The Local Oscillator

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The Problem with AM

Unless you have been living in a cave somewhere, it's very likely that you've been hearing about the most recent difficulties to beset the senior broadcast band.

We've known for some time that Tesla, Audi and other auto manufactures dealt with AM EMI issues caused by the motor controls and other systems in their electric vehicles by simply removing AM reception capability from their vehicles. Problem solved, except that kills the ability for people driving and riding in those vehicles to hear AM stations.

The shock came last month when Ford announced that it will remove AM reception capability from the entertainment systems of *all* its 2024 passenger vehicles, electric and conventionally powered.

I have been a loyal Ford customer for 20+ years, pretty much ever since they stepped up their engineering and manufacturing and started making quality vehicles. The 2003 Explorer that I continue to drive every day has been the best car I've ever owned in terms of reliability and capability.

We also have a much later model Explorer, gasoline ("Flex Fuel") powered of course, and it has always had some EMI issues. Tuning into even our 50 kW AM stations in the Denver market, I hear whistles and growls in the audio that go away if I turn the engine off. Before I bought that car, I had noticed the same thing in similar Explorers that I had rented. The strange noises, undoubtedly coming from the engine control system, are an irritation, but at least I can still hear AM broadcasts.

My guess is that Ford has for many years dealt with customer complaints of such noises, and rather than employing shielding and bypasses to eliminate the EMI, they are solving the problem by removing AM receivers from their vehicles. Problem solved, for them. Needless to say, I'm done buying Ford vehicles, at least new ones. No AM, no car.

This trend of removing AM reception from vehicle entertainment systems appears to be snowballing. Automakers responded to Senator Markey's inquiry as to their intentions vis-à-vis AM reception by saying, in essence, that because the programming offered by AM stations is available from various online sources and that as such, over-the-air AM is irrelevant. Can't the same thing be said about over-the-air FM radio? I can't help but wonder how long it will be before automakers deem OTA FM as irrelevant as well.

What the automakers don't seem to understand (or maybe they do and just don't care) is that if they kill off the AM stations (or FM stations) by removing their customers' ability to receive them, their content will also go away. The apps and streams that the automakers say can replace OTA reception will be gone, too.

The NAB has really stepped up with a public information campaign designed to get this issue on the radar of lawmakers and regulators with the hope that the automakers will reverse their decision to eliminate AM reception in their vehicles. We are actively running PSAs on all our stations to loop in our listeners to this issue and apply political pressure to their senators and representatives. Broadcasters can access the NAB's "AM Radio Toolkit," including produced spots and bare copy as well as links to contact legislators, at https://www.nab.org/AMToolkit/.

There has been a good bit of talk about legislation or rulemaking requiring automakers to maintain AM reception in all vehicles sold in the U.S., and this could happen. It's happened before. You might recall that television manufacturers were required to include UHF tuners in their TV sets in decades past. Personally, I have mixed feelings about

this – I think the government forcing private industry to do anything can be a slippery slope leading to all kinds of other mandates, but in this case, I could get behind it.

If this effort fails, what can we expect for the future of AM? I certainly don't have any special inside track to seeing the future, but logic would dictate a certain chain of events.

All car owners don't get new cars every year (yes, you have a neighbor or friend who does, but most don't). Because of the very high cost of new vehicles these days, people are driving their cars longer, so we can expect a few years of slow decline in the number of vehicles with available AM reception. But eventually, likely within five years if other automakers get aboard and pull AM receivers from all their offered models, we'll get below a critical mass of available receivers, and that will start to take a real, measurable toll on the revenues of even the most successful AM stations. What happens after that will vary from market to market and town to town, but I can see small-town AM stations going away by the thousands once that critical number is reached.

Folks, we can't let this happen. We've got to apply pressure to legislators, regulators, even car dealerships. If you are shopping for a new vehicle, ask if the car you're looking for has an AM receiver. If the answer is no, tell the salesman that's a deal killer. And friends don't let friends buy cars without AM reception. Write your senators and representatives. Use this easy online tool if you wish: https://p2a.co/ftcwn8g.

