FM TX offset)
- 50.0 MHz converts to 222.0
- Si530 single frequency LO (172 MHz) ver. 2.1 RF
- Si598 programmable LO option on ver. 3.1 RF
- Mitsubishi *RA30H2127M* 30W PA module
- 0.5 dB NF front-end (Mini-Circuits LNA)

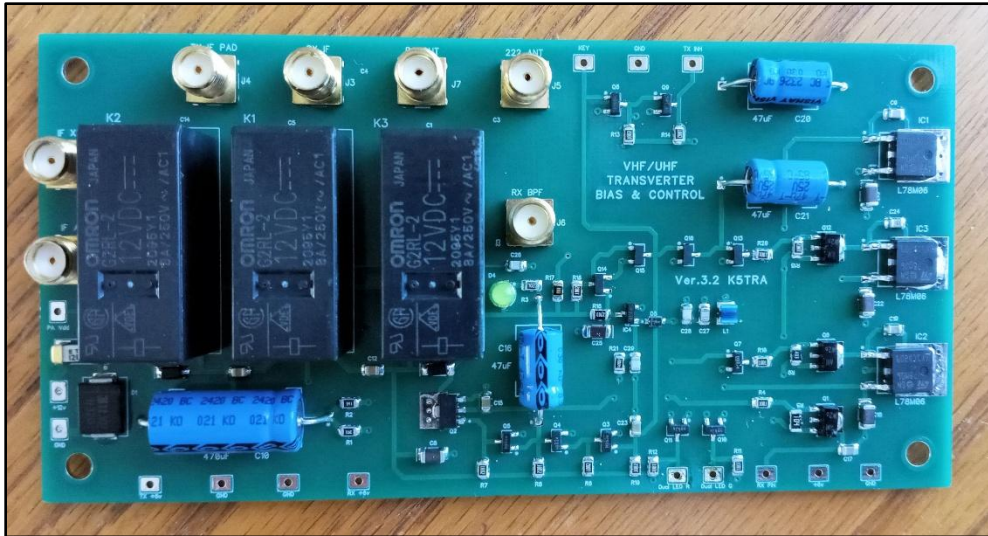
OLD HAND ETCHED 2011 BOARDS



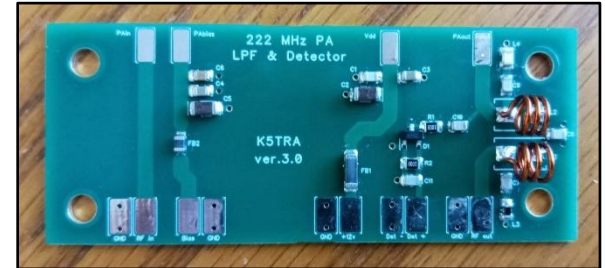
BACKSIDE OF OLD 2011 CONTROLLER



NEW 2025 BOARDS

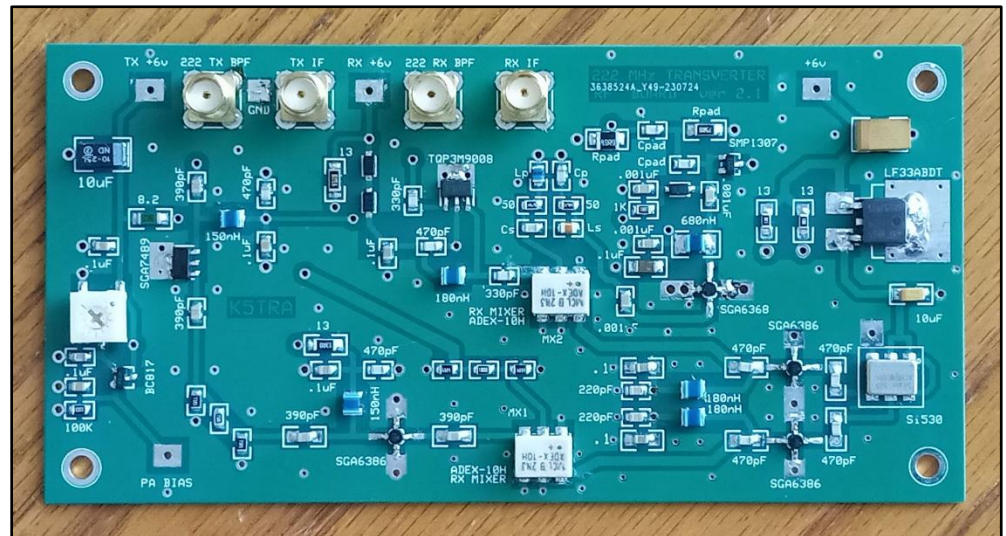


CONTROLLER/SEQUENCER



PA INTERFACE / LPF / DETECTOR

RF BOARD



CIRCUIT SUMMARY

- Three circuit boards:
 - RF board
 - Control/Sequencer
 - PA board
- Surface mount assembly
- Silicon Labs Si530 or Si598 LO
- Helical RF filters
- IF TX power load (-30 dB, 150W, IF power pad)
- IF pass through to antenna when powered off
- Keying options: IF VOX *or* PTT

LOCAL OSCILLATOR

- Si530 single frequency LO (172 MHz)
 - ♦ RF board version 2.1
- Si598 programmable LO option
 - ♦ RF board version 3.1
- IF frequency = 50.000 MHz

