



Not My Transmitter A Dirty Box Causes Cellular Interference

A paper by Gary A. Minker
Radio Works R.F. Consulting
(561) 346-8494
Copyright 2019

7370 turkey Point Drive
Titusville, Florida 32780
(561) 346-8494
Gary@RadioWorksRFConsulting.com

Over the years of hunting various kinds of interference, I run into many types of proud Engineers who really do keep a tidy ship, and try very hard to keep a neat transmitter site with that tidy transmitter that anyone's mother could be proud to show off both inside and out. This is refreshing compared to the grungy, filthy, slimy R.F. generators that many of today's contract care sites sport.

In the usual world, this kind of filth in a transmitter is only detrimental to the health of the one stuck with repairing the infested beast but now and then, these dirty birdies, create dirty birdies and these birdies show up at un-wanted places in the spectrum at both even and odd harmonics of the base carrier.

Since I work for a wide range of 3 letter acronyms with guns, various public safety organizations and piles of Cellular carriers, I get the call now and then to assist with a hunt for Red October that has popped up in the middle of someone's favorite band and I don't mean Led Zeppelin.

The Federal Communication Commission developed rules back around say 1934 that prohibit the generation of interfering signals to other types of licensed, un-licensed and machine devices. These noises can be generated by a host of maladies but the one that no one suspects is DIRT. Let's face it, dirt has been around for billions of years. It is way smarter than we are, only a few of us remembers when dirt was new, but we have all seen dirt in its non native settings where it does not belong. One of these places is inside the transmitter. While modern day Solid State transmitters operating in class A, AB, AB2, and other limited applications are generally more immune to generating trash for any reason, it is the venerable class C operation of both solid State and Vacuum devices that cause these issues. It is true that class C operation's primary purpose is to generate harmonic trash in both the even and odd registers, and the fact that this operation has a primary output of the desired frequency is an accident,

we still love our class C boxes. The containment of these errant generations of harmonic garbage is the key to successful operation in the eyes of the Cookie Company. Today, now that there are people in the forest to hear the tree fall where previously who cared if there was a noise in the 710mc or 1750mc bands, these days someone is listening everywhere and these previously here-to-fore harmonic blobs went un-noticed.

Ignorance be no more:

Our old friend dirt is the path to ruin where conveying harmonic trash is concerned. While a transmitter may seem pretty clean by anyone's standard, it is dirt, and primarily high carbon content dust or soot that is the worst enemy along with tarnish and corrosion. A transmitter can have multiple paths for leaking stray harmonic trash R.F. from the most un-seemly places.

MECHANICAL:

Panel covers, loose hardware, screws, nuts, bolts, and worse yet, rivets are horrible offenders. Transmitters should be thoroughly inspected for mechanical integrity at least twice per year. Loose hardware not only leaks stray R.F. it can cause burning, arcing, fire and the eventual destruction of your money tree.

TARNISH:

What is tarnish? This dull and unsightly discoloration of metal is a chemical reaction between the moisture in the air, dirt and the metal involved. This discoloration involves crystalline formations and when electricity is applied, bad things happen that range from the generation of more errant electrical trash to fire, and from previous articles, we all know that fire is inspirational.

DIRT:

