

CMARA Paxton 146.97 Repeater

Tour of the Repeater Site

February, 2022



Greg WA1JXR

Mike W1BNC

Marty W1EPH

Eric N1VX

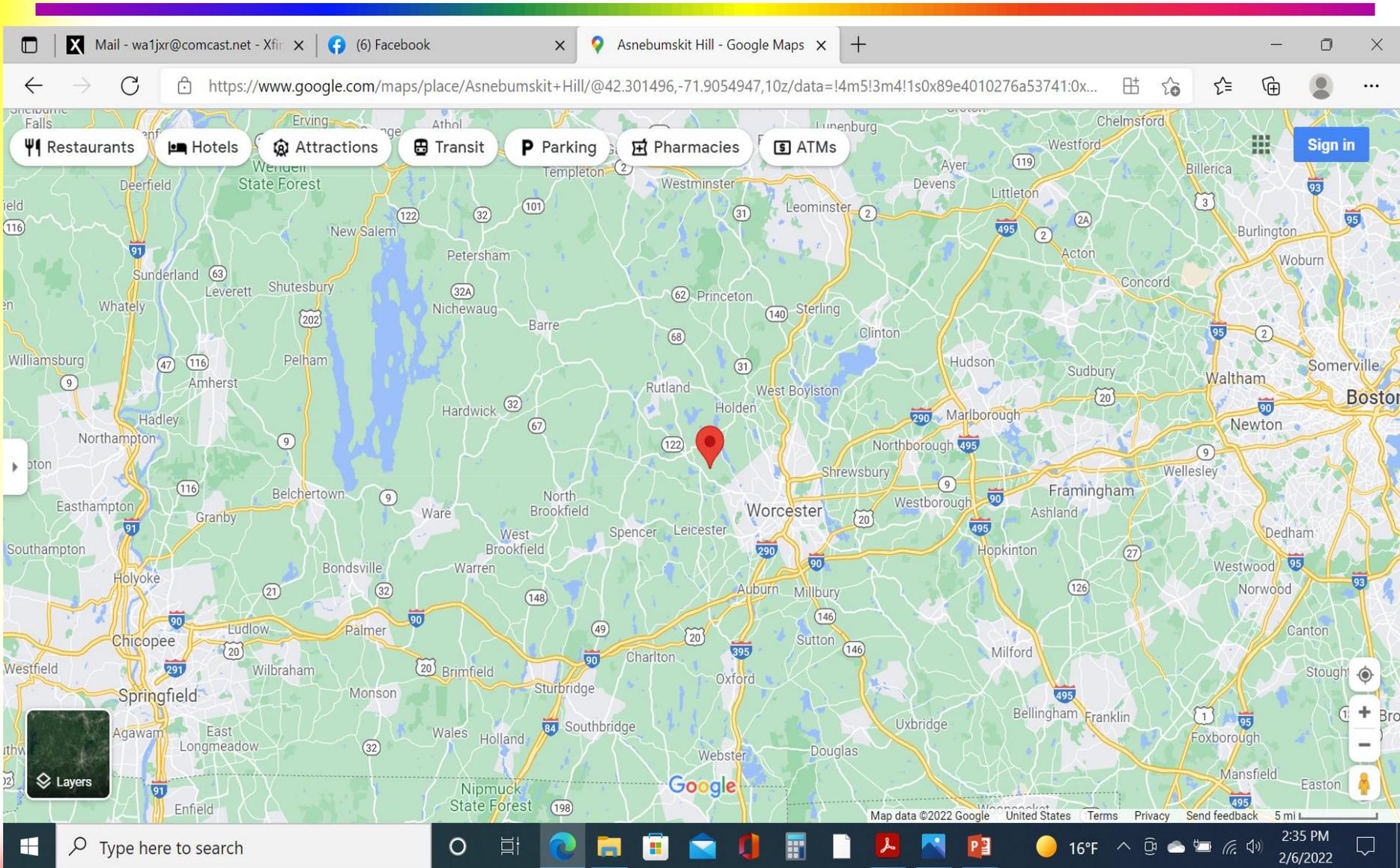
CMARA Repeater Tour

- **The CMARA Repeater operates on frequency 146.97 MHz with a PL Tone 114.8 Hz.**
- **The Repeater is located on Asnebumskit Hill in Paxton, MA. The hill is 1369 Feet ASL.**
- **The Repeater is a Motorola Micor vintage 1980's**
- **Repeater Output power is 40W into the filters.**
- **The Repeater has a 114.8 Hz Private Line (PL) tone required to open the receiver input.**
- **The Receiver Antenna is at the top of the tower**
- **The Transmit Antenna is located half way down tower**

History of Asnebumskit Hill and FM Radio

- If you're looking for important sites in the history of FM broadcasting, it's hard to beat New England and the northeast! To the top of Mount Washington, New Hampshire and to Alpine, New Jersey, where FM radio began at the hands of Major Edwin Howard Armstrong.
- On May 27, 1939, Major Armstrong signed on an FM station here under the calls W1XOJ, part of the Yankee Network's regional FM service and a critical link between the Armstrong-built stations at West Peak in Meriden, Connecticut and the Mount Washington transmitter. W1XOJ was soon being used as part of a programming relay that brought broadcasts from Armstrong's own W2XMN at Alpine all the way to Mount Washington - and to nearly all of New England in the process.

Where is Asnebumskit Hill ??



History of Asnebumskit Hill and FM Radio



Site Block House and Tower



Another View of Tower



View of Top of Tower



Close Up of Block House and adjacent building



Entry Gate to the Tower Site



View up the center of the Tower (Wireless Radio??)