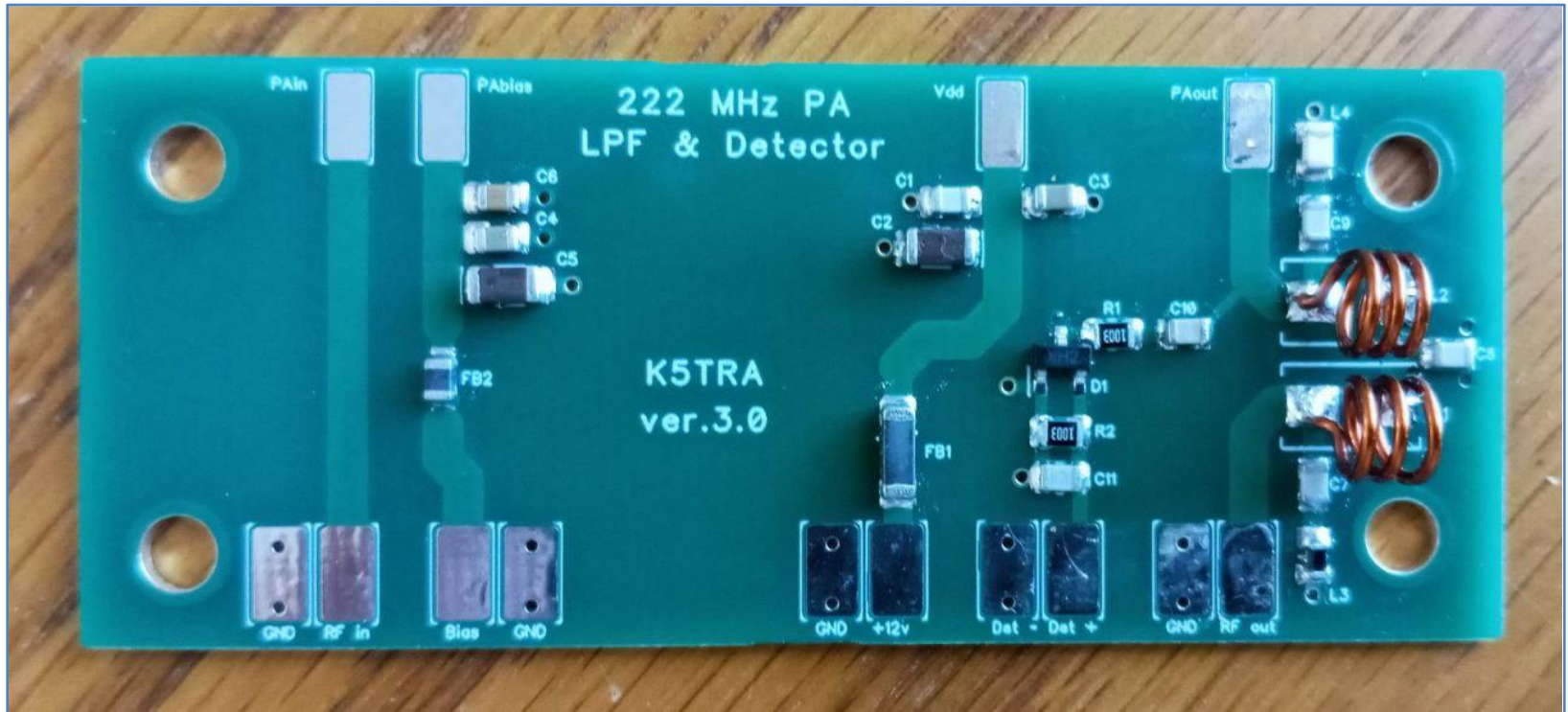
RECEIVER

- LNA is PGA-103+
 - pHEMT IC
 - Minicircuits
 - $F_{min}=0.5$ dB
- ADEX-10H mixer: 7 dB conversion loss, +17 dBm LO
- Sirenza SGA6386 IF amplifier followed by a π pad
- π pad also has PIN diode to step loss during transmit
- Overall RX NF ≈ 0.6 dB

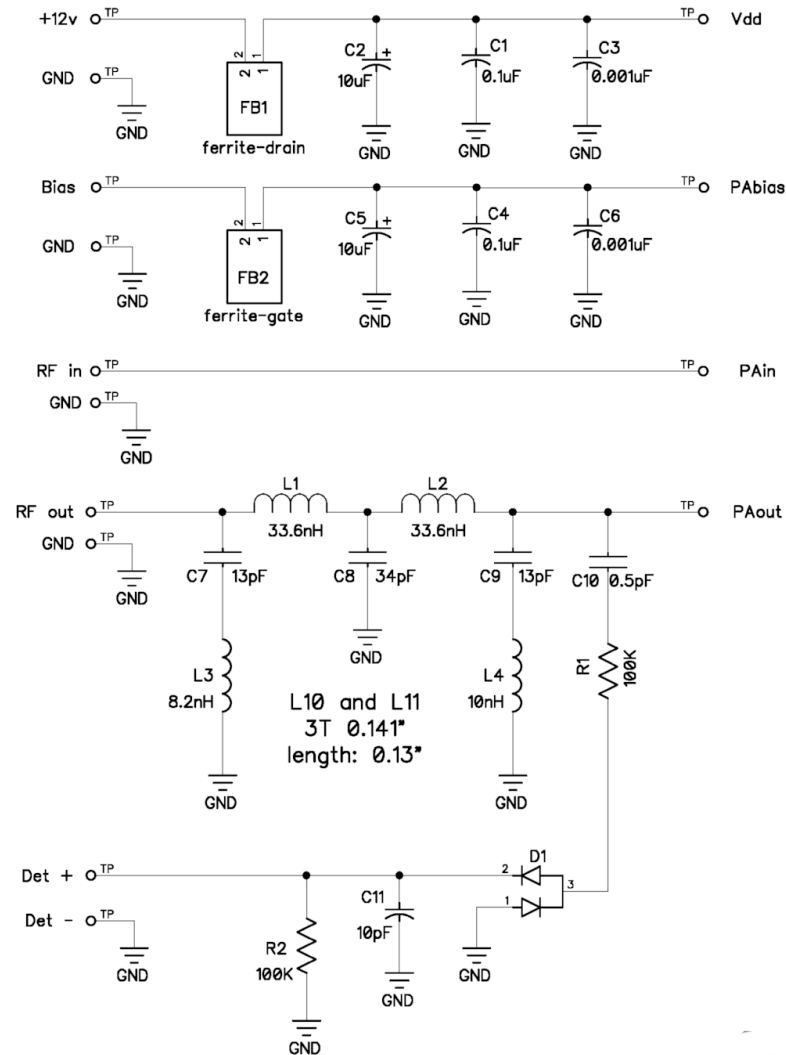
TRANSMITTER

- PA is 30 W Mitsubishi RA30H2127M module
- Bias regulator on PA board
- Transmit 6m IF drive is 48 dBm (nominal)
- IF power pad: -44 dB
 - ♦ -14 dB on RF board and -30 dB external
- Helical RF BP and 5th order PA LP filters
- RF level detector on PA board drives LED display
- Thermocouple PA temp sensor for fan control

