

# Two-Way-Radio Noise Floor

AN ARTICLE

BY

GARY A. MINKER

[Gary@RadioWorksRFConsulting.com](mailto:Gary@RadioWorksRFConsulting.com)

[www.RadioWorksRFConsulting.com](http://www.RadioWorksRFConsulting.com)

561-346-8494

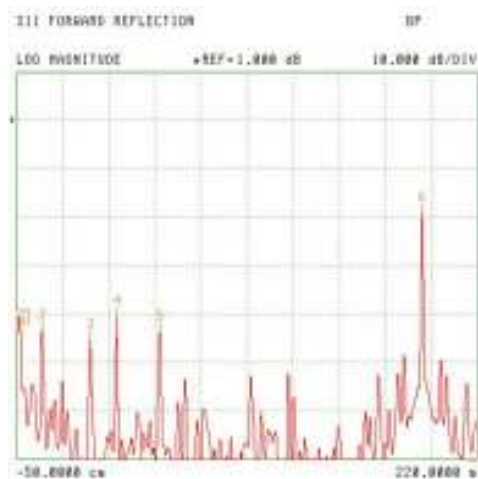


Things around your office have been freakishly quiet. It is un-nerving how quiet. Usually you hear the chatter of the Two-Way-Radio system in the background with the Remote truck, the Sales people, the talent and their IFB return feeds droning on. Chatter, chatter, chatter but things are just freakishly quiet and you can not put your finger on it.

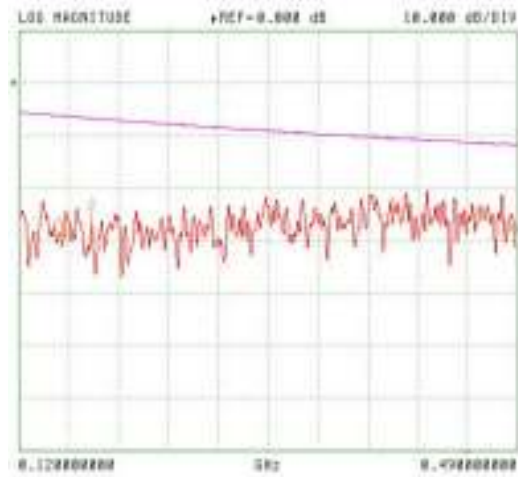
Now that you have had your coffee, and you are ready to hold court with the line backed up at your office door, the reason for the quiet appears. The radio system can not hear the peasants and no one is happy. You listen to the first 8 people complaining that the radio system can not hear anyone IF both UHF repeaters are up at the same time. Things work fine if only one repeater is up at a time but suddenly they are fighting like cats over the litter box. This can not be good.

This is a dual repeater transmitting system with two 450mc full duplex repeaters in addition to a VHF Marti receive system, all on the same transmission line. It has worked for years and you have been very proud of this home brew with some commercial parts plumbing ordeal, but now something has run amok. You muster up your courage and dust off your favorite Service Monitor from your Two-Way days and traipse over to the repeater rack. You and your trusty monitor connect in to the receiver multi-coupler and key up both repeaters to see the spectrum in the 450mc band looks like old lady Farrish's un-cut crab grass. One carrier at a time is just noise free but not so with them both up. You don't really want to have to call the tower crew but that may just be a pipe dream.

What is going on here? To rule out something but you don't know what, you install a dummy load on the output of the band combiner to eliminate the line and antenna(s). The noise goes away when everything is up and keyed. Hmm, Normally this means trouble upstairs. The call goes out for the tower crew to make the 500 foot climb. The next day after copious gulps of coffee, the crew trots up the stick armed with dummy loads and a small rope. Your trusty Line Sweeper under your oppressive thumb the seemingly starts and the orderly testing begins. The line has the same number of hideous dents in it that it had after the last storm where the 7/8" hangers let go of the snake and it beat itself up a bit. The nearly dozen dents while not severe are still there but ok, let's move on.



