

# Intermittant Fire Alarm

AN ARTICLE

BY

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Honk Honk Honk, Blink Blink,

Oh man, not again.

The fire alarm is going off again or worse yet, the fire alarm is reporting trouble in the upper floor loops. Boy does this get old.

You should be the proud one. Snapping your suspenders over your new transmitter site on the roof of a 700 foot tall building. Wow, what an accomplishment. You even have a grounding system that has survived lightning season. New everything. Four new transmitters in a shiny new combiner with a moderate gain Omni Cavity Backed Antler. A few tens of Kilowatts and some R.F. energy levels on the roof just below the antenna that warranted safety measurements, screening and R.F.R. signs on all the doors and hallways. Yes, this is a great new site.

Did I forget to mention that ever since the first 1,000 Watts was radiated that the fire alarm on the upper most floor either trips the trouble fantastic, or just outright goes in to alarm scaring the children at all hours of the day or night.

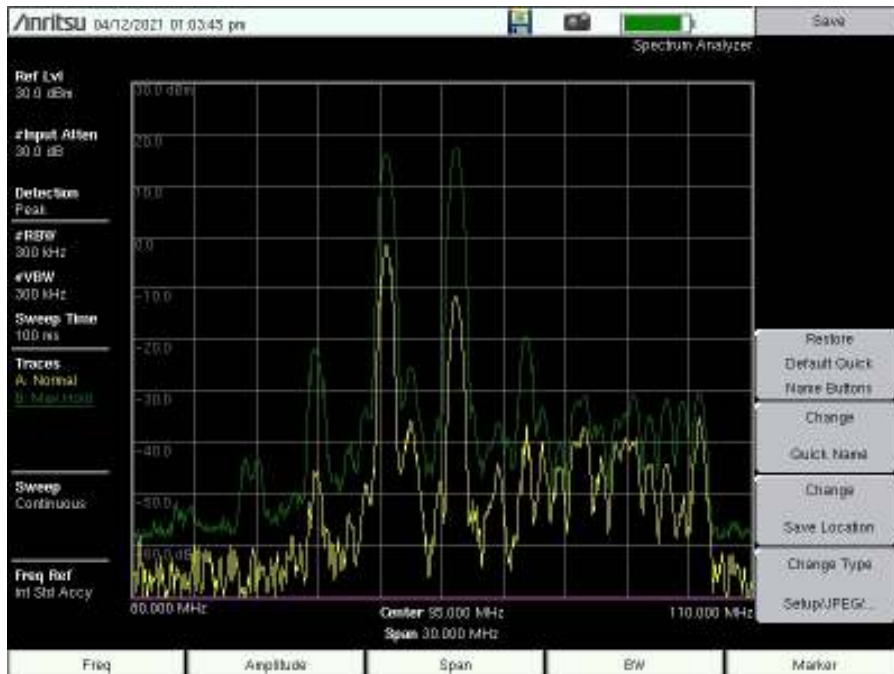
The various factions involved in this adventure such as the building management, the fire alarm maintenance company and the station Engineering staff have all be pointing fingers at each other but with no proof and a pile of moldy conjecture, nothing was getting the issue closer to a resolution. Logic dictates that the last one to the party just like Intermod, is usually the one who caused it, and usually gets to fix it. Those common sense rules seemed to apply here and everyone thought that the Radio Stations should surely be the guilty culprits.

After much conversation and many frightened residents of the building, the Pro from Dover was called in to help with an evaluation. In order to keep all of the involved parties invested in a day of diagnostics, a meeting was called prior to the physical / electrical testing that gathered the members of the various entities and their weapons. I got the pleasure of leading the pre-war meeting and many of the attendees (9 of us) checked our guns at the door but kept our knives. Very candid discussions about the method of wiring, style of conduit, type of wire used, shielding, devices, analog V digital and a host of other relevant topics consumed almost 2 hours of fantastic discussions that while enlightening, also nearly led us astray with falsely pre-conceived notions.

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The next course of investigation was agreed to be a Walk-About on the first exposed roof level with a portable Spectrum Analyzer and a Rubber Duckie. We wanted to prove out that the levels of R.F. on the roof area were as frighteningly high as predicted. This assumption proved to be very true.