MITSUBISHI PA INTERFACE, LPF & DETECTOR

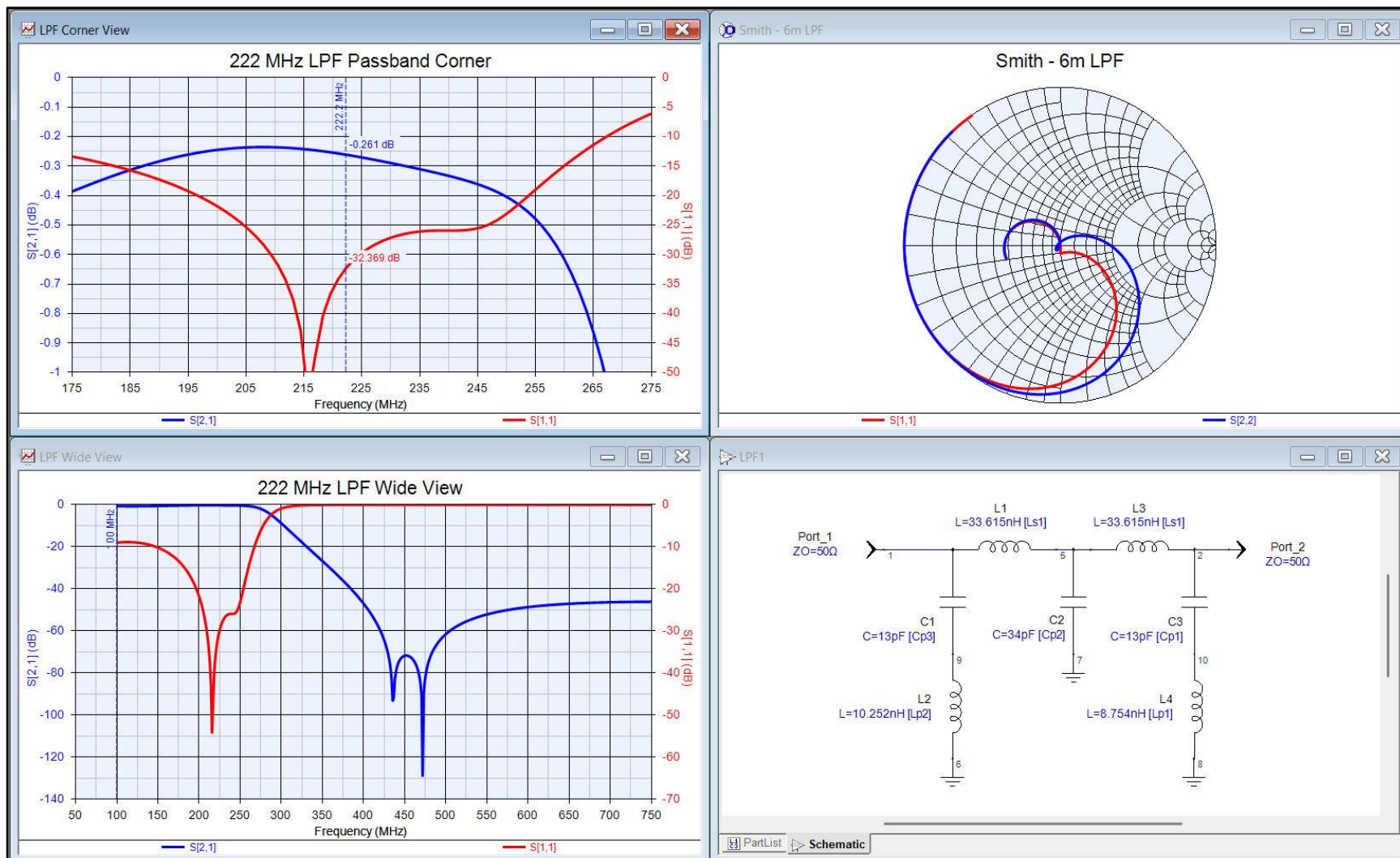


PA, LPF and DETECTOR SCHEMATIC

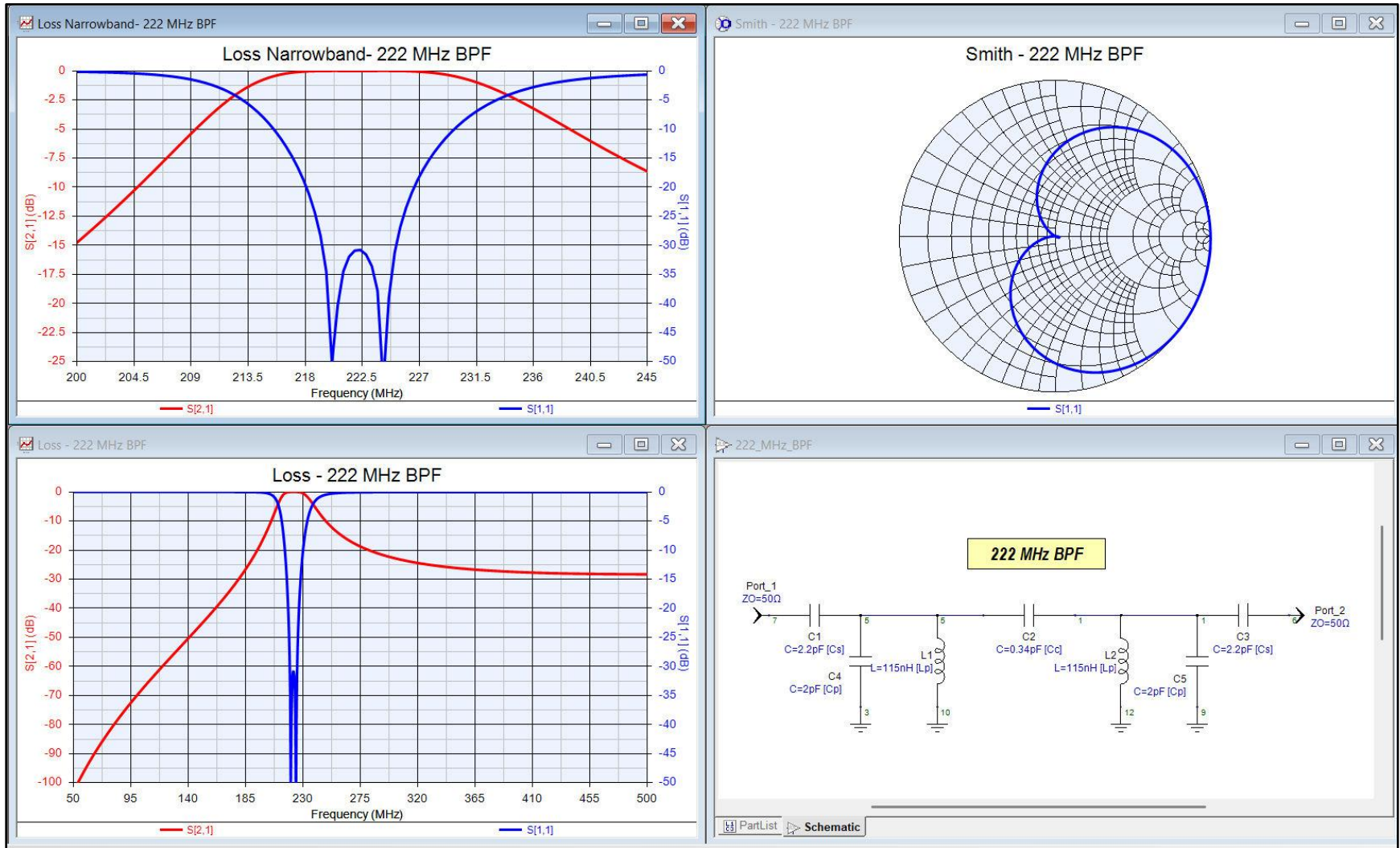


T.Apel

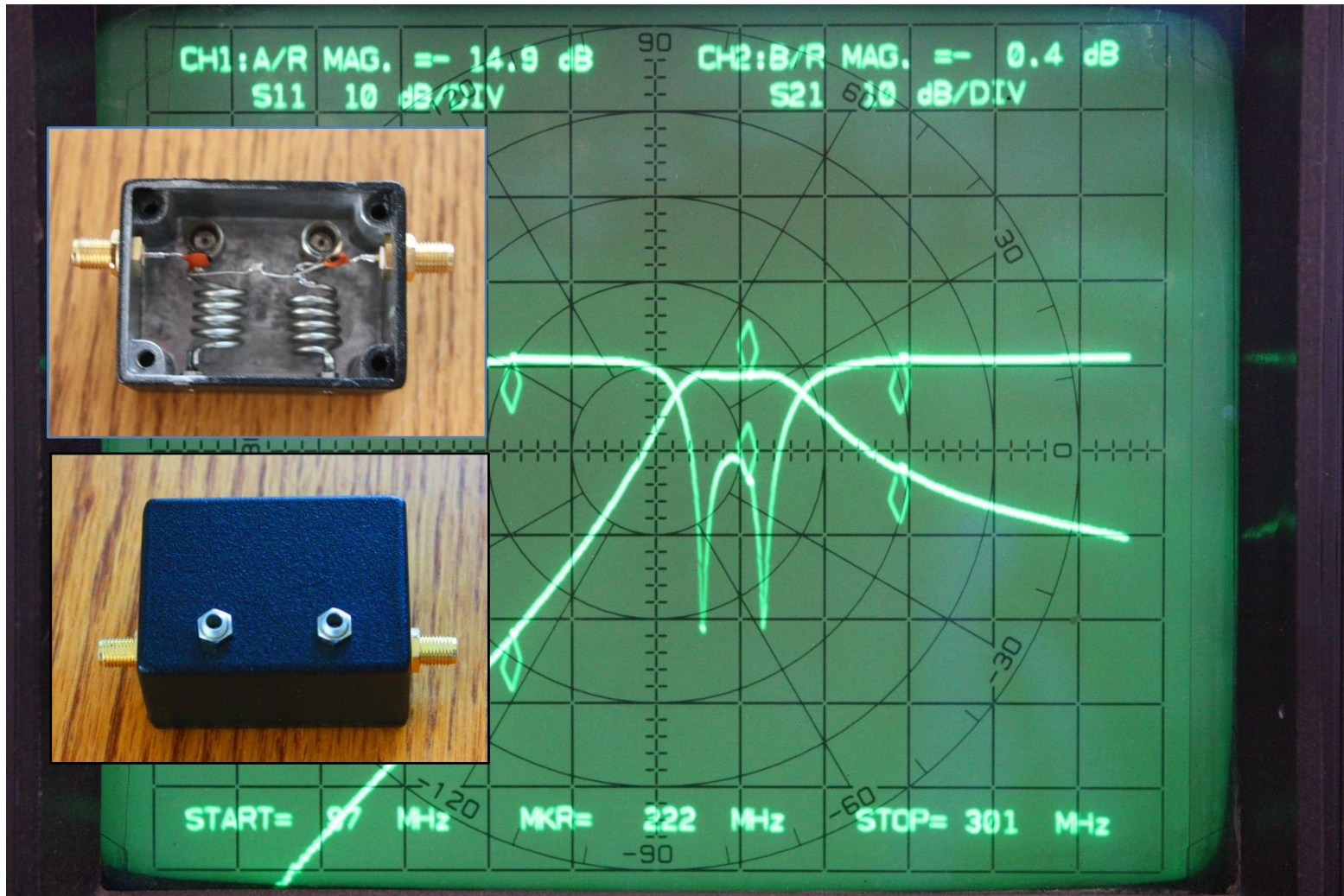
PA LPF



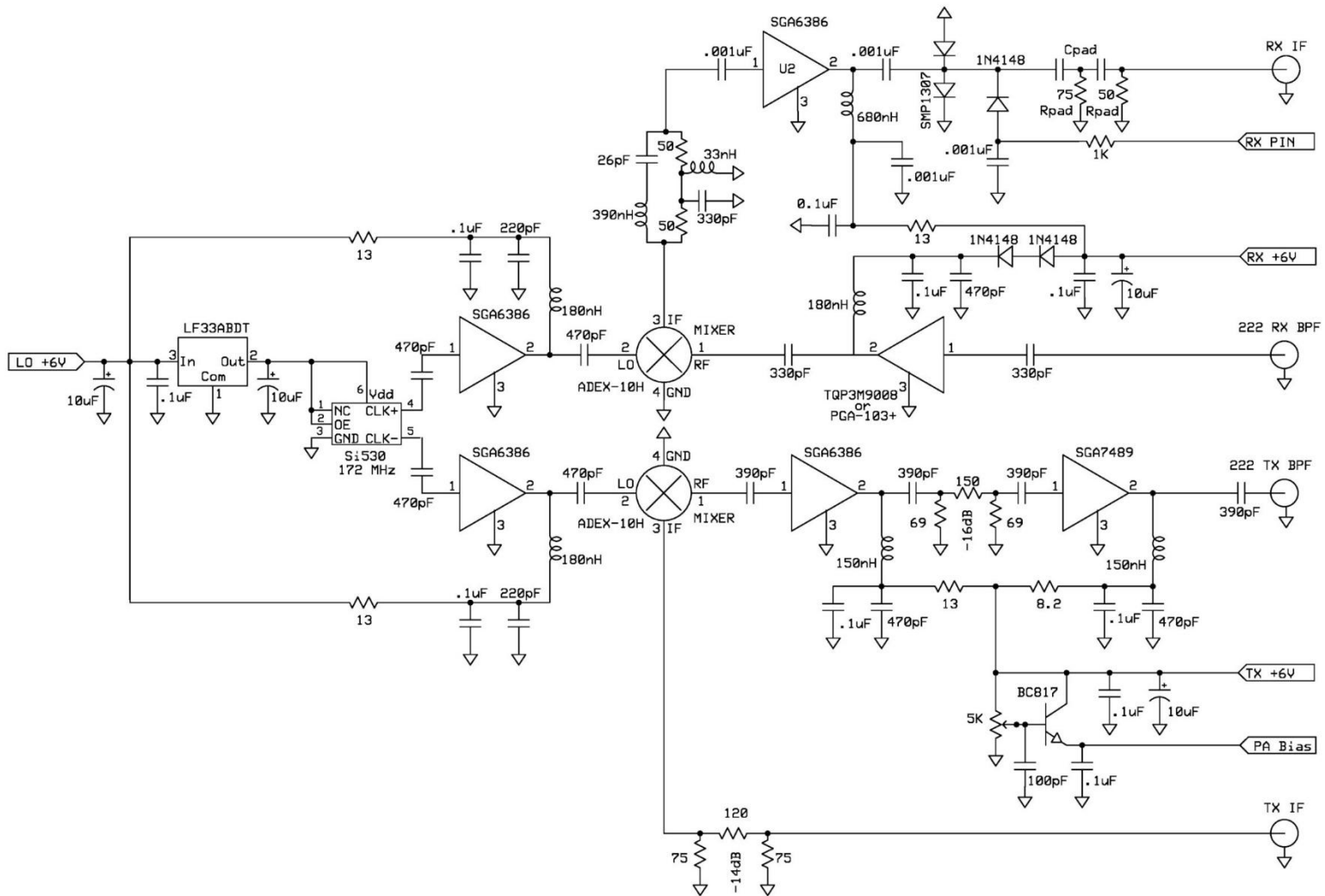
BPF DESIGN



BPF RESULTS

