

DON'T DO THAT:
My Transmission Line Can Hear!
By: Gary Minker



I got a call the other day from an old Bibb Overalls wearing customer of mine with a nice little country Music station that blows a paltry 100kW in to the Ether. This is a nice old guy who does know a thing or three about tractors, generators, farming and now to his amazement, Transmission Line.

The call was typical from him. ME: Gary, HIM: Hey, How y'all, ME: What's new?, HIM: I seen somethin I never knowed,,, and this is where things went South,,,

I learnt a new thing. I was out to the transmitter the other day when a powerful big rain come up from the North and there was lightning. Man,,, there was lightning ever-where but the transmitter was a runnin good and I wasn't worried about nothing till then it happened. ME: OK, What happened? I saw a big old bolt of lightning and things was fine and then a few seconds later the boom come up on me and when the boom come up, the transmitter musta got scared cuz it shut off. My line can hear.

This is pretty funny. This is not the first time that I have heard this joke but my friend wasn't joking, and he wasn't too sure if it was the line or the transmitter. He said that the big box was humming along just fine and when the big boom hit the site, the box dropped to its' knees and did not come back up.

I know this trick.

I told him that I know this trick and he probably has a problem with one of the 21 sections of rigid line or some of the multitude of joints or bullets and that the vibration just rattled a bad joint and pop goes the weasel. He of course being a down to earth farming kind of guy said that I could not be right and this is where the bet for real money comes in.



THE BET:

I told him that I was pretty sure that I knew what to do and that if he was willing, I would pay for the tower crew, bring them in and prove to him that I was right. IF,,, I was wrong, I pay for the crew, dinner and all my expenses. IF,,, I was right, he pays for all that, more, and the parts to fix the problem. This bet was more than he could walk away from so we agreed to come back in two days and start at Midnight.

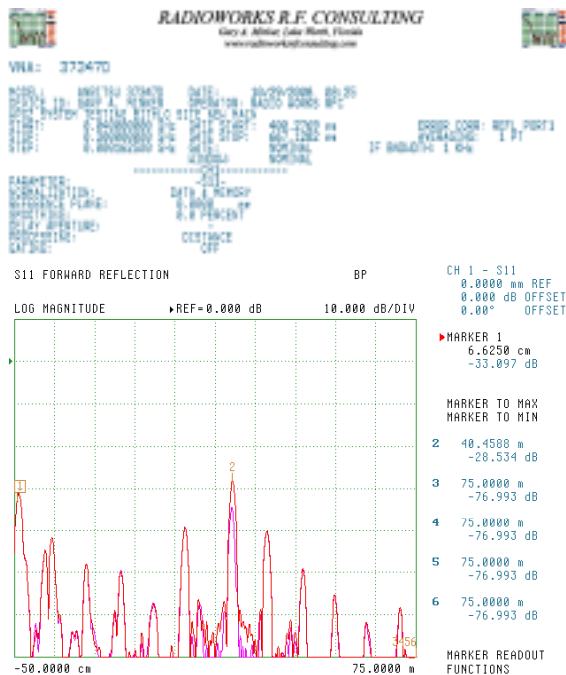
The fire:

THE PROOF:

We all met at the tower site on the appointed day, Krispy Kreme's in hand and I went over the game plan with the climbers. Go up the tower to the top most joint under the antler. Take the line loose, put an EIA to Type "N" on the line along with a dummy and bring your 1 pound rubber mallet.

I warmed up the Vector Network Analyzer and performed a characterization on the line along with a live over Memorex trace that showed all 20 or so line sections, the joints and the insulators. Clearly the joints were all over the road for Return Loss and I knew that I had this fish shot in the barrel before it swam, but we started the diagnostic anyway since there was a dinner to be won. OK, I called up on the radio. From the first joint with the mallet one time with a reasonable and repeatable amount of bang. WHAM,,, no changes. OK, 1 down, 20 something joints to go. Go down to the next joint. WHAM,,, no change. Next, WHAM. The joint jumped 15dB in Return Loss in Time (frequency) Domain. The colorful display of the red over the violet was all too clear to see. As the old joke goes,,, that's one I said. We repeated this banging all the way down the line and revealed 7 Krispy Kreme flaky joints. Dinner was delicious.