Other Stuff on the Hill



Repeater History

Although 2 meter operation in the 1950-1970 time period was mostly on AM and CW modes (and SSB, in the 1980's) an up swell in the introduction of surplus GE commercial FM equipment began to spread across the Country. New markets in new Amateur equipment offerings from companies such as Inoue in Japan (later named ICOM), Standard Communications, Clegg Laboratories, Pierce Simpson, Regency, Yaesu, and Trio (later named Kenwood) began to popularize VHF FM as the "new way to go."

One day in a meeting in John Terrell's, W1DRP, Holden garage, he and Bob Heck, W1JLA, decided to introduce 2 meter FM to CMARA. By the next year, a repeater was built at W1SPG's QTH. Bob Heck, W1JLA, Ron Buckley, K1QQB, Larry Jaffe, WA1FIH, and Franny Moy, W1SPG were heavily involved in the Project. This repeater was finished and was tested in 1970, Records show that it was 39 in and 34 out... perhaps a little out of convention, but the Club was not interested in taking the machine over. **This first repeater became silent.** As with most unstoppable ideas, this false start was not in vain as we will see in a minute.

Repeater History

In August, 1971, Charlie Butkus, WA1KRJ got a repeater on the air with 50 watts output. By mid November (the 10th to be exact), Charlie had convinced Franny Moy, W1SPG, that getting this on the air officially was the way to go. The receiver was at Charlie's QTH in North Grafton, and the transmitter was located in North Worcester at Frannie's location. The 3/4 meter link centered on 445.1 mhz. provided the necessary link communications. A week later, the men bought an OMNI-4 antenna by Prodelin setting them back, as records show, \$143.00. By February of 1972, their coverage increased with the purchase and installation of more Prodeline gain antennas, Now running a solid 35 watts output on 2 meter FM, and with the addition of 52.525 mhz, at 10 watts out, things were working quite well.

On February 19, 1972, the primary receiver preamplifier blew during a 15" snowstorm. WA1KRJ was able to quickly restore service by replacement. On August 26th of that year, the repeater was combined and moved to Pete Peterson's QTH (K1HIS) on Anderson Avenue in Holden. The arrival of an early Winter ice storm on December 4, 1972 knocked the machine off the air due to ice buildup. For the next 11 years, this repeater was operated by Charlie, WA1KRJ and Robert Condon, K1WUK. On May 17, 1973, it was relocated to K1WUK's QTH at North Main Street in Shrewsbury, where it remained in operation for about 9 months.

Repeater History

The transmitter was relocated, on February 28, 1974 to Asnebumskit Hill in Paxton, The output power was also reduced at that time. The repeater remained configured with split QTH's for another 12 years. In 1982, the callsign was changed from WA1KRJ/r to W1BIM/r, Jim Carpenter's original callsign. On January 12, 1984, a CMARA Board of Trustees was formed and first met at W1UD, Bill Voedich's QTH. A month into the formation of official Trusteeship, it was decided that the aging machine was definitely in need of a "major facelift."

In November, 1984 the Trustees purchased an LR-1 Micro Specialists basic repeater from Kendecom, Inc over in Groveland, MA. Gene Gregoire, WB1DZK provided a loaner machine until the new LR-1 was ready. The cutover from the borrowed repeater took about 4 weeks time, and on April 5, 1985, the new CMARA facelift was well underway. Duplexer cavity drift was an immediate issue causing interference with the repeater at Billerica, MA. Gerry, WB1GSO stepped forth and convinced the Trustees and Club to spring for a new cavity costing \$600.00. Later that year, Gerry also pushed for an extension of the timeout to 90 seconds, for by now, members were getting used to repeater etiquette

Repeater History

1987 brought about the purchase of a 440 mhz, link and antennas for \$600.00 and a new PD-220 Super Stationmaster Antenna with hardline feed, which went into service in January, 1988 moving 31 watts of 2 meter RF. Later in 1988, Santa Claus was heard on the Paxton Machine, under the guise of Izzy Meltzer, K1ACP! Debates were held during the next several years regarding the pros and cons of 911 service, which was rejected many times.

A milestone occurred later during 1996, when a new converted repeater was purchased, moving the repeater's configuration over towards its existing status today (2016). It was decided to place antennas over to the Shulan Tower, also located on Asnebumskit Hill in Paxton. Kurt Jackson, then KA1JVC, (now W1OBQ), Site Manager for Shulan, placed the receive antenna at 250 feet up, and the transmitting antenna a bit lower, at 150 feet. Results were profound! The combined elevation of Asnebumskit Hill, combined with Kurt's relocation offer resulted in outstanding area coverage. The Trustees decided to purchase a Motorola Micor Repeater system along with new cavities and a 4 voice messaging controller, which was installed in 1997. The PL tone was moved from 100.0 to the current 114.8 hz frequency during 1998. Additionally, in 1998 the "/R" cw id was dropped. The melodious voice id used now is provided by Gwen Ackley, N1XYZ, Marty's, W1EPH's daughter. Marty, W1EPH did all the work to put the Repeater's NHRC-2 controller in place.

Repeater History

Since then, the repeater has been maintained by the 4 CMARA trustees, Marty, W1EPH, Eric, N1VX, Bob, K1SF, and Greg WA1JXR. Bob, K1SF moved out to Western MA, and was voted in to be replaced by Mike, W1BNC. Tower climbing on Asnebumskit Hill and antenna maintenance has been done by Kurt Jackson, W1OBQ and his crew Eric, KS1N and "the other Eric", KA1SUN, over the years.

As of the year 2000, the repeater operates from 2 antennas, the transmit at 100 feet up on the inside of the tower, and the receive antenna WAY up on top at 250 feet, at about 1601 feet ASL! Asnebumskit Hill elevation alone crests at 1,381 feet above sea level. These milestone changes remain mostly in effect to this day, and are a main reason why the W1BIM Repeater provides such stellar performance.