The dummy load and short test are also revealing but your trusted Line Sweeper is wrinkling his nose and things just don't seem right. The purple line is the insertion loss of the line. The upstairs band splitter is removed and a dummy load is attached to the trunk line Type "N" connector. This value is divided by 2 since the insertion loss is a one way trip thing and the Vector Network Analyzer is a bi-directional measurement. Even for 7/8" Heliac type product 7dB seems a bit high for a value in the 450 band. The line is sort of linear in its loss curve but the number is a bit high. The #38 Bible catalog says .8db a hundred at 450mc. A total line length of just over 500 feet should not be more than 6dB. The next nose wrinkling item is the red data Return Loss. A precision load on the end of the line (given the high number of dents) looks sort of un-normal with the average value of "only" 25dB. A 40db load, with 6dB of line loss comes up with the dreaded phrase, "The response to stimulus is not as expected".



More troubleshooting commences. The decision is made to remove the 7/8" brass connector and check for water. The crew sends down some photos of Tadpoles swimming in the connector and the foam on the Heliac is so wet it is crumbling. This is Foam filled product and water in the connector usually means water slithered WAAAYY down the cable but the Time Domain said no. The cable is cut back 12 crummy inches and to everyone's surprise, the line is clean. The Analyzer was right, the connector was cleaned within an inch of reality and re-installed.



The testing results are much better so we move on to checking the band splitter. The female connectors on the splitter look ok but the possibility of some water seepage into the input connector from the obvious failure to tape and snot does exist. Dummy loading of the band splitter was marvelous.

With the previous Insertion Loss purple trace still visible, the VHF / UHF band splitter shows the crossover hump right in the middle around 310mc as it should be. Good quality loads on the output ports of the splitter show the target frequency areas and things look pretty good considering the nearly 7dB of Heliac insertion loss. OK, so far we have cleared one nasty problem. Testing moves on to re-attaching the VHF antenna. This reveals a properly shaped Return Loss of the antenna and the mood lightens up as submarine sandwiches are eaten.



The VHF antenna has a great shape and the crowd goes wild. Amidst the cheering with the UHF port screwed to the still un-terminated cable from the antenna, we decide to test the UHF jumper with a dummy load. Comparing the purple to the red, the jumper seemingly responds correctly for insertion loss addition and load, but whoa to us. This is where we get fooled again. Testing this jumper with the top mounted band splitter, its loss (though small) and the high value loss of the trunk line, this all seemed fine until we try to look at the UHF antenna.

The UHF antenna looked alarmingly like the dummy load on the end of the UHF jumper. The decision is made to bring the antenna down to the ground. Once on the ground, the antenna tested as good.

(confusing) This confounded pretty much everyone so we decided that though the jumper appeared to test well, the losses must be hiding the band shape of the antenna so a new jumper went up the tower along with the freshly tested antenna. With just a few minutes to install the antenna and jumper, great joy was found when suddenly both antennas could now be seen. The correct band widths appeared, and the system came back to life.

Sometimes things are not as they appear. As the Chief Engineer of the station, your knowledge base must sometimes extend outside of what you might think is required of you in the Broadcasting genre'. Electrical, Mechanical, Generators, Two-Way-Radio, even Plumbing and Parking lot asphalt patching may all be chucked in to your pervue. It is sometimes unfortunate that these out of box fields of expertise may be foisted upon you but if you aim to keep attending those Christmas parties as an employee and not a guest, this may be what is required of you. IF you have not had the pleasure of actually working in or for these extracurricular fields, make friends with your various service and support persons. They can be a fun wealth of information. It helps to own your own test equipment or work for a company that can afford to, or has the desire to purchase some of this pricey stuff for you, but either way, learn to speak the language of these trades and your life will be so much easier You will have another thing to show Mr. or Ms. Mangler why your department is not an expense but a profit center like their trusted suits.