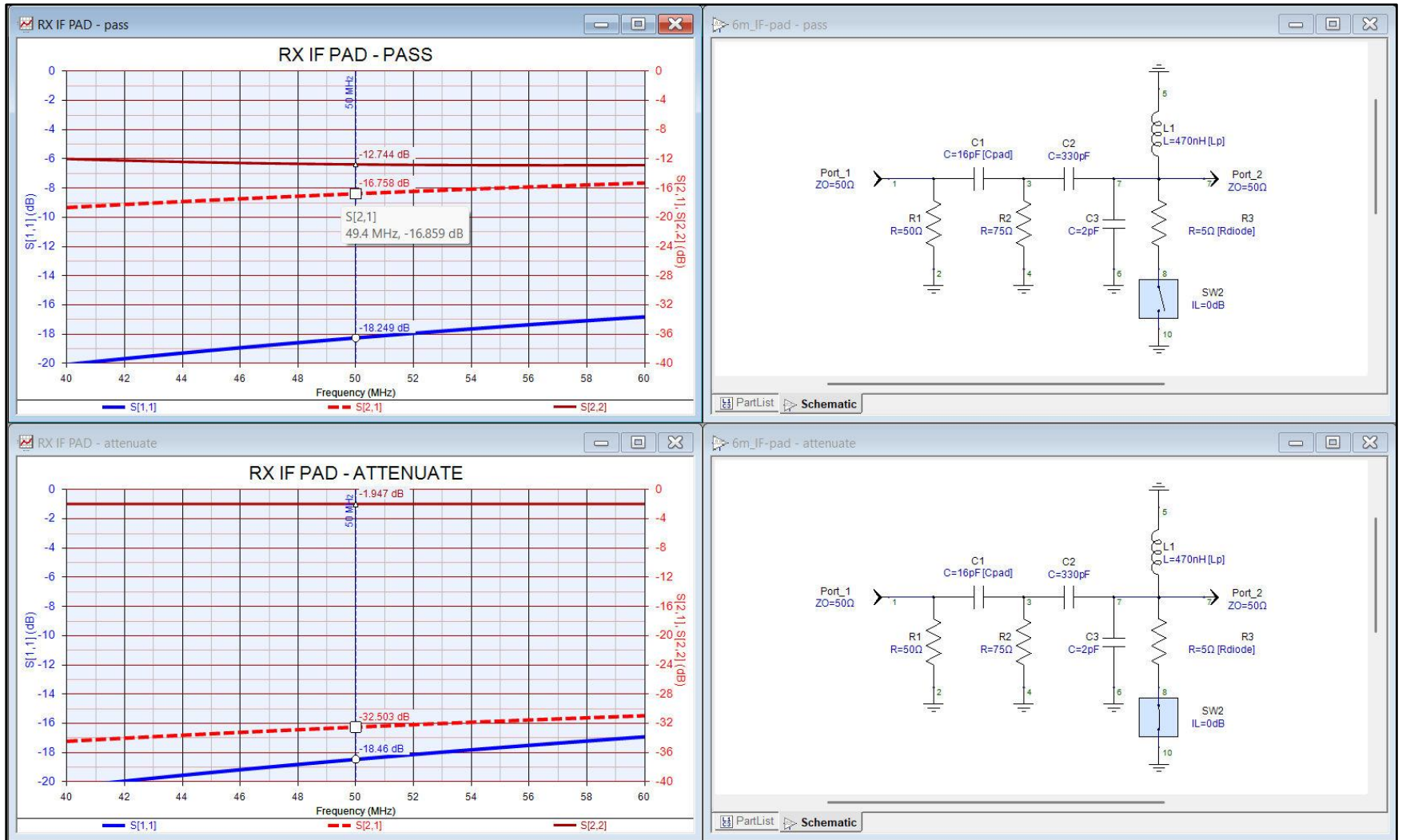


222 MHz RF BOARD SCHEMATIC



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RX IF ATTENUATOR



RF Ver. 2.1 - GAIN and POWER BUDGET

RECEIVER

(v2.1 RX)

STAGE	PWR-IN (dBm)	GAIN (dB)	PWR-OUT (dBm)
Input	-135.0		