Here are listed some of the Design Parameters:

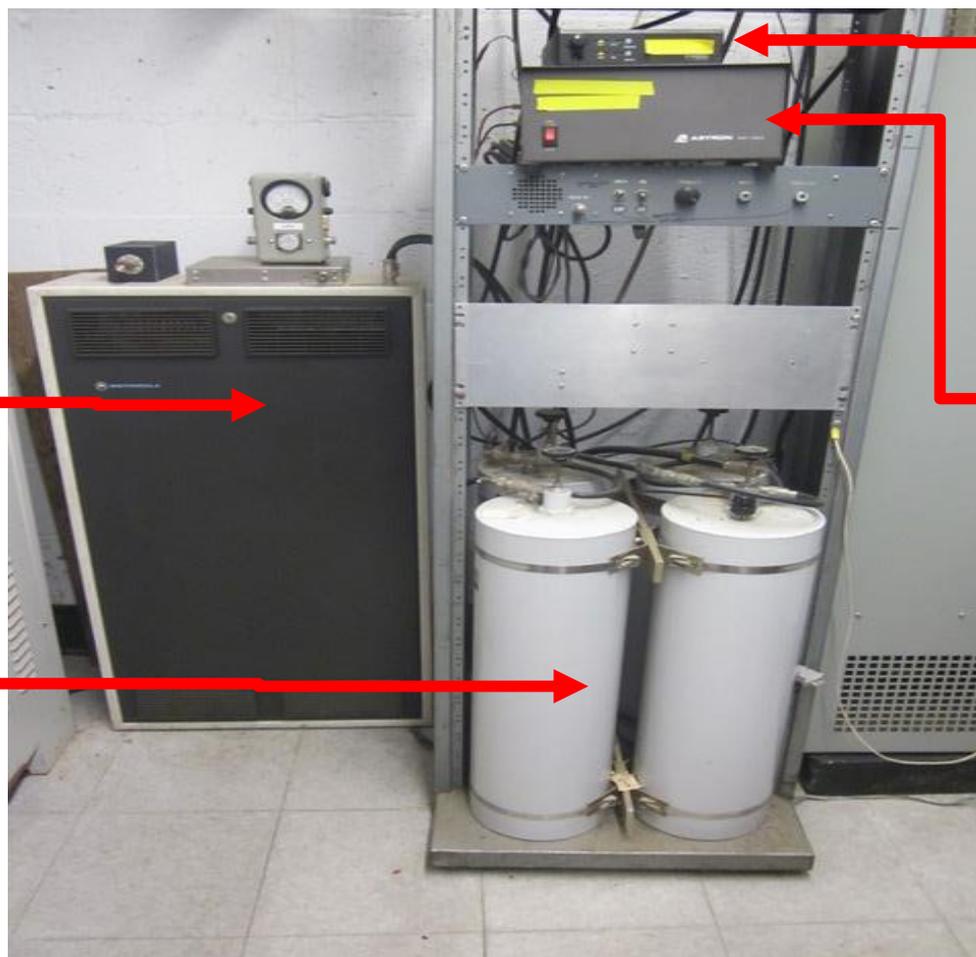
- Controller: NHRC-2 Features: Voice ID, CW ID, duplex or simplex operation
- Repeater: Motorola Micor In Frequency on 146.370 Out Frequency on 146.970
- P.L. Tone: 114.8 hz.
- Power 100 watts or less (typically 30 watts or so)

Repeater History

Without the following CMARA Club Donors, whose individual monetary contributions helped to establish and grow the hardware we use on W1BIM today, none of this recorded above would have transpired. A special thanks goes to donors: WA1JXR, WB8NTA, K1CTU, WB1GSO, W1JWM, W1JLC, N1VR, NE1O, WA1RCQ, W1JKQ, W1SPG, N1LST, W1QFD, KB1EDD, WR1T, N1NMK, Mary Dehais, N1JET, WA1IDK, KA1DGU, KB1COP, W1MMM, KA1RPR, N1SKM, KB1EVV, N1ZQM, Virginia Russell, KC1WA, KB1FQG, W1BGL, KB1GNR, and N9SC.

Thanks from the bottom of our hearts for establishing a World Class repeater system, which serves Central Massachusetts and then some!