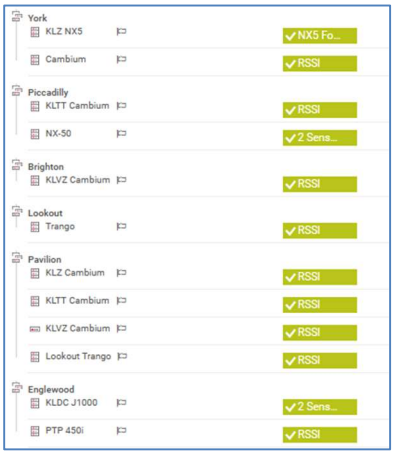
Finally, as engineers, we've got to make sure our AM stations are at their very best, operating at full power with licensed parameters and with aggressive but clean audio processing. They have to sound as good as we can make them. Hybrid digital stations have got to be on their game with proper analog/digital time alignment and optimized spectrum for a fast lock and robust digital performance. PSD metadata has to be right and in proper time alignment with the audio.

You can bet we'll be watching this issue closely and aggressively pursuing any and all possible remedies.

SNMP

You've read about SNMP in these pages in recent days. Our very capable folks in Birmingham have made great use of SNMP and monitoring tools to keep track of things at their five transmitter sites.

For several years now, we have used SNMP with our Nautel transmitters and Burk remote control systems to good effect. That use has been somewhat limited, however. Frankly, we (meaning I) didn't really know a lot about SNMP and how it worked. MIB files were mysterious, and OIDs were cryptic number/dot groups. Getting SNMP to work with a particular device was often a PITA, with a lot of things having to line up just right to make it happen.



A bunch of "sensors" are being monitored by PRTG on our Denver system. Microwave links and transmitters.

Of late, however, we've found the need to monitor some things in certain equipment that are only available by SNMP, and that has pushed me to really dig in and learn about the technology, nomenclature and syntax. It's still mysterious in a lot of ways, but not nearly so much as in the past.

In a lot of our markets, we use the input failover function of our audio processors to switch to a backup (usually internet-fed) audio source should the main (usually microwave-fed) audio feed fail. The issue was that because the failover is so seamless, we wouldn't know when this happened.

The problem came to light in Denver when we had an internet outage at our studio, and that took down one of the stations. Amanda quickly figured out that the primary feed was down, the result of a codec lockup, and that had apparently happened some time before. The station operated just fine off the internet backup… until the internet went down.

Had she known about the primary failure, she could have fixed it and had things back to normal in no time, but she didn't and the internet outage was the canary in the coal mine. Very clearly we needed a means of alerting her should the audio processor failover to the backup audio source.

There was no alarm output provided for that (or anything else), but we found that the processor was SNMP equipped. After some experimentation, we found that the input status could be mapped to an alarmed status channel on the Burk remote control. Problem solved!

At a glance, we can see that everything is happy on our SNMP- monitored parameters in Denver.

It was in solving that problem that our awareness was raised that SNMP might offer all kinds of parameters that we either can't get by another means or can't get singly. Things like RSSI values on microwave links.

One of the first things we looked at was the J1000. One of our J1000 transmitters has Nautel's NXLink on it, which is a serial-to-GUI interface, not super-capable but good enough to provide us with all kinds of status and metering indications. Both Amanda in Denver and Mike Kernen in Detroit had tried to make the Burk ARC Plus Touch work with the J1000 NXLink but without success. I took a shot at it, and with the help of some tools recommended by Todd Dixon, I figured it out.

In Birmingham, Todd uses PRTG to monitor a bunch of SNMP parameters in their operation, and Amanda and I set up PRTG on our Denver network, configuring it to monitor a bunch of stuff, including those microwave link RSSI values.

We've got it set to make notification should the RSSI on any of the links drop below a certain value, usually 5-6 dB below normal. If any of the monitored sensors have a glitch or the parameter goes beyond the preset limit, PRTG blows up Amanda's phone. The iPhone app links to the PRTG server on our Denver network.