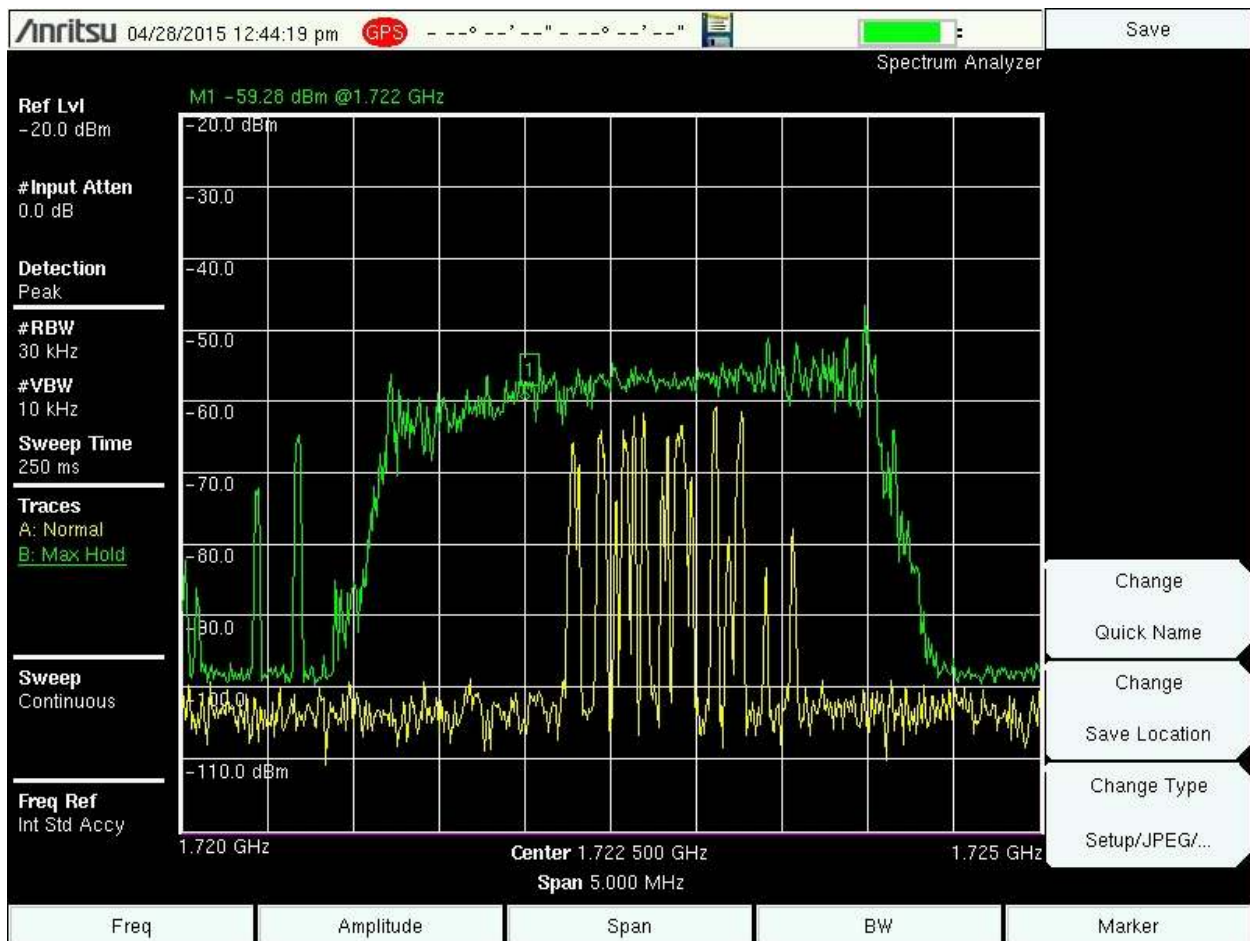
In its simplest form, dirt in transmitters manifests itself as a high carbon soot like substance. While having an inherently high basic resistance to the flow of electricity while dry, this carbon is a fantastic conductor when either damp, or encroached by a high enough voltage. Aside from the inspirational fire that erupts whilst conducting massive amounts of electrical plasma due to an arc, these carbon paths also guide harmonic trash out of containment boxes, cavities, or other sources of high powered R.F.. Carbon infested high voltage wiring such as the B+ lead, bias voltage and sample sensing wires along with coax and insulated tuning rods all conduct harmonic trash out of the cavity. Another dirty culprit is the dual capacitor and choke bypass set up on high voltage wiring. Dirt on the capacitors, and standoffs are notorious for allowing harmonic trash to exit the building along with a bad Elvis impersonation.

UN-TERMINATED SAMPLE PORTALS:

Most Engineers are so used to looking at un-terminated sample portals on line sections and coaxial connections for things like modulation monitors that we just gloss over them and ignore them. This is not a good thing to do. These open portals are very high impedance avenues for leakage of all manner of trash.

Install some cheap 2 Watt terminations on them. Do not install shorts or shorted connectors on to these abandoned or un-used portals. Other malicious activities can occur that could be stinkers to trace out.