Repeater Hardware



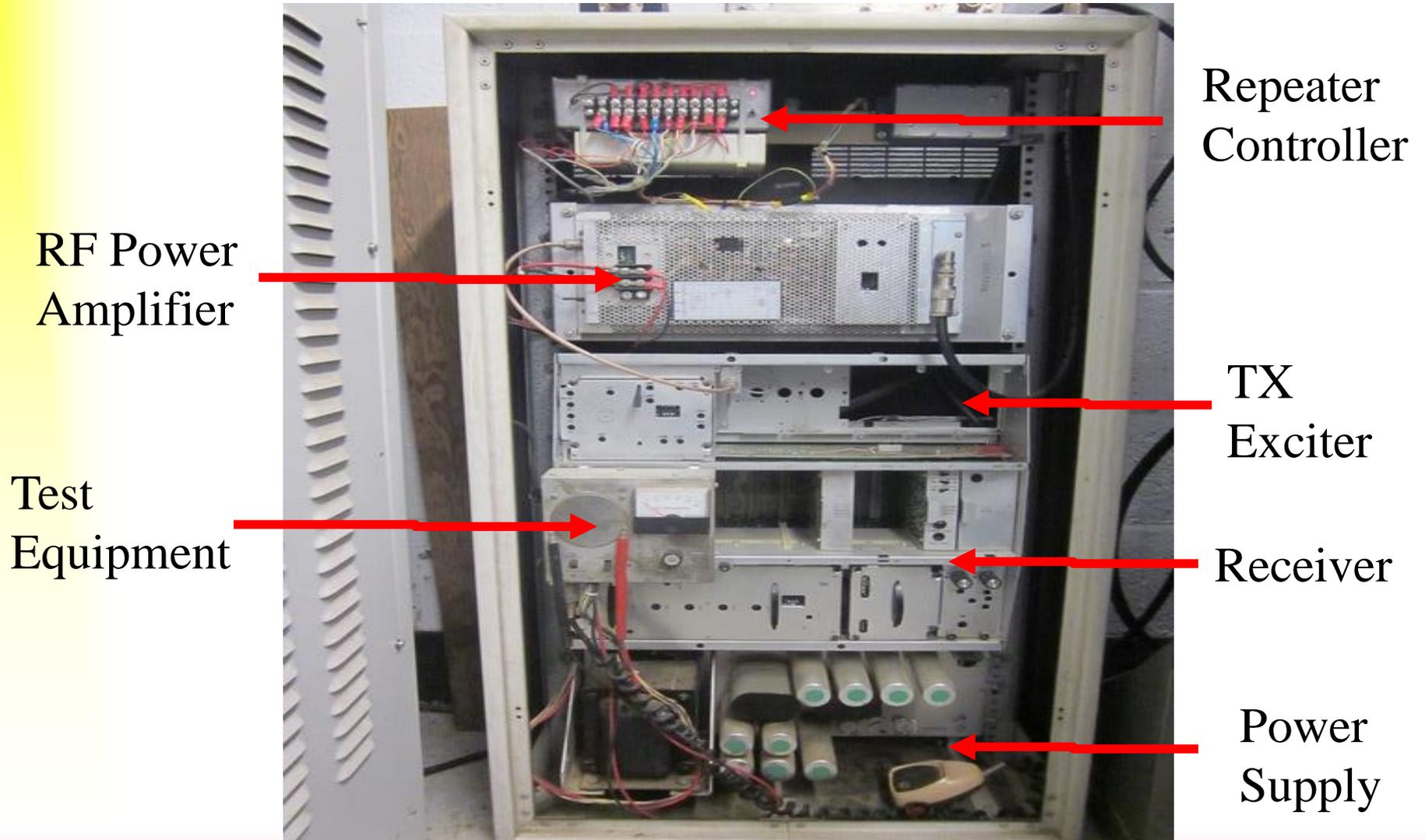
Repeater
Motorola
Micor
Rack

RX and
TX
Cavity
Filters
(Cans)