Together with the input source monitoring on the Omnia processors, SNMP will keep Amanda continuously informed of the state of a lot of things in her operation that she would otherwise have to look at singly, which is anything but convenient. Now it's one-stop shopping.

The New York Minutes

By
Brian Cunningham, CBRE
Chief Engineer, CBC – Western New York

Hello to all from Western New York! It has been quite some time since we visited here in the pages of *The Local Oscillator*, as last month I was covered up with projects associated with the WDCX studio relocation. Operations are almost back to normal, but there are still a lot of small items to complete. It seems lately as soon as I start one thing, I get sidelined on some other situation, and it goes on and on!

There are many within our company that have assisted in some way or another to see this project through, and I would like to publicly thank everyone for their willingness to help see this project through.

First and foremost, Thanks to Mr. Crawford for allowing us the ability to significantly upgrade our entire facility, and to Cris Alexander, our esteemed Director of Engineering, who put in countless hours putting together the plans and documentation to get this project off the ground and overseeing each step of the way.

Amanda Hopp also provided her expertise in getting our new Nexgen workstations and audio servers up and running, and Todd Dixon – thanks, Todd, for getting our firewall configured, and answering all the questions and working through the bugs to get the firewall operational.

From our General Manager, Brett Larson on down to the board operators, thanks to each and every one of you who volunteered to assist in any way possible. This old man appreciates each and every one of you!

We were indeed fortunate that there were no major issues that came up while the station build was going on in March, just the little nuances that pop up from time to time. However, in April there were several problems that popped up unexpectedly.

The first occurrence happened on Saturday April 1st (no fooling!), when I got a call that WDCX-FM and WDCZ were both off the air. A quick check of each transmitter site revealed that the issue was audio in nature, so a trip to the Amherst studios was in order. Once I arrived, I checked that the audio server was indeed running and a log was present.

I next checked the Wheatnet audio play-out channels on the audio server and found that all four channels were gone! It appears that Windows had performed an update, and after doing so, the Wheatnet audio drivers were deleted. After re-installing the drivers, both stations came up, life was good again, and the Windows update was turned off to keep this from happening again.

At the WDCX(AM) transmitter site in Rochester, our power provider, National Grid, notified us that a scheduled power shutdown was to happen on Friday the 14th. We have recently experienced issues with our standby power generator, and our generator maintenance contractor, R.B. U'Ren, could not access the generator to make repairs due to standing water and mud all around the concrete pad where the generator sits.

The issue was that the radiator was totally clogged up with grass clippings, dirt and cottonwood, and after starting, it would run for about 10 seconds and shut down. As we have no municipal water service on the property, they would have to bring in several 55-gallon drums of water to pressure wash the radiator. As the shutdown was rapidly approaching and our generator repairman could not get the work done, I went to the site on Tuesday April 10th, and removed the clogged-up radiator and took it to the closest car wash to get it cleaned out. I was successful in getting the radiator cleaned and obstruction free, and the generator was again operational.

There is still one issue that needs to be addressed, the variable resistor that adjusts the output voltage is dried out and the voltage varies up and down. I am recommending that it be replaced with a 10-turn sealed pot to keep this from happening again.

Also in Rochester, I received a call on Thursday 13th that WLGZ-FM was off the air. I dialed into the Burk remote control and was unable to get the transmitter back on, so a trip to Rochester was warranted. Once I arrived on site, I reconfigured the BE FMi-206 digital transmitter to operate in FM+HD mode so we could get analog audio back on the air.

Turning my attention to the Continental 816R-2C transmitter, I found that the phase-loss detector fault was showing. This usually means that the phase-loss detector's contacts are either dirty or failed, so I jumped out the detector on the 8-pin octal socket. This did not clear the fault, so further investigation was warranted.

After about an hour of troubleshooting, I found that the 28-volt DC power supply was running wide open, putting 34 volts on the control board. I pulled the A1A1 control board out and found that the excessive voltage had burned numerous traces, and many components well beyond the chance of repair.

