

Building "The Beast"

A 2m/70cm Transverter

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I loved my new Flex-5000A for HF, but soon grew disenchanted with the VU-5K 2m/70cm Internal Transverter Option. It had lots of fan noise, couldn't reach rated power, and had less than stellar linearity. The option was removed, but what to replace it with? The locked oscillators of the VU-5K spoil you, and I quickly ordered a pair of Kuhne MKU XO 1 PLL locked oscillator modules at 116 and 101MHz, the latter to quadruple to 404MHz for 70cm. Initially I modified Elecraft XV-144 and XV-432 Transverters to accept the locked LO's, but they weren't great as receivers, and again had poor linearity, with FM bricks pressed into service as (quasi)linear amps.

Slowly an architecture formed in my mind:

- A 28-32MHz IF Bandpass Filter driving a high-level mixer capable of handling the Flex's +10dBm Tx output, and being bi-directional, providing good strong signal performance in receive without switching.
- The 116MHz Locked Osc Module could drive a +26dBm output amp as LO on 2m, and be switched on 70cm to the 101MHz Locked Osc Module driving a Diode Frequency Doubler, then an amp to restore the level, then another Diode Doubler, followed by a 404MHz Bandpass Filter into the shared +26dBm LO amp.
- An RF Bay LNA-580 could provide 0.7dB NF on both bands, but how to keep it from out-of-band strong signal overload without lossy selectivity ahead of it? Looking at 0-1250MHz on a spectrum analyzer while rotating my antenna, I discovered that the worst offenders were FM stations, with several at -22dBm at the worst azimuth. So the best answer was a MiniCircuits FM Band Reject Filter, which would provide less than a quarter dB insertion loss on both bands, while knocking down the FM signals.
- To protect that sensitive front end, the only suitable T/R switch I could identify was the Toitsu CZX3500 with 65dB isolation, assuring that even with a kilowatt on transmit the LNA input level would not reach damaging levels.
- Since my antennas are stacked log-periodics that cover both bands, I could use a single T/R relay, with the antenna line going directly to the relay common port, and the Tx port going to the PA band select relay and the PA's. This minimized the number of relays and coax ahead of the LNA.
- Custom Bandpass Filters were ordered for the 2m and 70cmbands, the 28-32MHz IF and the 404MHz LO, spec'ed for the specific image and unwanted frequency rejection desired.
- Ebay provided sources for six SMA relays, for filter input and output bandswitching for Rx and Tx, selection of the correct LO, and T/R switching of the output of the high level mixer.

- The problem of getting the approximate 0dBm Tx mixer output level up to enough power to drive kilowatt amps was solved when a 12W 50dB gain Tadiran lab amplifier became available, with more than enough output to drive my 2m kilowatt directly, and enough to drive a TE Systems 4410G amp to 50W output on 70cm to drive my tubeKW linear.
- So the Tx chain is just the IF Filter, high level mixer, and a 2m or 70cm bandpass, output to the Tadiran Lab Amp, and then a 2m/70cm duplexer which serves as an harmonic filter on 2m and directs the output to the correct PA chain by band. Net Tx loss (prior to the Tadiran Amp) is -9.0dB on 2m. and -10.9dB on 70cm.
- On Rx the FM trap feeds the +23dB gain 0.7dB NF LNA, which drives a Bandpass filter, then a +13dB gain 3.5dB NF high intercept buffer driving the high level mixer, and on to the Flex-5000A through the IF BP filter. Net Rx gain is +27.1dB on 2m, and +25.5dB on 70cm. Measured overall transverter NF is 1.2dB on 2m, and 1.4dB on 70cm, which is in line with my expectations, and well into diminishing returns for the atmospheric noise levels at my location.

A center-off manual band select switch is provided for testing, but this is normally automated by outputs from a MircoHam StationMaster. A single keyline from the Flex-5000A generates all the independent keying outputs needed:

- 2m/70cm keying of a higher Tx fan speed in the Tadiran amp.
- 2m keying of the 2m linear.
- 70cm keying of the TE 4410G booster.
- 70cm keying of the 70cm linear.

Illustrations:

- Front Panel: Center-off Band Select for testing; "Locked" indicators for the LO Modules; "Keyed" indicators; and the output to the Tadiran Amp, which has a front panel input.
- Top View: Showing the various modules, filters and SMA or BNC interconnects.
- Rear Panel: T/R Relay; +14V Input and Fuse; Band Select inputs from the StationMaster; Key In from the Flex-5000A; Key Outputs required by the other system components; 10MHz Reference Input; IF Output.