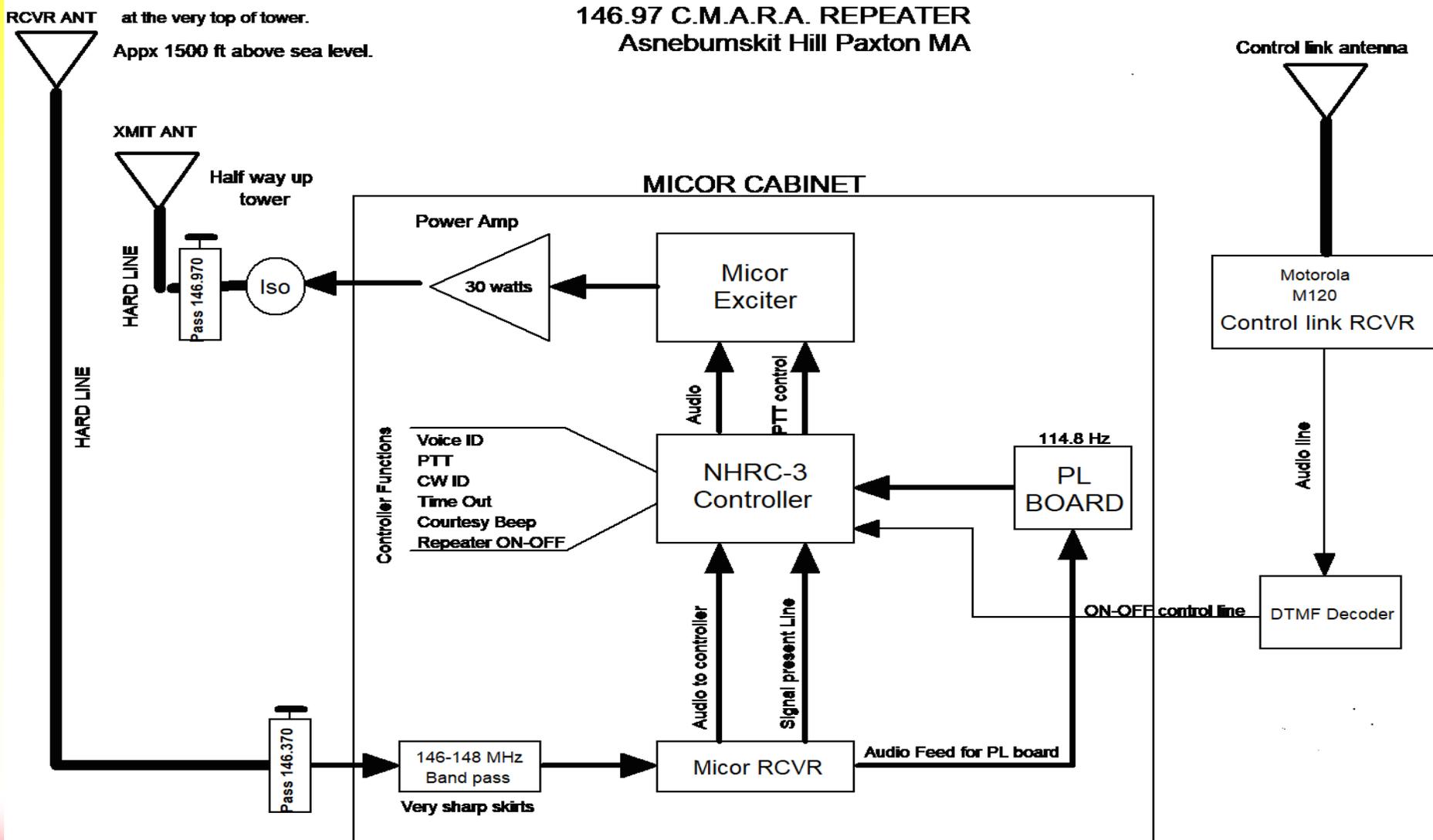
Link
Control
Receiver

13.8
VDC
Power
Supply

Motorola Micor Repeater Rack



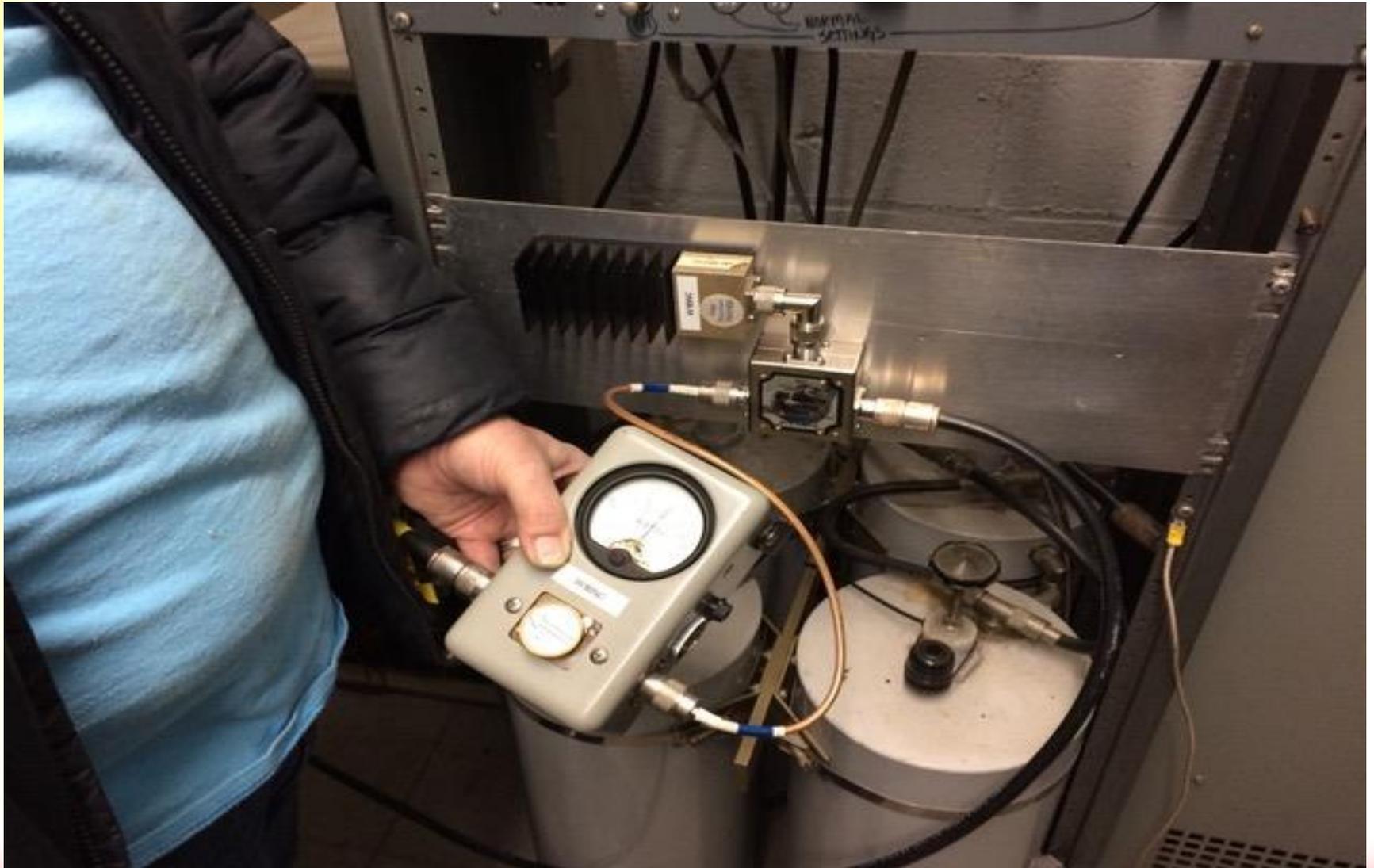
Repeater Block Diagram



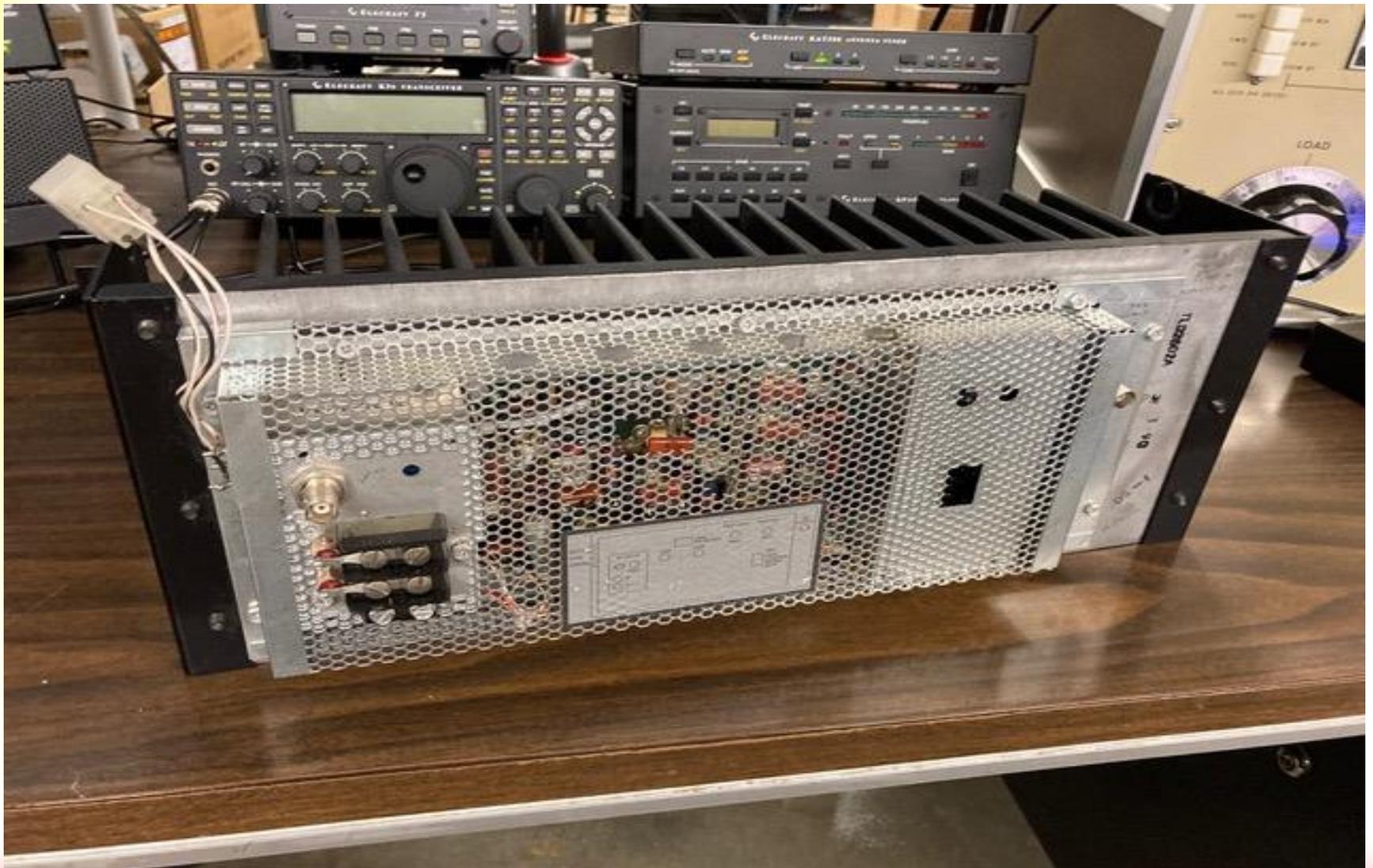
RF Power Output 40 Watts



Transmitter Isolator and Load



Spare 100 Watt Power Amplifier



Motorola Hardware, Built Like a Tank



New Controller for future Repeater



What Does the Repeater Controller Do?

- The Controller is the “Brain” of the Repeater
- When a signal is received on the up-link frequency 146.37 MHz by the Receiver, if it has the correct PL tone, the Tone decoder opens the receiver.
- The Controller creates a PTT signal to turn on the Transmitter
- The Controller sends the receive audio to the transmitter