LNA (PGA-103+)	-135.0	23.0	-112.0
Mixer	-112.0	-7.0	-119.0
IF equalizer	-119.0	-1.0	-120.0
RX IF buffer	-120.0	18.0	-102.0
Pad	-102.0	-16.0	-118.0
Output			-118.0

OVERALL GAIN (dB) = 17.0

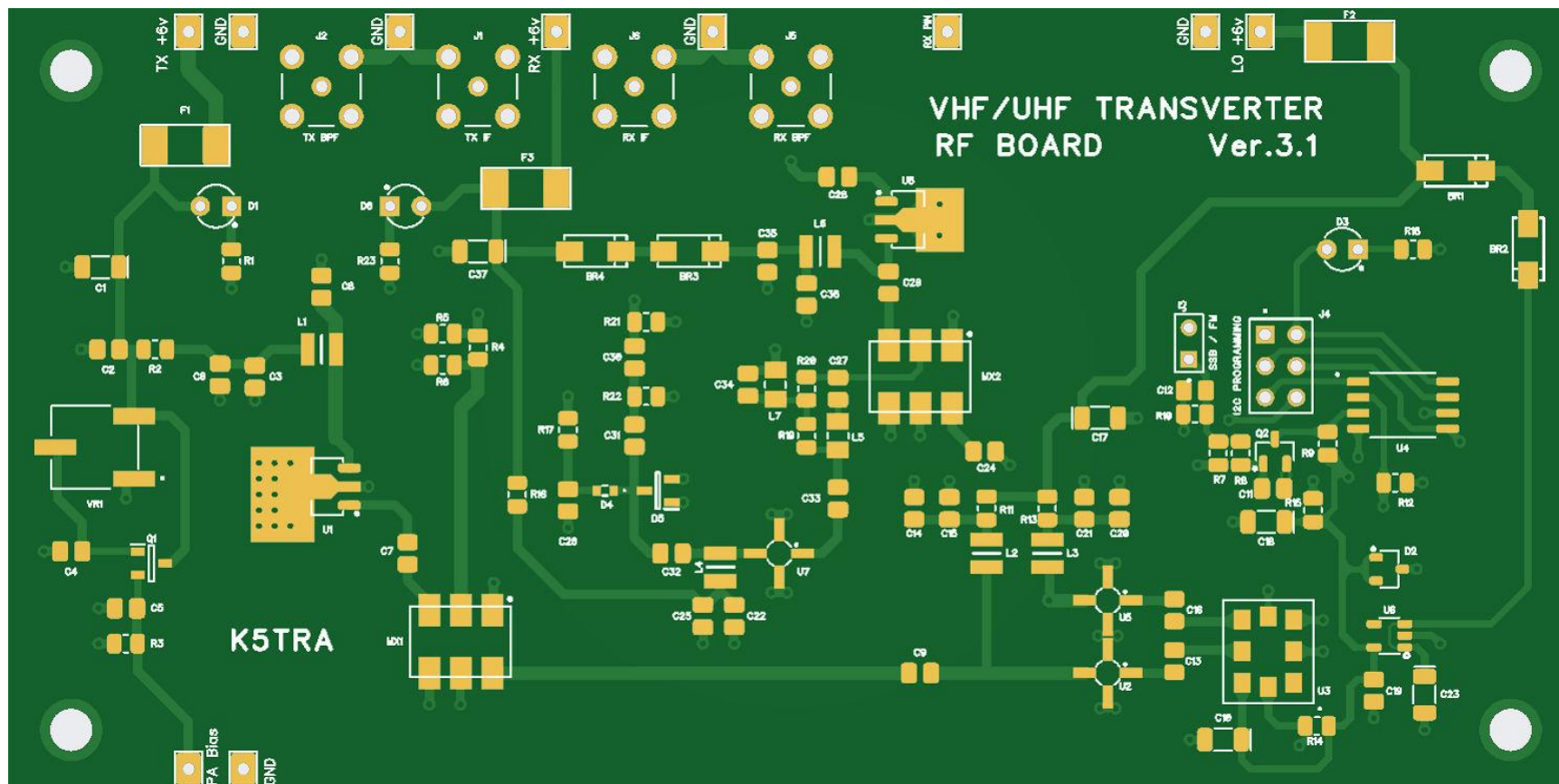
TRANSMITTER - RA30H2127M Mitsubishi PA

(v2.1 RF, v2.0 PA)