I called Richard Robinson at Continental to inquire about replacement parts. He said that the controller board was in stock, but they did not have the power supply. Once receiving approval to order the controller board, I placed the order and was then told that they in fact did have the power supply, at a cost of $1095.00. Cris found a replacement switching supply for much less, actually under $100.00. Cris placed the order for the supply which arrived on Friday, and the controller board arrived around noon on Saturday.

As I was not feeling well, I opted to wait until Sunday to make the trip over to Rochester to make the repairs. I installed the supply, which turned out to be an easy replacement, and the A1A1 control board, but the transmitter still would not come up. The filaments would come on, all interlock indicators would light, indicating all was good, but no plate on. After an hour of troubleshooting, I found two very small traces open on the back of the card cage that were preventing voltage from reaching the last two cards. I was able to repair the open traces with some copper stranded wire and was able to bring the transmitter up.

I never like it when a transmitter goes down, but I sure do enjoy the challenge in finding the cause of the failure and making the repairs. We just don't perform much in the way of repairs on equipment these days, I miss the bench time troubleshooting and repairing equipment down to the component level, but with so much computer (IP) based equipment these days, problems are usually solved by simply replacing a board or module. Bench repairs are a skill set that is rapidly going away, along with the older engineers that were capable of repairing down to the component level.

That about wraps up another month here in the great northeast, and until we meet again here in the pages of *The Local Oscillator*, stay safe, and happy engineering!

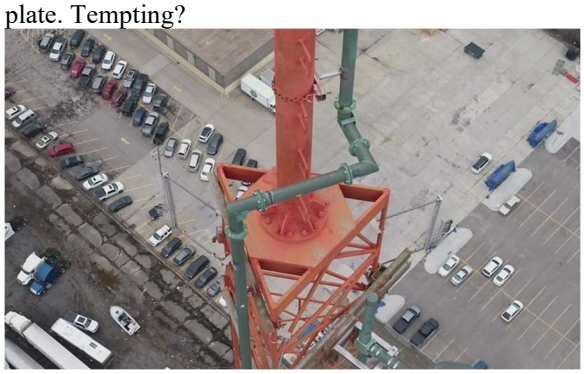
The Motown Update
by
Mike Kernen, CSRE
Chief Engineer, CBC–Detroit

Main Antenna Line Burnout Cont'd

Last month you read about our feedline burnout on WMUZ-FM's main antenna. The line and antenna replacement project has begun, replacing all of the feedline with new Heliflex and to cap that off with a new ERI SHP-4AE "Rototiller" 4-bay antenna, giving us a fresh RF pathway all the way into the transmitter building.

Since that report, the new feedline and the antenna have arrived, along with a few elbows and some hardline, making it possible for us to end the run of Heliflex just at the tower's top plate and cross over to the antenna's tuning section.

We discussed several possible ways to cross from the back side of the tower where the feedline comes up over the top plate to the antenna given our new Heliflex's ability to bend and snake through the tower cross bracing. Could we eliminate the hardline and elbows by flexing the feedline into the tower and up through the triangular gaps in the tower's top plate. Tempting?



The existing rigid line uses a few elbows and a short straight section to cross over the tower top plate and connect to the tuning section.

Well, as tempting as that shortcut may be, and like many shortcuts in life, it is not without its drawbacks. Like everything flexible, Heliflex has limits and cannot be bent too sharply. That means that sending it into the antenna's tuning section after poking out of the top plate may require quite the S-curve. Add to that another bend radius to route the antenna into the tower from its assent on the southwest leg and we were concerned that we might find ourselves with points of interference that could rub the Heliflex cable's outer jacket and eventually rub through the outer conductor. Towers are a very dynamic environment where wind, rain, sun, ice, and vibration are always to be considered when installing any appurtenances. Not a place to cut corners.

Today I dropped off the new elbows and hardline together with the old cross-over piece for my favorite welder to recreate. Normally, I wouldn't shy away from knocking this stuff together myself, but I don't have a TIG MIG JIG FIG GIG or whatever inert gas-of-the-month welders like to use to create a weld worthy of installing on a tower.