- The transmitter re-broadcasts the received signal on the down link frequency 146.97 MHz
- i.e, the Repeater “Repeats the Received Signal”

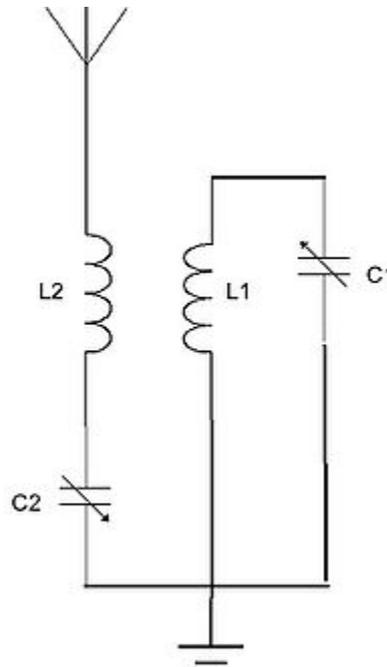
What Makes Repeater Operation Difficult?

- **Repeater Operation is a unique operation situation**
- **When you operate your station at home you receive and transmit at separate times**
- **The repeater when it operates is receiving and transmitting at the same time**
- **Feedback and overload will happen unless special filtering of TX and RX paths are included**
- **High Q (narrow) bandpass and notch Cavity (cans) filters are installed in the TX and RX feed lines**
- **Separate TX and RX Antennas are also used to help with TX and RX Isolation**