STAGE	PWR-IN (dBm)	GAIN (dB)	PWR-OUT (dBm)
TX IF	48.0		
Pad (ext & int)	48.0	-44.0	4.0
Mixer	4.0	-7.0	-3.0
SGA6386	-3.0	16.0	13.0
Pad	13.0	-16.0	-3.0
SGA7489	-3.0	22.0	19.0
BPF	19.0	-2.5	16.5
RA30H2127M	16.5	29.0	45.5
LPF	45.5	-0.3	45.2
Output			45.2

OVERALL GAIN (dB) = -2.8

PROGRAMMABLE LO VERSION OF RF BOARD



UHF/UHF TRANSVERTER
RF BOARD Ver.3.1
222 MHz Design - K5TRA



RF Ver. 3.1 - GAIN and POWER BUDGET

RECEIVER

(v3.1 RX)

STAGE	PWR-IN (dBm)	GAIN (dB)	PWR-OUT (dBm)
Input	-135.0		
LNA (PGA-103+)	-135.0	23.0	-112.0
Mixer	-112.0	-7.0	-119.0
IF equalizer	-119.0	-1.0	-120.0
RX IF buffer	-120.0	18.0	-102.0
Pad	-102.0	-16.0	-118.0
Output			-118.0

OVERALL GAIN (dB) = 17.0

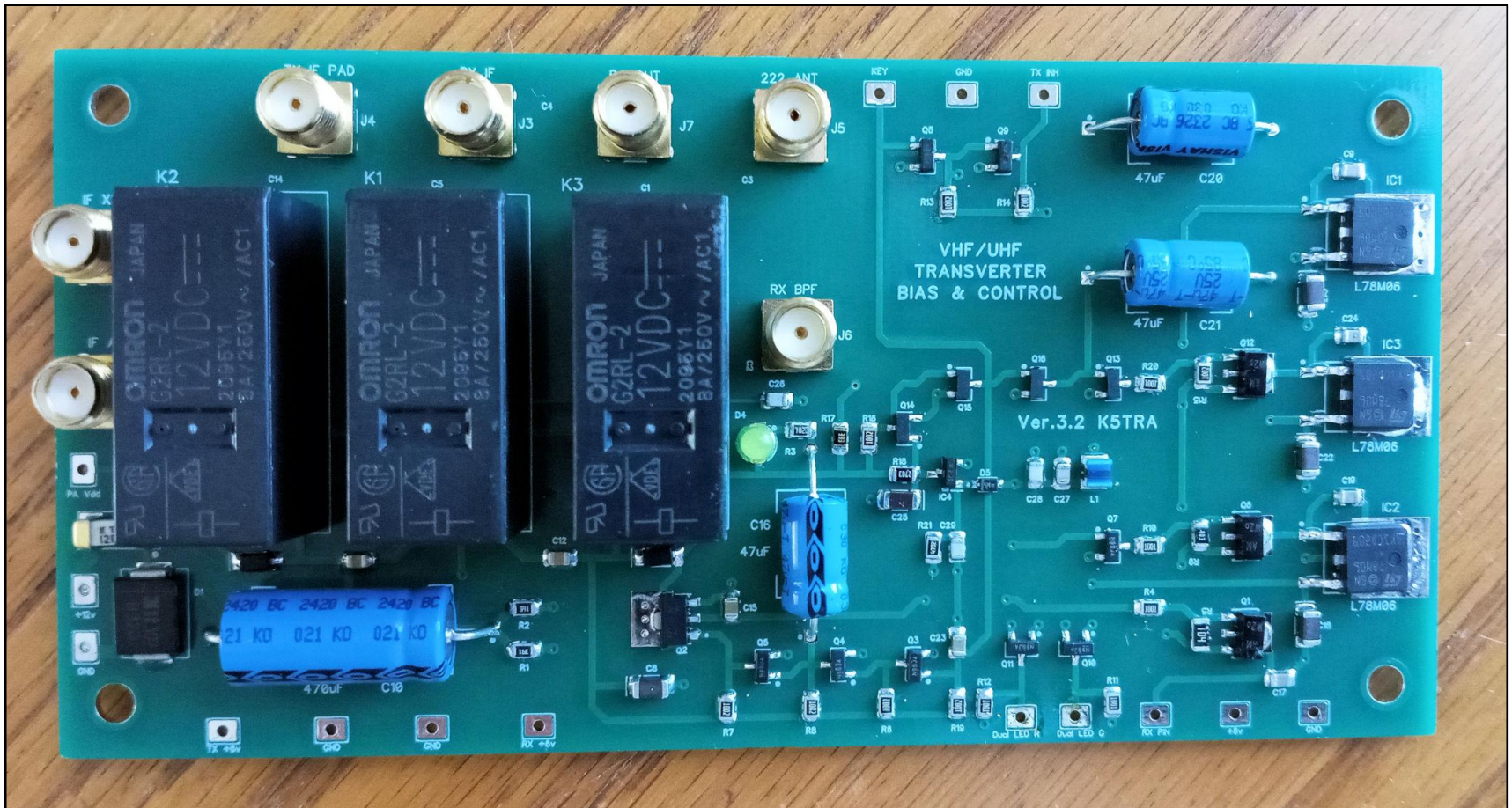
TRANSMITTER - RA30H2127M Mitsubishi PA

(v3.1 RF, v2.0 PA)