Tower crews are getting harder and harder to find these days. I had one lined up who called and said they were going to "have to pass" on doing the work, saying they're too busy already. I called several more in the state of Michigan, and most didn't even return my calls. One company I've worked with in the past did call back and agreed to do the work, but they're shorthanded and have to work us in around other jobs and Michigan's infamous difficult weather. Winds, rain, and more rain dot our springtime calendars and tower crews don't work unless it's calm and dry.

In preparation for an extended period on our standby antenna (which is identical to and just below our main), I added more remote telemetry to our old Continental 816R-4C transmitter. The Continental is our standby transmitter, and is much more able to run at low power levels than the Nautel NV40. The NV40 is a super early example, being the very first to be delivered to a customer. While its software allows the user to select power down to 4 kW, the transmitter becomes aware of all of the modules' low output levels and its controller brain decides they have all failed. The Continental has no software nannies and with the screen grid's circuit breaker switched off can loaf along at a very low power level,

which is needed when the tower crew is on the tower working.

Single Board Computer

I recall a story told to me by a former supervisor of a particular transmitter remote control system with a vexing propensity to fail. If its failure wasn't bad enough, in a symbolic adolescent parental revolt, it would turn off the transmitter too. Having had to jump in the car and drive to the transmitter site one too many times, he condemned the unit and installed a replacement. The recalcitrant remote-control system was taken to a farm and repeatedly shot with high powered rifles. It returned to the radio station where it served as a warning to other electronics who may themselves be planning their own acts of rebellion.

Why am I telling you this? Well, it's a fun story of retribution and target practice, but I was reminded of it while I was thinking about how much we lean on our remote control systems. For the most part, the remote control systems we use are very solid and have more than one way to communicate with the engineering staff, either by computer, mobile app, or in the absence of internet, they can be used via touch-tone voice interfaces.

These days, transmitters themselves have web-enabled user interfaces, too, and these sometimes are the only way to interact with them beyond simple basic control, metering, and status. I use SNMP for more advanced control and monitoring, but that's a whole different topic.

After 20+ years of service, the single board computer on our Nautel NV40 started to exhibit significant signs that it was ready for retirement. Unlike the old remote control system in my story, it didn't shut off the transmitter, but it would balk at any attempts to log into it, more-less saying buzz-off! Maybe after ten attempts it would give in and load the AUI (what Nautel calls their GUI).

I hate being ignored, and after having my fill of its rude behavior, I replaced it. Nautel offers a kit for upgrading the single board computer that includes new brackets, the SBC itself, all cables, and an SSD hard drive. Those familiar with the NV40 and many other Nautel transmitters know that they used Compact Flash media for their storage that could at times be intermittent, not to mention difficult to find if a replacement is needed!

The current AUI is completely Flash based, and we all know that Flash has been flushed. Installing the new SBC restores a reliable AUI and gives us a pathway to upgrade our transmitter to Nautel's new HTML5 user interface, which is becoming available to a broad range of Nautel products.

I attended a webinar with Nautel's Jeff Welton who demonstrated the interface and showed us lots of exciting new features we can look forward to. It looks fantastic and will no doubt begin to ship on most of Nautel's transmitters in the near future. I'm told the new HTML5 operating system is mobile phone friendly, too! I'll write a review about it once it's available for the NV40 and I have some experience with it.

News from the South
by
Todd Dixon, CBRE
Chief Engineer, CBC–Alabama

This, too, shall pass…

If you've been playing the WDJC-FM antenna installation game at home, this month has seen a lot of progress and we're close to the end of the journey. Our original contractor that took down our old ERI SHP-8 could not get back to Birmingham in a timely manner and offered to subcontract the rest of the job to another tower crew.