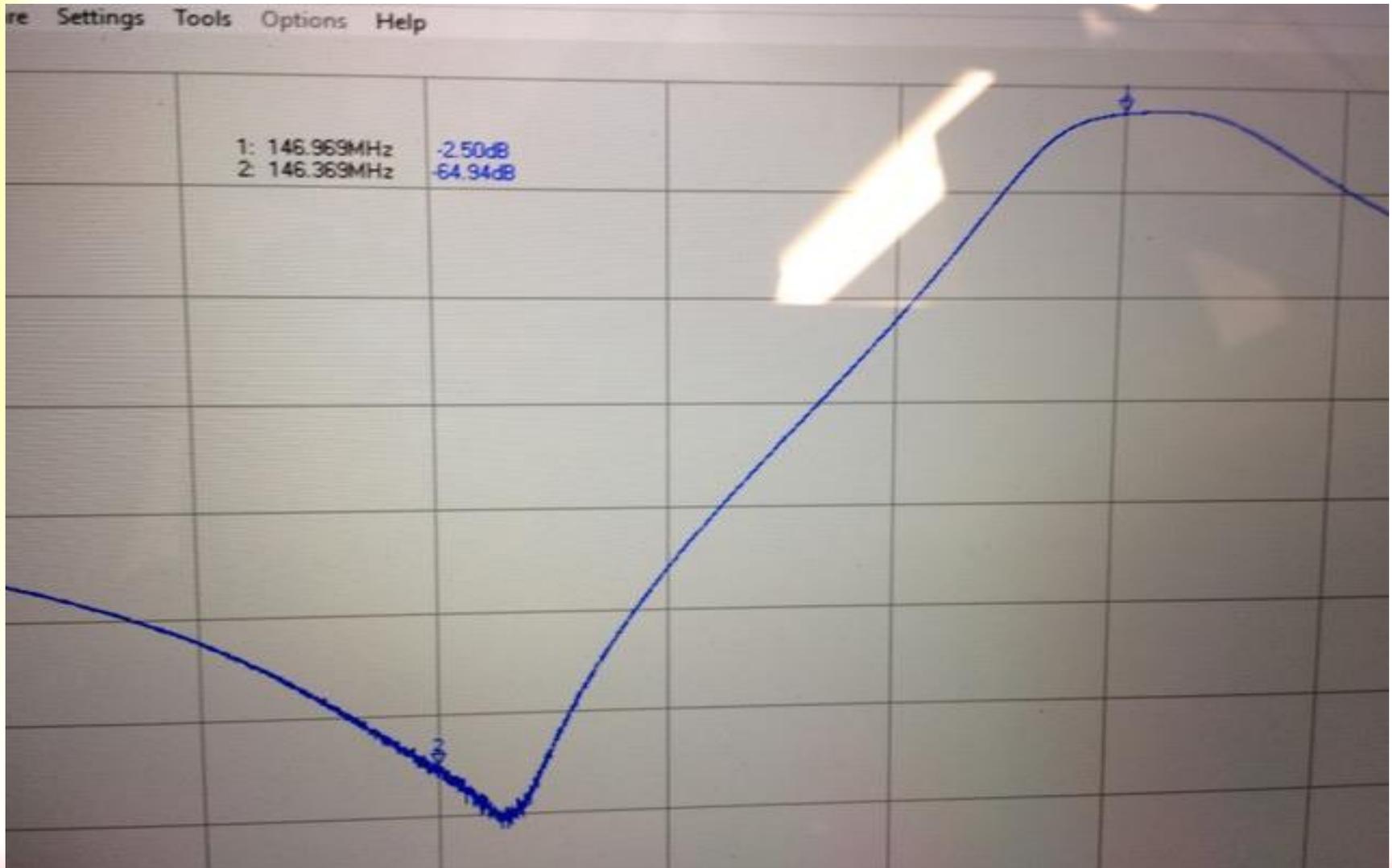
Circuit of the Band Pass/Band Reject Cavity Filter

Parallel Resonant circuit L1 and C1 make up the Band Pass filter

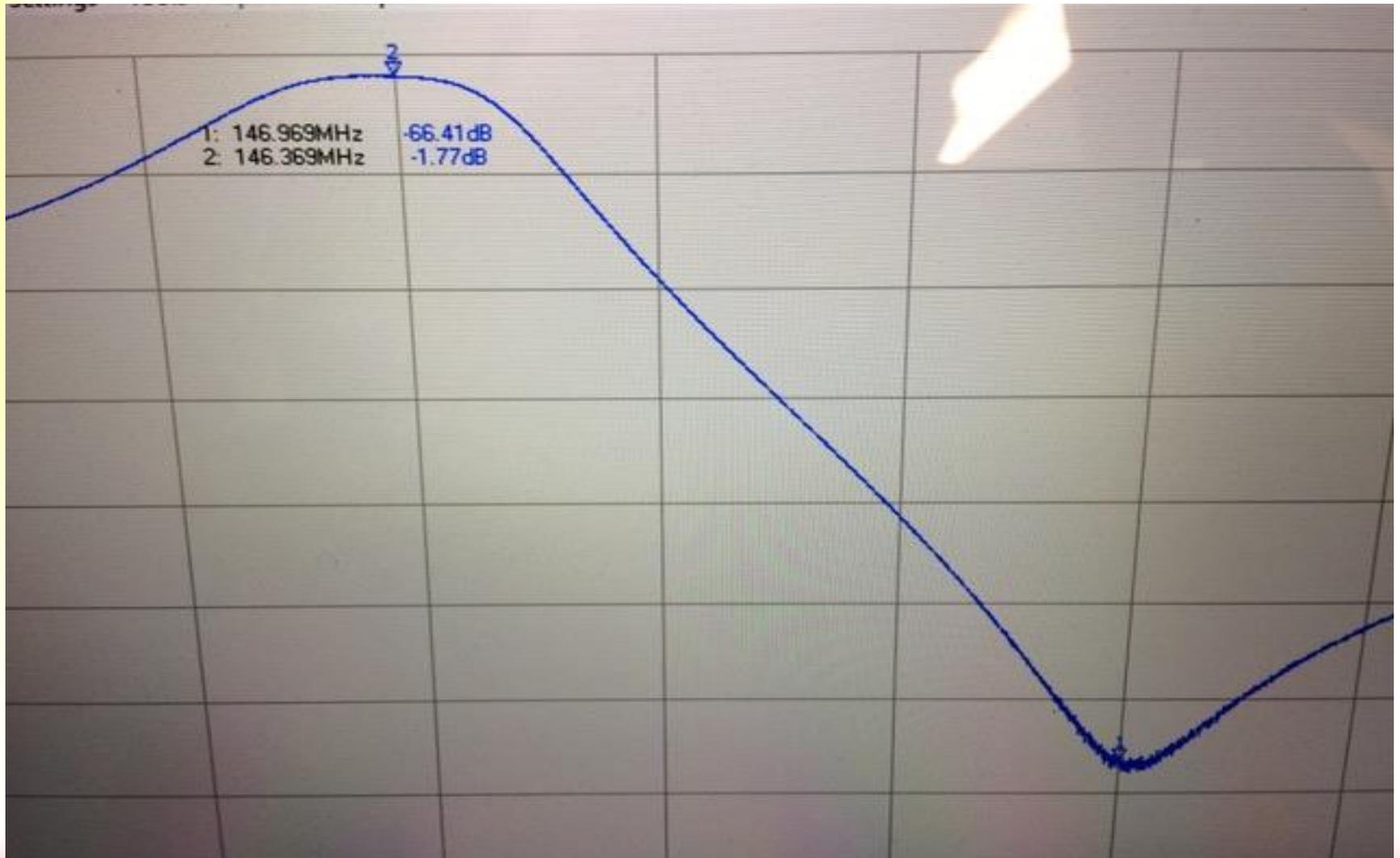
Series Resonant circuit L2 and C2 make up the Band Reject Notch Filter