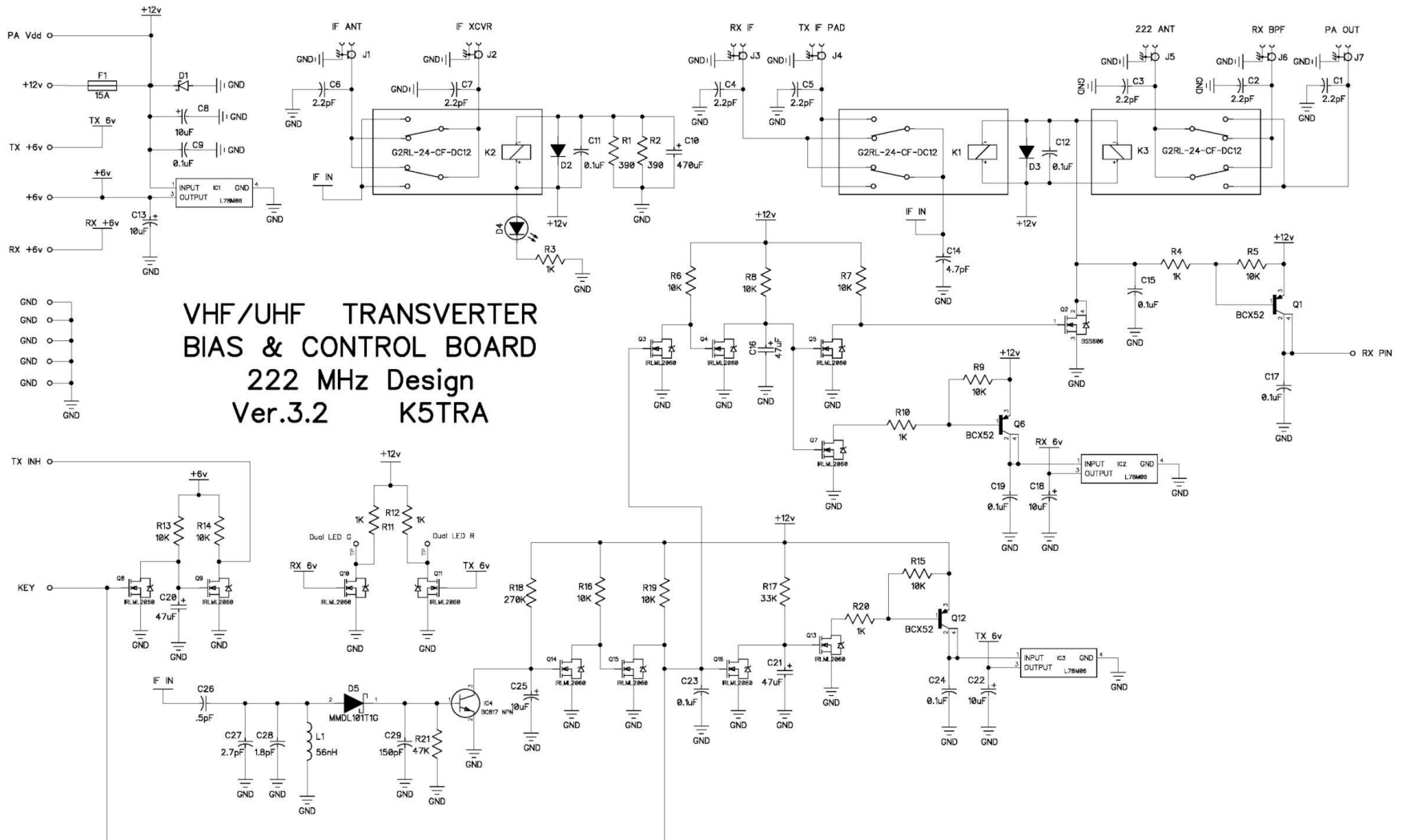
STAGE	PWR-IN (dBm)	GAIN (dB)	PWR-OUT (dBm)
TX IF	48.0		
Pad (ext & int)	48.0	-45.0	3.0
Mixer	3.0	-7.0	-4.0
SGA7489	-4.0	22.0	18.0
BPF	18.0	-2.5	15.5
RA30H2127M	15.5	30.0	45.5
LPF	45.5	-0.3	45.2
Output			45.2

