

# 145.31 Repeater Visit

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Figure 1 - The roof-mounted 145.31 antenna

The 145.31 repeater had been acting up for a while. It seemed that receiver sensitivity was down, though it was pretty easy to bring up. The signals would get noisy pretty quickly, even when there should have been adequate signal strength.

Frank, KOBRA, Rick, AI1V, and Craig, N4FSC had been discussing and experimenting with the repeater for a while. We came up with a theory that something in the vicinity of the antenna was turning the 145.31 transmit signal into energy in the receiver bandpass, which then interfered with the received signal. This was based on the behavior of the machine with weak signals and also some very painful war stories that Craig had over the history of the repeater at this site.

Frank and Rick finally got a chance to visit the site and brought along an HP8920B service monitor to help with the troubleshooting. The first measurement we took was to disconnect the repeater receiver from the duplexer and hook it up to a spectrum analyzer centered on 144.71. We then manually keyed the transmitter. Whenever the repeater was transmitting, we saw very frequent noise bursts, many of which spanned 144.71. These were pretty strong bursts - around -30 to -40 dBm. The repeater can receive signals weaker than -100 dBm. We didn't see anything significant in the Rx passband when the repeater wasn't keyed. This behavior is shown in Figure 2. The spectrum analyzer is centered on the receiver frequency and is set to 20 KHz per horizontal division. The noise was pretty strong and jumped around quite a bit.

We then disconnected the antenna feedline from the duplexer and hooked it up to my analyzer to look at the return loss (related to SWR) vs. frequency. We saw a very nice curve on the analyzer, with the return loss at the Tx and Rx frequencies

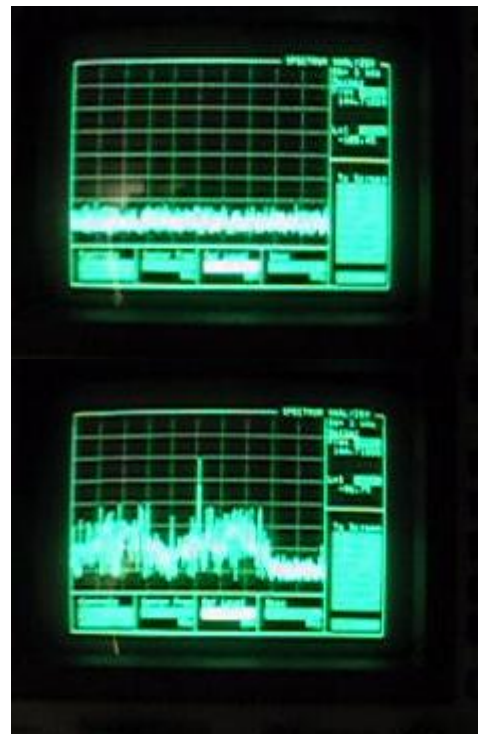


Figure 2 - The top photo is the spectrum coming into the receiver from the duplexer without the transmitter keyed. The bottom photo shows the noise bursts that appear when the transmitter is keyed.

better than 20dB (better than 1.2:1 SWR). As we watched it, though, we saw the curve jump around pretty drastically and pretty frequently. This was without the repeater transmitting (or even connected), indicating something wrong or unstable in the feedline or antenna.



Figure 3 - Three screen shots show the way the return loss plot jumped around



Figure 4 - The hex bolt after we replaced it

So Frank showed me the labyrinth path to get to the door to the roof. We looked at the feedline where it came out and went up over the edge of the upper roof. It looked pretty secure. The wind was really blowing but I didn't notice any movement. So we climbed up on the upper part of the roof where the antenna is mounted. It looked pretty sturdy, but I almost immediately noticed a hole in the tubing at the base of the antenna that looked like it should have a screw in it. I showed it to Frank and he confirmed that there should be a screw there. I went down to the gutter to see if it had gotten trapped there, when Frank found the screw lodged in the u-bolt just below where it had fallen out. We replaced it and tightened it down as much as we dared without risking stripping the threads and went back inside to repeat our tests.



Figure 5 - After the fix we had a nice stable return loss plot, shown on the left side figure. The right side figure shows a spectrum plot of the signal coming into the receiver with the transmitter keyed. The plot is centered on the receive frequency and the attenuated transmit carrier is shown on the left. It is at around -46 dBm. There were no transmitter induced parasitics on the receiver frequency.

I looked at the return loss curve for over a minute and it stayed rock solid. We repeated the experiment where we looked at the receiver port on the duplexer with the transmitter keyed, and saw absolutely no noise bursts. We did some weak signal tests with Craig who was at home and the receiver behavior was silky smooth! We declared victory, packed up and came home.