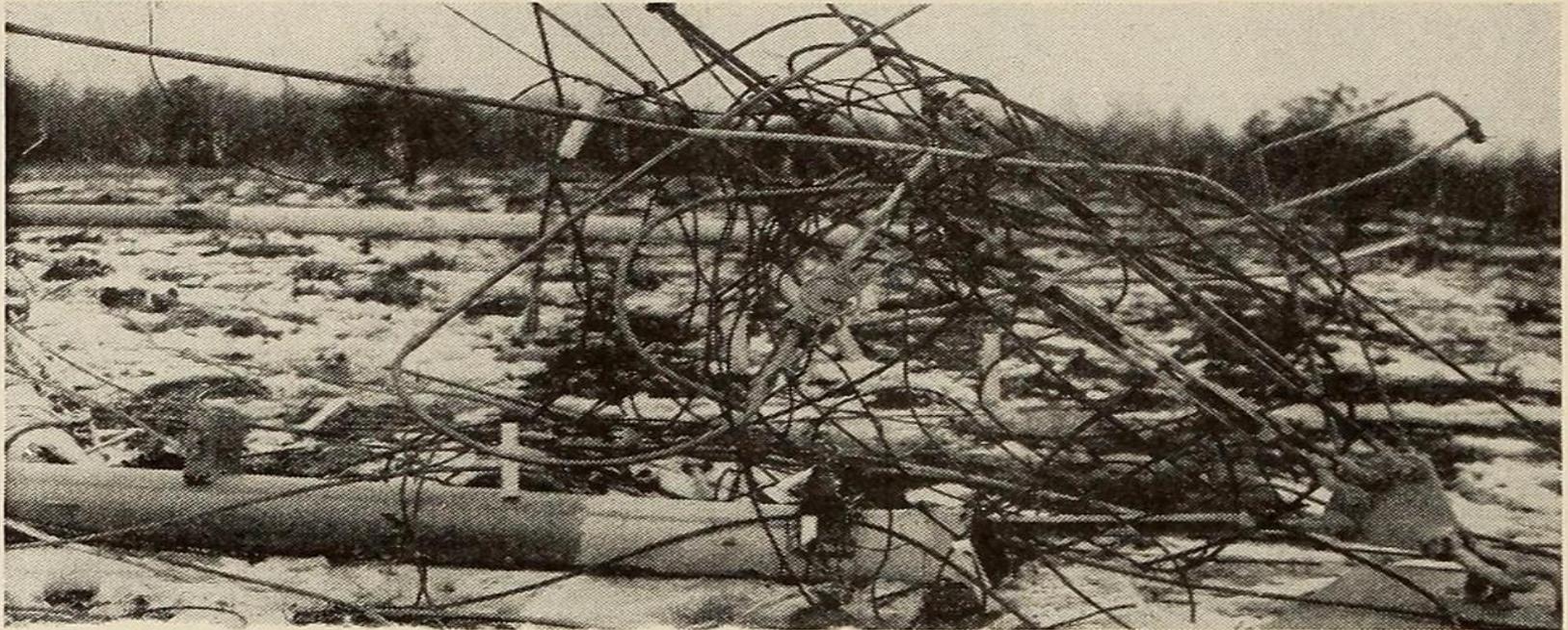
Transmitt Band Pass and Notch Cavity Filter



Receiver Bandpass and Notch Cavity Filters



Circa 1940 Top 200 ft of Tower Destroyed 6" Ice 100+ MPH Winds



TWISTED WRECKAGE of Yankee Network's F-M broadcasting station W1XOJ, atop Mt. Asnebumskit at Paxton, Mass., looked like this in the early morning of Jan. 15 when a storm of unusual severity tore away the top 200 feet. Ice accumulated on the structure to a thickness of more than six inches. Combined ice load and wind velocity of over 100 miles an hour exceeded the loads for which the structure was designed. Enough of the mast remained standing, according to Technical Director Paul A. deMars, to permit the station to continue on its 16-hour per-day schedule. Covered by insurance, the old structure will be replaced with one capable of withstanding New England's severest climate.

Conclusion

- **Thank You for your attention to the presentation**
- **We will now answer any question you might have.**
- **Thanks Greg, Mike, Marty and Eric**