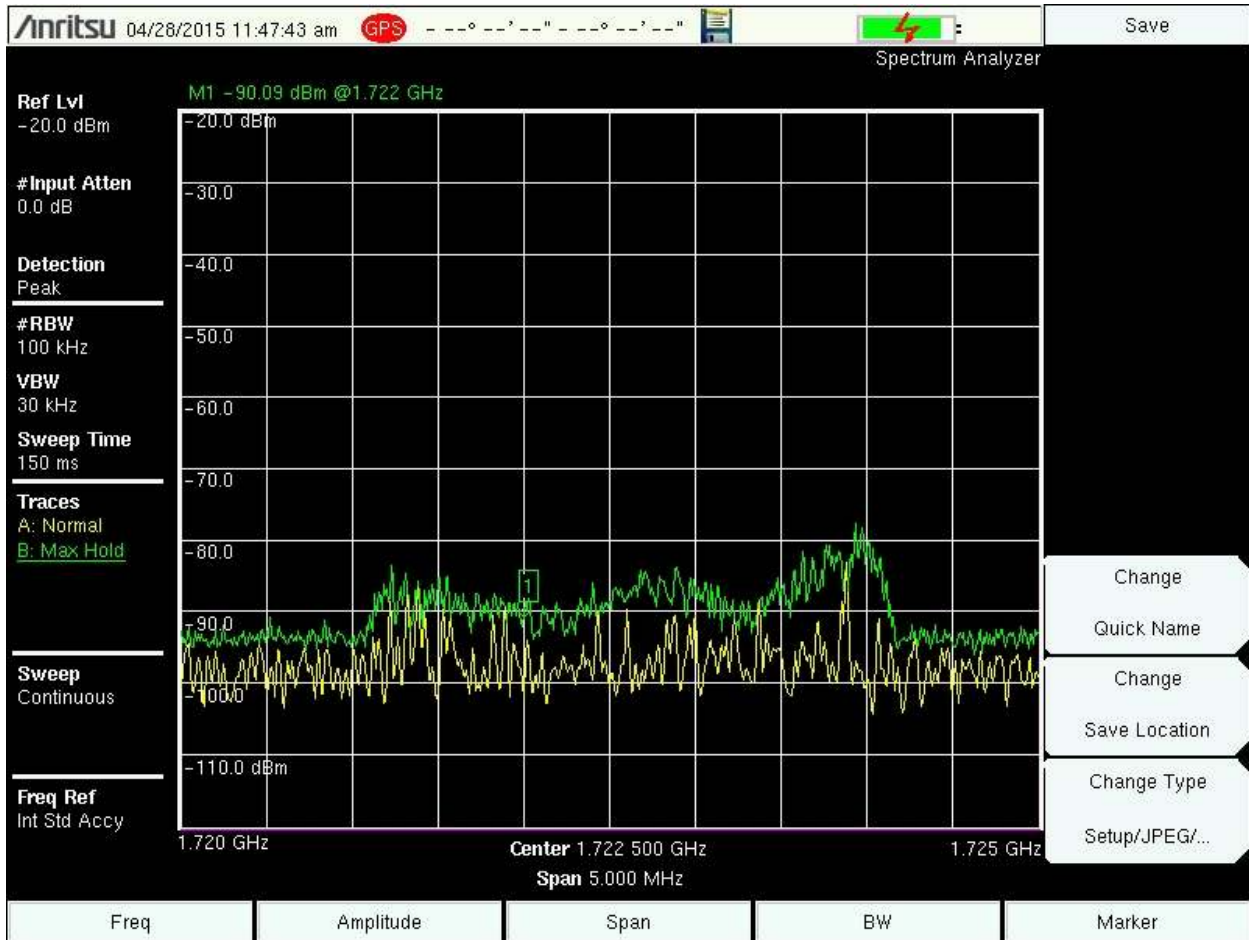
The spectrum Analyzer traces shown below are before cleaning and after cleaning along with a good mechanical inspection and tightening session. The local Cellular carrier was eternally grateful after this 3 hour clean up on aisle 5. When faced with changes in the radiated noise levels such as these, even 10 to 20dB of change when plugged in to the free space loss Friis Equation makes all the difference in the world.



BEFORE CLEANING, TIGHTENING AND INSTALLING TERMINATIONS:

Admittedly changes of this magnitude are not the norm but this does show how a good cleaning and mechanical inspection can make a substantial difference. While the rules of the Communications Act of 1934 are still very valid today, do not get sucked in to the notion that just because your transmitter output up the stack conforms to the -80dB down from main carrier bit, the Commission wants all parties to have skin in the game to peacefully co-exist in this tree falling forest. Violations of the cabinet radiation standards from various other sections of the CFR Federal Code such as Industrial-Medical-Scientific (ISM) can trip you up.

If your licensed facility is interfering with another licensed facility, you need to hope it is not Federal, Municipal, Life-Safety, or Law Enforcement, and even then the Commission wants everyone to work toward a viable solutions. Digging in your heels WILL earn you a citation and likely for multiple issues. Fortunately they can't cite you for being stupid but they will find a half a dozen other things to ruin your day over if you and the complainant don't get on.



AFTER CLEANING, TIGHTENING, AND INSTALLING TERMINATIONS:

END OF DATA: