DOUBLY INTERMITTENT

AN ARTICLE
BY
GARY A. MINKER
Gary@RadioWorksRFConsulting.com
www.RadioWorksRFConsulting.com
561-346-8494

FAILURE is not a great word. Yet here you are with your third line burn out in less than a year, and General Mangler in the corner office wants your head on a stick. You try to explain to her that the antenna system is nearly thirty years old, it never sprung a leak, it never smoked a sausage, or failed in any way until this year. This year it has left you tripped up with three strikes and poof for the third time, and your favorite Line Sweeper has warned you about those watch band springs several times. Convincing the corner office that it is time to gut the line and install all new inner conductors is going to bankrupt the station, but as you have tried to tell them, save up for that rainy day cuz it's a cummin. Re-lining just the inners is cheaper than 1200 feet of new line, even with all new hangers since yours are missing all the buttons and your springs are shot.

Things look bleak but the corner office very reluctantly agrees with you and the money magically appears. The new line comes in and your trusty tower crew begins the nearly three week trek to renewing your system. Things go pretty well. No problems to speak of, no issues rise up and the end of the actual installation is at hand so you call your favorite Line Sweeper and give him an arrival date.

The big day arrives. The Mangler is anticipating getting off of the auxiliary that she thinks only covers the city limits, and you are ready for that Grape Nehi that you have been saving for the glorious turn on. Line Sweeping commences and in the first several minutes with all eyes transfixed on the Vector Network Analyzer, the deep V of the grand canyon appears with a nearly -30dB Return Loss and Viola, right before everyone's eyes, the screen flat lines like a bad cardiac trace, and the room falls silent. Of course your line sweeper freaks and the nervous check of the machine and the test cable reveals that the Analyzer is indeed operating correctly, and upon plugging back in to the line in question, the trace is still flat at only -9dB. Choice words are beginning to be uttered in several foreign languages including Klingon and Viola, right before everyone's eyes on the next trace painted on the screen, the Return Loss is back to about -30dB. OK, this is a joke right? The Line Sweeper guy must just be funin us right? Questions get asked in rapid fire succession by all in attendance and the poor Line Sweeper is in shock. Just sitting there watching the screen over the next ten minutes, the Return Loss is jaggedly all over the road, and appears to be anything but stable. This is not what we expected. This is certainly not what anyone wanted. It is late in the day and everyone agrees to hit it again at first light.

Day two is clear and blue with perfect elevator ride weather and up goes the crew. While watching the Analyzer go berserk the day before, the dual screen overlay with Time Domain on top and Return Loss on the bottom, it is clear that the high resolution Time Domain pin points a dramatic change in the elbow complex just in front of the antenna at the Lambda transition.

The twenty minute ride and short climb brings the crew to the area, and the step by step careful process of elimination begins. Firstly the rubber mallet comes out and a serious framming of the elbow complex reveals that the intermittent issue is mechanical in nature. Now the question is where?

The type "N" to 3-1/8 transition cap and precision load is installed on the end of the vertical trunk. The results are stable and secure, at least so sayeth the rubber mallet. The first of five elbows is now made ready to install on the system under test and after a good looking over, the cap is moved and the output of the first elbow passes with a resounding thud. The second elbow is removed and upon its inspection the crew finds that the output bullet cup is hand loose and the hex cap screw that holds it in place is three turns loose. Hmm. The cap Hex is tightened, the test and load is cap moved to the output of the elbow and with several decent frams with the rubber hammer, the system is secure. This process is repeated three more times with no additional a-ha moments and the cap and load declare the system to be vibration aggravation free. Whew, that only killed half the day. Now back to the Line Sweeping at hand.

One of the tests for this antenna was to be sure that the shorting stub mounted on the top of bay one was electrically present and accounted for since this is a high lightning area. The tower crew had been trying to use an ordinary digital meter and were not seeing the short. They were watching the meter Watusi which was not a reliable indication. I showed the crew how to use a small battery, a DC ammeter with a couple of alligator clips to test for the short, and to everyone's dismay, the short was not home. At this point General Mangler is pretty steamed and is just looking for someone to yell at. I tell the crew to go to the top of the antenna and remove the stub. They do this and with twin screw drivers they short the upper block TEE to the case and the battery is employed again. No Joy. No Short. Now this is getting pretty weird. We had performed an on frequency short the bays test on all of the bays and all of the arm ends and all eight bays responded including bay one but there was no short with screw drivers, and no short with the stub.

We make the decision to bring down the upper three bays to inspect and clean them. Bay three has a bit of arc soot on the bullets but it is easily cleaned and has continuity between all of the inner conductor parts. To insure that we did not just have the word of some flaky faced digital Ohm meter, I brought out my specialty tester that I affectionately call "Mr. Burner". This variable, isolated, low voltage source can deliver up to 50 Amperes of current to test for bad connections, bullets and weak watch band springs. We employed Mr. Burner for all of our continuity testing and looked for a solid five to ten short duration Amps to indicate quality connections.

Bays three and two cleaned up and passed their continuity tests very nicely. Bay one was another case. Mr. Burner revealed that the shorted stub was indeed not viable. We removed the stub and tested it with the Burner, and of course the stub drew current perfectly. The test leads were moved to the top bullet of the bay one block and the test run again, No Joy. The Burner was applied to the arm ends of the bay and still again, No Joy. OK, this is just not funny. The bay passed the shorting wire R.F. Analyzer test but won't pass AC or DC. This bay had suffered a lightning strike that burned a few holes in the pressurized side of the system. The tire patches did a great job of sealing the air leaks, and for several years, the patch looked great, but at the same time, the main antenna seemed to lose coverage. The auxiliary at half the altitude had better coverage with the same horsepower, and no one could understand why. No one noticed that at the same time, the shorting stub disappeared. It wasn't until the transmitters were changed out that anyone noticed that the antenna did not have a short on it, and the transmitter manufacturer recommended that a new tuned short be installed in the building to eliminate static issues.

The new tuned short created some issues with the Line Sweeping. While it solved the static problem, no one put three and six together to realize the antenna was broken. Further testing with Mr. Burner brought us to the bay one block. The alligator clips were attached like a torture device and the continuity testing began. Up comes the Variac and with a hush on the crowd gathered, the Ammeter cried out NO JOY.

Alright, this is nuts. A bay connected to the block has no AC or DC continuity to the block on either bullet. Neither bullet has continuity to each other. The bay is clean inside or so it seemed.

The block was removed from the bay arm and the Burner applied again to the center conductor bullet on the arm tube and both arms with great high current success. How could the block not pass current? The next drama filled find was an eye opener.

Soot. Look, soot. The bullets were removed from the bay inner block to find that both bullets were not properly torqued and they were both blowing arc soot out of their threads. The soot passed the R.F. testing and would not pass AC or DC.

Once the soot was brushed out of the inner TEE on both ends, and chemically cleaned. The freshly cleaned bullets and their dirty deeds were re-torqued and Mr. Burner applied his brute force.

Finally we have conductivity from bullet to bullet and with the shorting stub attached, we had continuity from inner to ground.

All of the rest of the bays were brought to the ground for cleaning and continuity testing along with a right and proper torquing of the bullets.

The antenna was reassembled, and with several reassuring thuds with the rubber mallet for good luck, the system was returned to service. With all eight bays running and 1200 feet of height, the coverage even made Ms. Mangler happy.

Sometimes it is the little things that as chief you need to watch.

Enjoy,