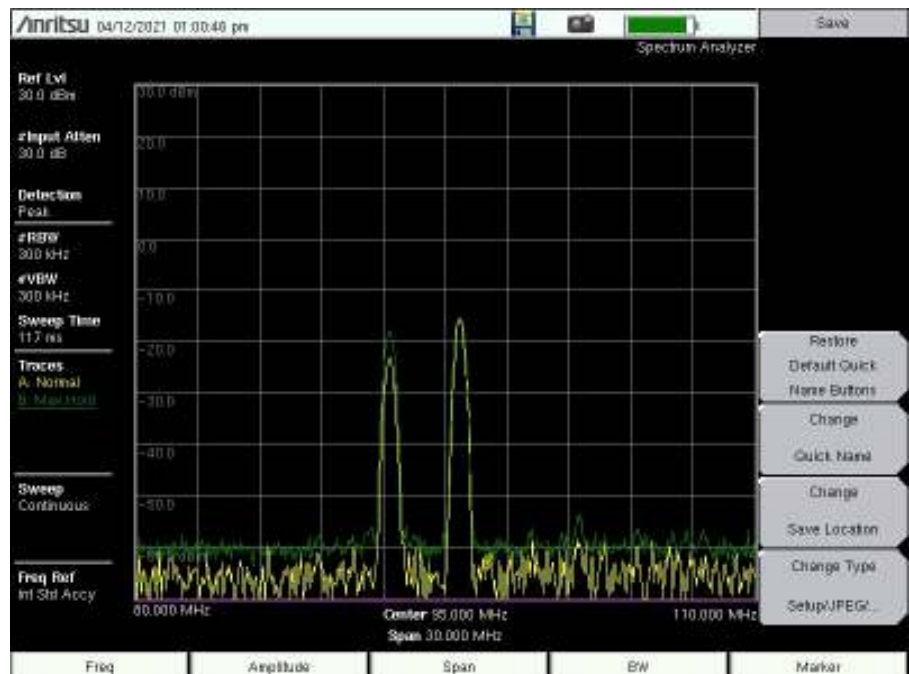


The peak hold energy readings of -23dBm were very impressive. Considering the loss value of the average Rubber Duckie, I could feel my belt buckle complaining while I walked around snapping samples all over the roof. Interestingly enough, the transmitter room which is on this same level and has a 14 inch thick concrete and mesh mat roof had a significantly lower R.F. level.

With the reading of radiated signal being 20 or more dB down from the readings directly outside, a bit of a wet rag was starting to form over the possibility that the new transmitters were the problem.

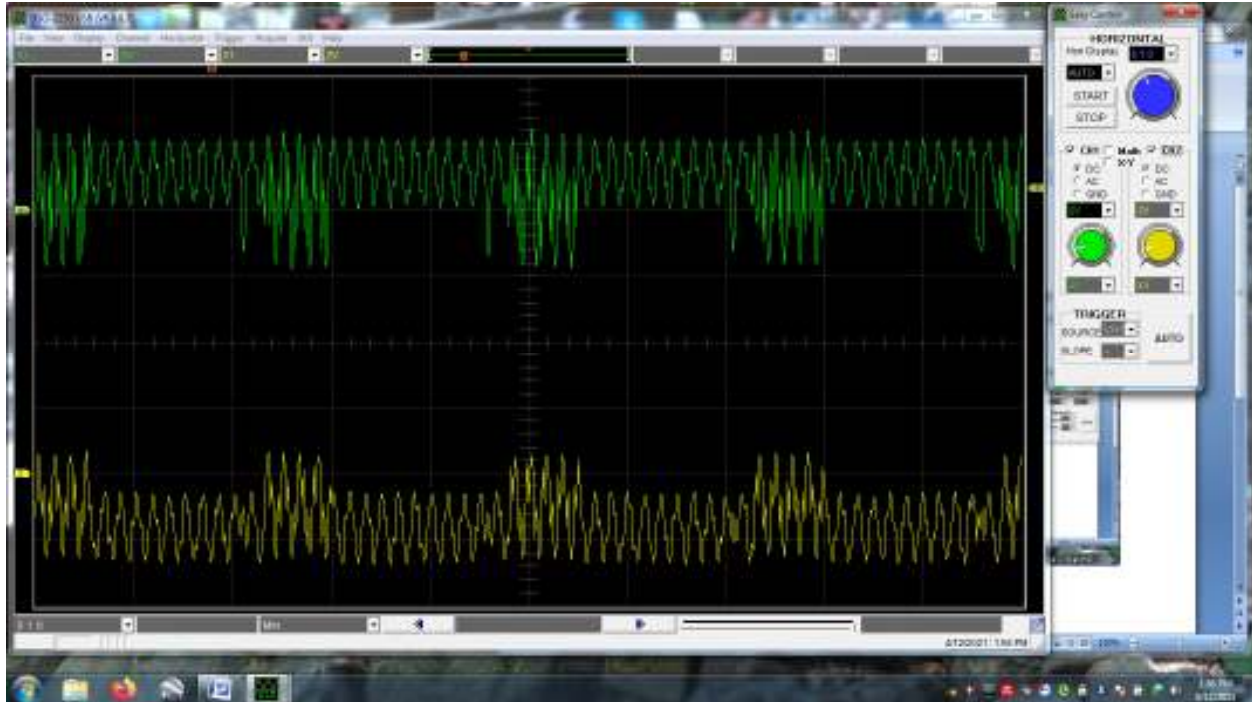
### WHAT COULD THE MATTER BE?