OVERALL GAIN (dB) = -2.8

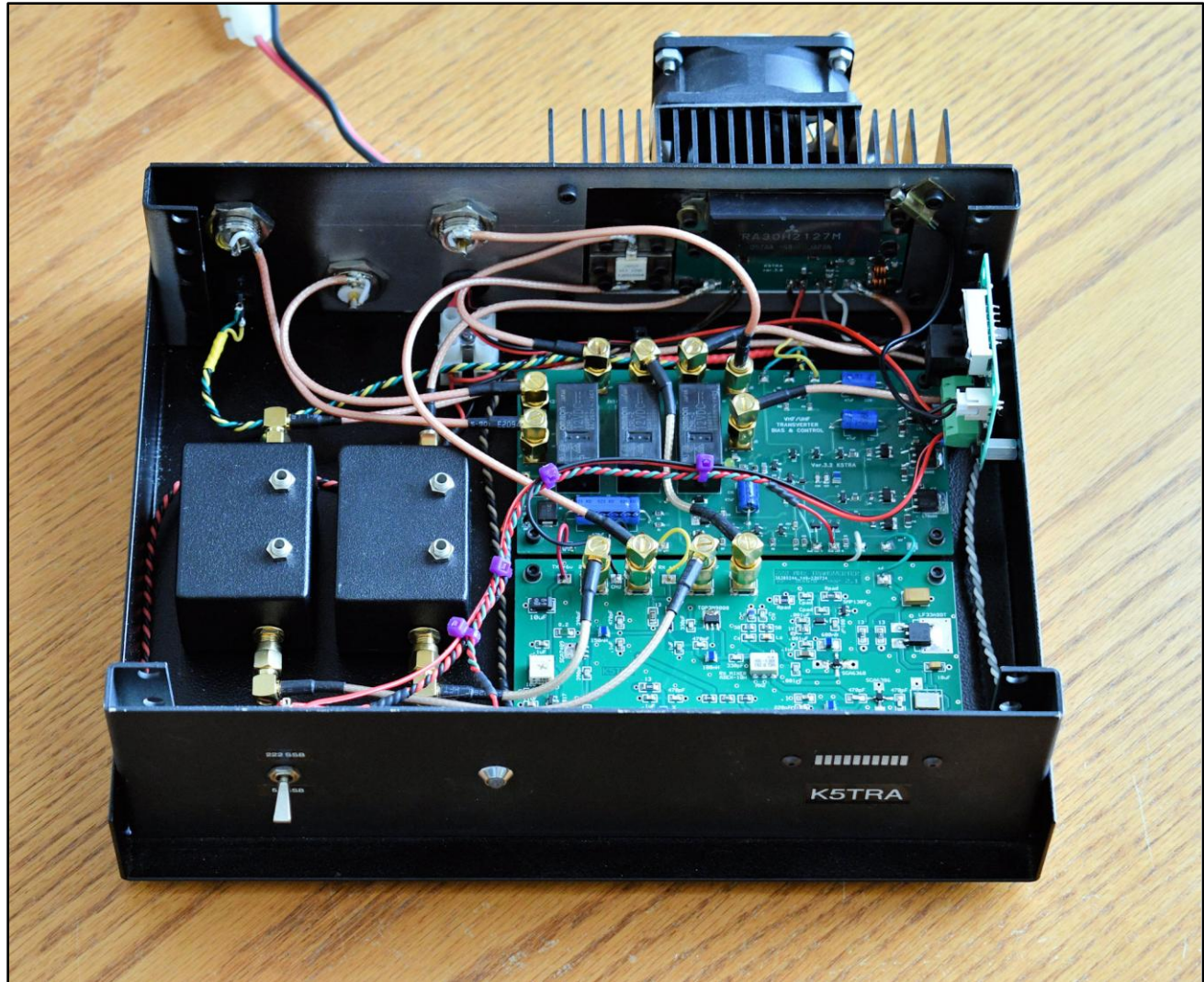
CONTROLLER / SEQUENCER BOARD



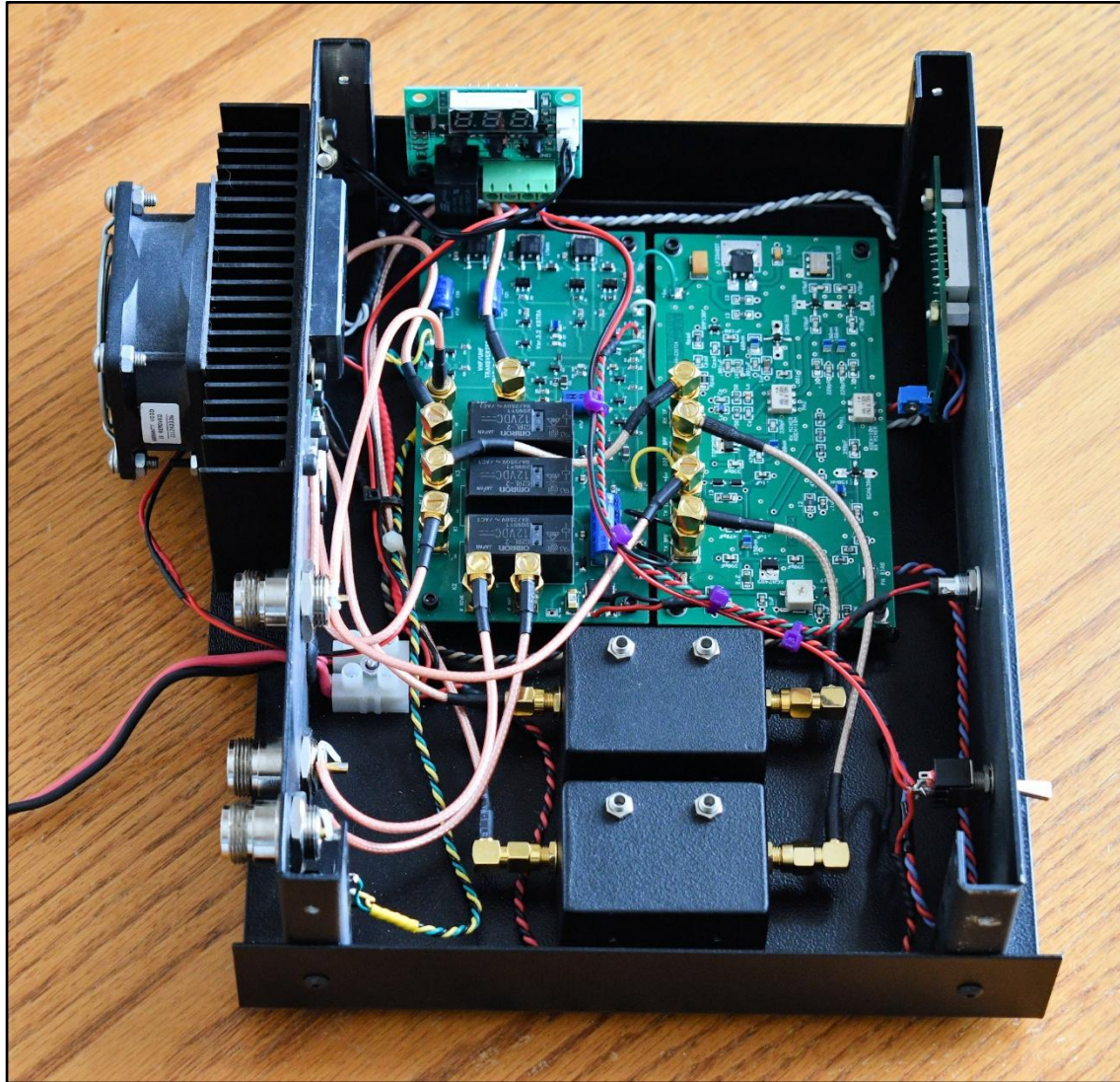
SEQUENCER / CONTROLLER SCHEMATIC



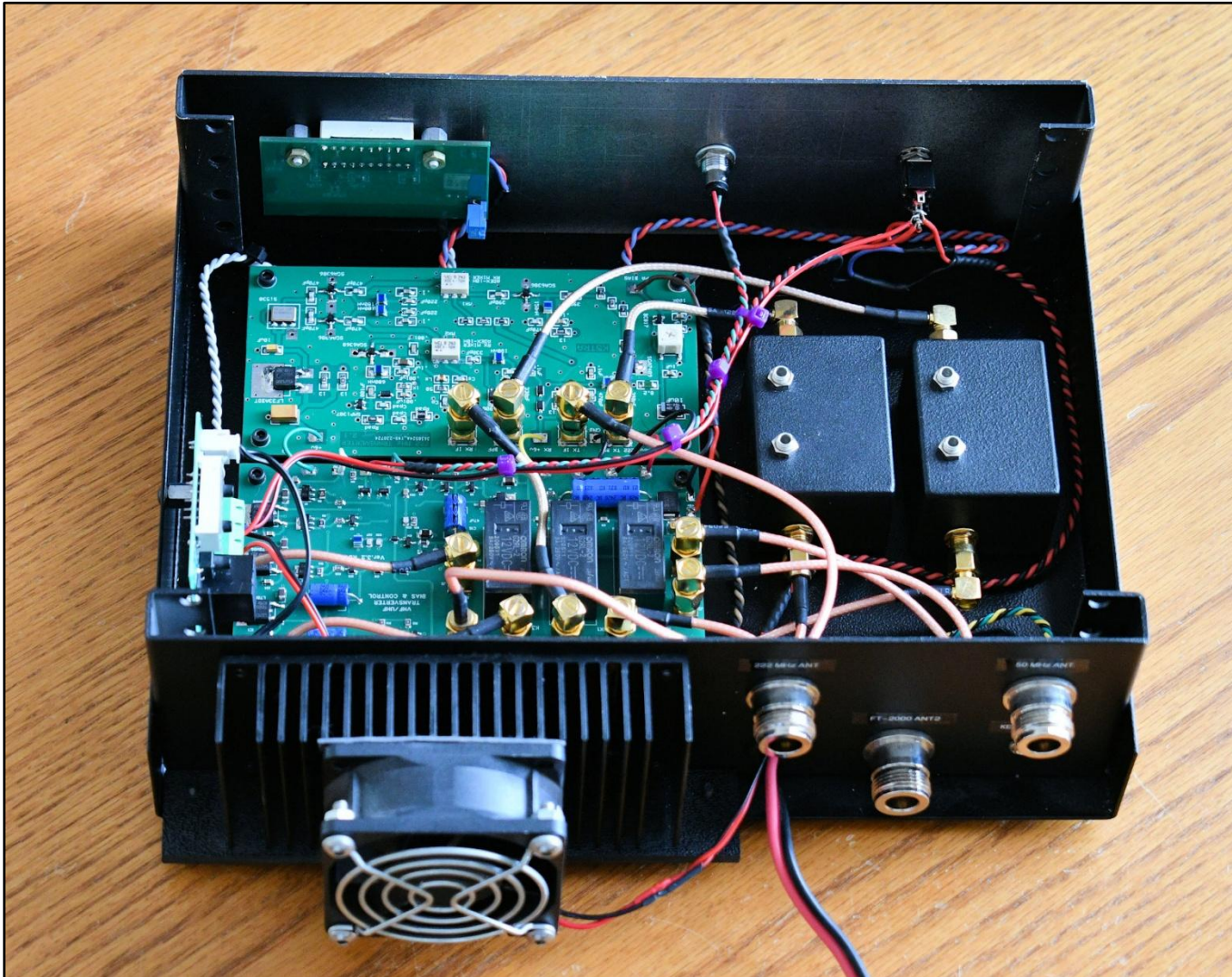
222 TRANSVERTER – FRONT



222 TRANSVERTER – SIDE



222 TRANSVERTER – REAR



QUESTO E' TUTTO