CAUSE AND EFFECT;



Transmission line in the best of conditions is not a forever kind of thing. While there are a great many Wave Guide, Coaxial, and Elliptical lines that have never given trouble, and are 30 to 50 years old, many rigid lines just do not give the trouble free length of service that one would hope for. Line Sweeping is a tool in the bag that can often locate discontinuities in the system that are about to be problematic. While I do admit that in the low single digit percentages, line can always quickly fail right after a house call from the doctor, rare as this may be, joint based rigid slip bullet line thermal cycles and shaves microscopic slivers of metal on a twice or more daily basis and at some point with the micro-arcing from this slippage, fire can be inspirational to quote Richard Pryor.

Figure 1, intermittent joint

As the joint degrades, any sudden vibration can trigger a larger than before arc at a connection which could set off an irreversible burn that only goes out after all the Teflon and brass have melted in to a puddle or dripped down the inside of the line. The soot is tough to clean and all the molten beads of metal need to be found or the problem can happen again and again.

LINE SWEEPING:

It is important to Love your Line Sweeper. With so many people claiming to be a "certified" Line Sweeper because they have an "Anritsu Card" that only proves that they know what buttons to push on only a certain model of test apparatus, let alone competently interpret what the squiggly lines mean, you have to develop a relationship of trust with the person that you call Line Sweeper. Different types of line, have a different signature.

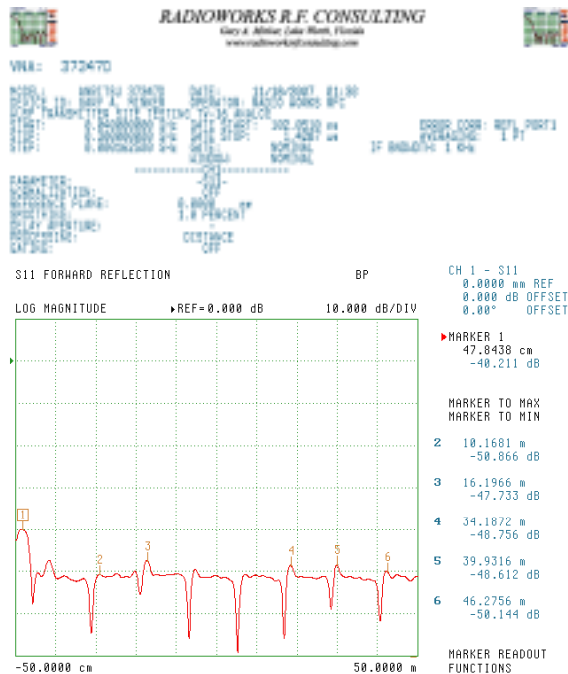


Figure 2
This is an example of SWR brand Rigid line

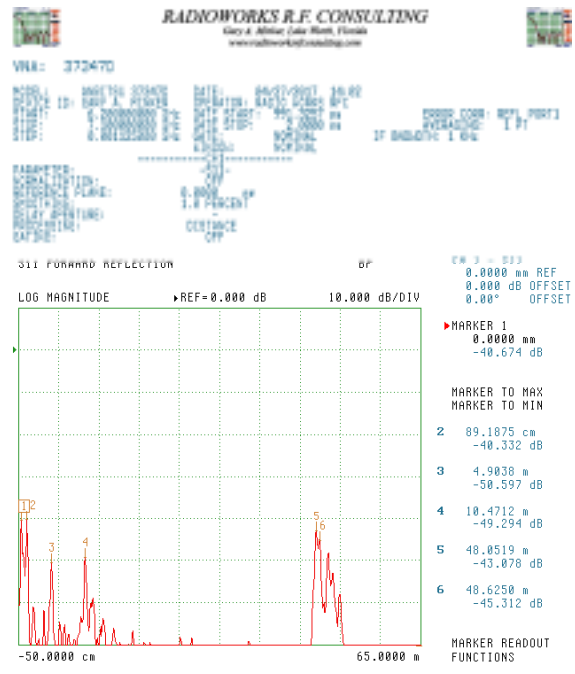


Figure 3
This is an example of a Metal type coaxial product

Various types of line exhibit well known signatures. Standard EIA type line has a positive going distinct bullet joint that also has the signature of a dent or other discontinuity. Figure 1 above with the red and violet traces shows the effect of repeated strikes with the rubber mallet. A similar result can be seen with the figure of the close in view of SWR branded line. The unique cup and cap joint yields a better Return Loss than does the standard EIA type flange joint but when the joint fails, the same positive going result will be displayed as in the red over memory violet trace. Metal type coaxial products like Heliax or Helifix are virtually discontinuity free except for the numerous small dents, kinks and ground kit applications of Figure 3.