With the Spectral evaluations stored in the memory of the Analyzer, we had agreed that additional testing would be performed on the actual wiring of the fire alarm through invasive scope probe methods with a color digital Oscilloscope. The first sample location was in an electrical room on the upper floor in question. From here we could directly access the home run to the master loop controller as well as the two loops of trigger devices such as smoke detectors.



This fire alarm is a new technology one pair digital system that both powers the detectors and communicates with them on the same pair. While my feelings on the approved choice of wire was askew from the other participants, un-shielded solid, single twisted pair 16 gauge in a vinyl jacket and encased in conduit might not have been my first choice but I digress.

Everyone was expecting to see this massive smear of R.F. carrier on the screen of the Oscilloscope. I have to admit, I was half expecting this also but when we got started connecting to the system, The picture of the grinning idiot was not what we expected.

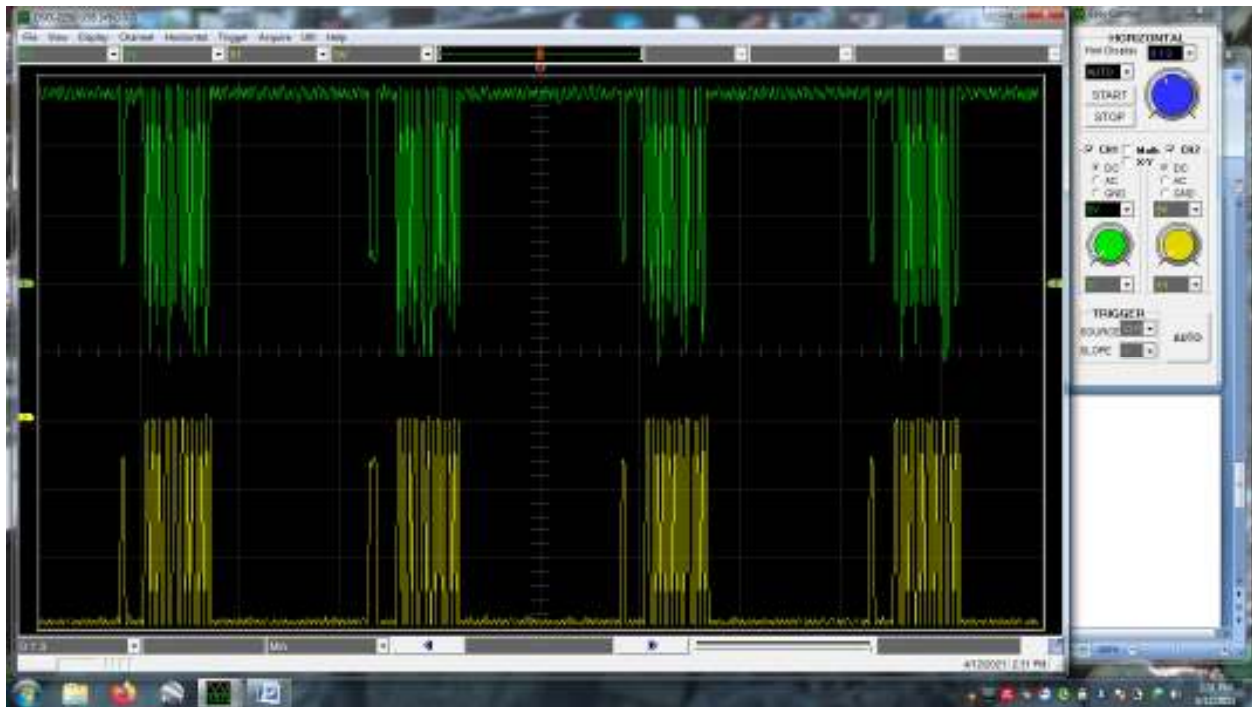


To be fair, I selected a battery powered test set up that could be powered from either a wall outlet, or a battery so that ground looping and hum issues would not be a finger pointer. From the insert above, the salient points are that this is a single pair of wires being probed by a dual trace digital scope. Both AC power and battery power were used in the testing to verify that no possibility for ground looping or insertion of aberrant signals in to the system could be a gremlin and lie to me.

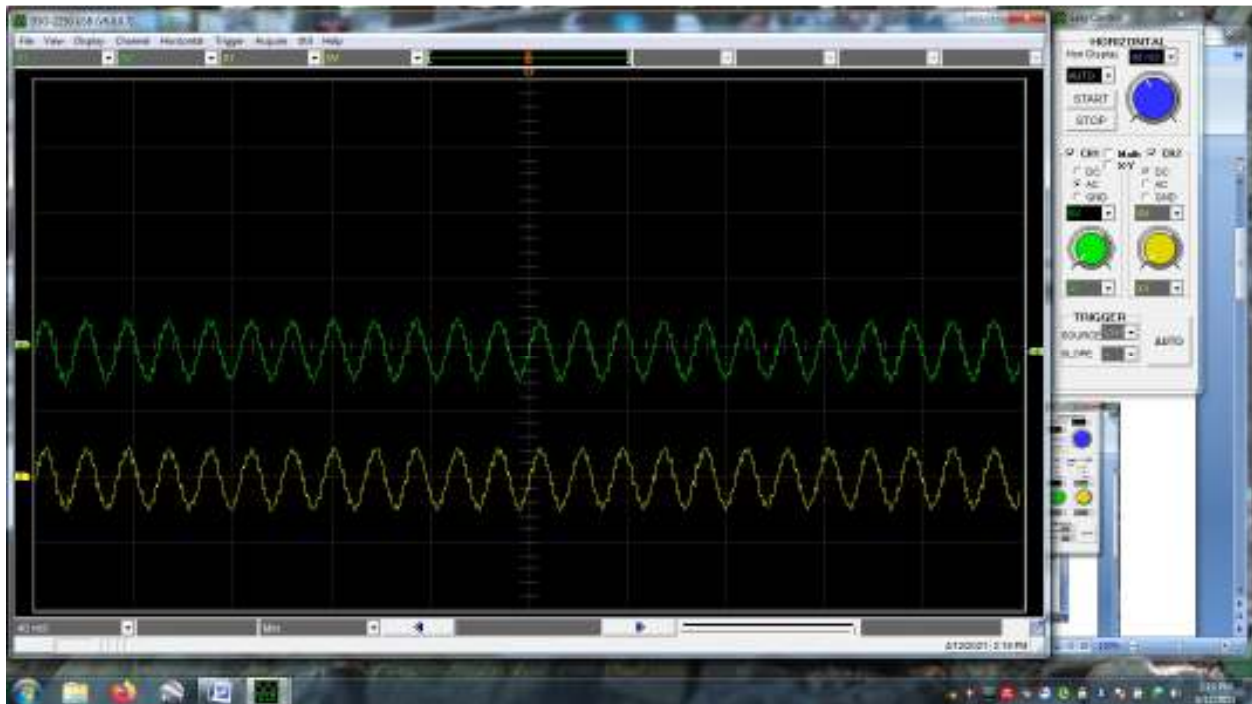
This signal is supposed to be a positive offset DC bias of 14 Volts DC with ping inquiries and answers back from the field devices. A negative offset on the black wire is a mirror image of what should have been seen. What we got to our surprise was this 60 Hertz hum filled picture that totally obscures the DC offset values.

This was a shocker (pun intended) to all of us, especially the fire alarm technician who was working the wires with sweaty hands. What we were expecting to see was a screen full of R.F. carrier obliterating the alarm signals but nope.

What we should have seen rather than this above monster hum was a very clean and explainable picture shot from a loop on one floor down from the target problem child. Clean DC offsets and clean ping requests are clearly visible.

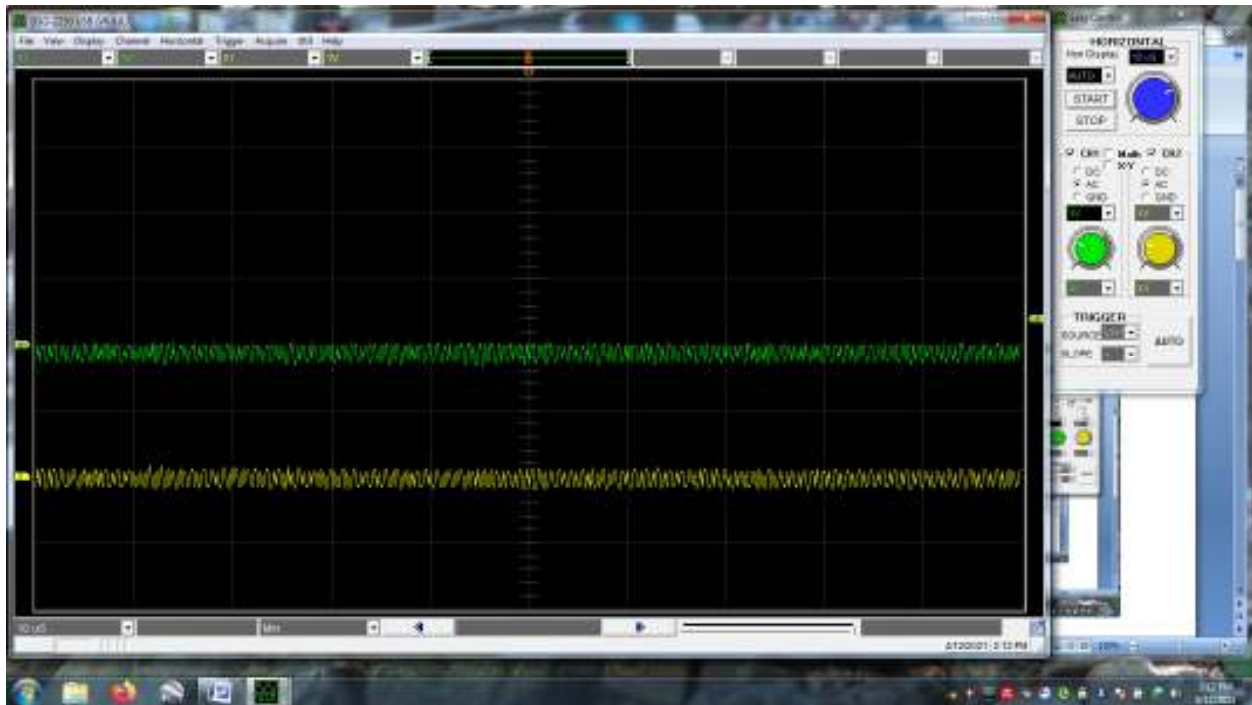


To insure that the visual results were fair and honest, multiple methods and configurations of sample were made and taken. We removed the loop from the controller and found the wiring to present a quite clean signal picture. Additional testing with the problem child loop disconnected from the controller also yielded a massive hum.



With detectors on the loop, I did not want to energize the system with a precision ammeter to investigate the possibility of a low level wiring short or other issue as I did not want to blow up any of the devices. Loops on the properly operating floors when disconnected from the controller yielded what we all expected which was very low noise results.





The addition of the R.F. carrier was just the straw that broke the camel's back. The R.F. combined with this gruesome hum was enough to randomly trip the alarm controller in to believing that the data on the line was wrong or corrupt so the response was to go in to full blown alarm or show a trouble when ever it felt like it.

#### THE LESSON:

The problem(s) in a system or machine is not always what convention would suggest. While everyone assumed that it was the new kid on the roof that caused the problems, the first law of troubleshooting and repair states

1. Fix the worst thing, first thing and see where you go from there.

Clearly the existence of the nasty hum as compared to properly operating floors is an issue. The addition of any level of R.F. was just a catalyst to push the poor Camel. Because of the very absent R.F. carrier posing any level of significant energy in to the loop, the troubleshooting took a right at the fork instead of a left. Be big enough to realize your pre-conceived mistake use the right equipment and make progress from there.

I was informed by the alarm company that the problem was traced to a "wire problem" in the problem loop. How very specific.