Subcontracting tower work was a new experience for me. Even as an assistant engineer for 20 years, every bit of tower work had been done by the actual crew we had hired. Readers of Stephen's column over the years know that Alabama isn't exactly friendly to things like tower work in April. It's hard to string together three or four days that aren't dotted with heavy rain and/or high wind (or worse). The new crew ended up having to come back and forth from Pensacola several times, scheduling between rain, clear windy days and clear days that they could actually fly antenna pieces up the tower.

On Saturday the 15th, the crew hung the last of the eight antenna bays and got our parasitic elements back in place on the antenna (more on that

later). The line and the antenna were holding pressure around 3.5 psi.

Figure 1 – Look closely at the lower saddle clamps holding the directors to the interbay line. Not just no…

The TPO from the Nautel GV40 for this antenna is a shade over 27 kilowatts. During some testing, the reflected power stayed linear until we got to 16 kw and then it spiked. During several calls between Cris, Stephen and myself, we determined that it may very well be that the antenna simply wasn't tuned well yet, so at this point, we went back on our auxiliary antenna once again.

If I may digress from the account for a moment, allow me to offer one pearl of wisdom: GET LICENSED AS A PART 107 UAV OPERATOR and have Cris buy you a setup. They are invaluable for things like this.

I had been routinely flying the drone up the tower and getting pictures of the work progress – and then showing the crew on the ground how good the pictures were so they knew we could see their work. I didn't have my drone on that Saturday, but when I sent the drone up on Monday, I saw that the tower crew had put our parasitic directors back on the tower with one steel hose clamp at the top of each and then they had electrical-taped the bottom mounting saddle. It would be putting it mildly to say that I nearly blew a gasket. Drones are the equalizer to not only see what is happening on the tower before a crew gets on your tower, but to check on their work during and after leaving as well.

After a couple phone calls to ERI and the tower crew (who said they were going to fix their mess – they ran out of clamps and said they used tape as a temporary fix until they could return), we scheduled antenna tuning and everybody was on site early Friday morning.

Once the crew got the parasitics mounted correctly and securely, Jeff Taylor from ERI began his work on tuning the antenna. His testing showed that the antenna already has a VSWR of 1.04 on carrier!

Despite that incredibly good news and the parasitics being installed well, when we put power on the antenna again, it exhibited the same characteristics that it had previously.

While Jeff was there with every RF test rig you could name, we ran several sweeps of the line and got plenty of pictures to analyze. We suspect that the problem resides in a 40-foot section of Heliflex cable we had to replace at the top of the antenna feed line some time back. I hate to hold you in suspense until next time, but that is just how close the game is to ending (it's called a "hook" to keep you reading until next time).

I can only say that if you've never had the opportunity to work with Jeff Taylor from ERI, it was a great experience for me. He really taught me a number of things while we were studying what was going on in this new antenna.

Figure 2 - The completed antenna installation.

Nexgen woes at an end…

You might recall that last month I detailed a colossal UPS failure that resulted in both Nexgen databases going down. One problem that was plaguing us post-failure was that several DRR recordings were not happening as they were programmed to do.

I called RCS about the issue and explained what had happened. Their tech spent about an hour and a half between the two databases and determined that there were several folders that only had "read-only" permissions on them so that the recorded DRR files could not be written to the other database where the files actually lived.

After making sure that both the folders had read and write permissions, we haven't had an issue with the recordings. The other thing that hasn't happened since the RCS tech changed those file permissions is that the WDJC-FM audio server hanging problem has completely disappeared!

I can only suspect that God knew that even the apostle Paul only had one thorn in his flesh, so it was either this new antenna or our Nexgen problem and so he removed one of them. I also anticipate that we'll have closure on the antenna problem as well, but that is for next month's visit. Until then, blessings to all of you on your work and your lives.

Tales From Cousin IT
by
Stephen Poole, CBRE, AMD
CBC Corporate IT Specialist

Some wonder where my weird sense of 'yumor comes from, and the answer is simple: life itself. As a Christian, I know that this is not the real world; it's a holding pattern before we land in eternity. The way I look at it, anyone who takes this life seriously is in serious trouble. I take my job and ministry seriously, of course, but dealing with crazy people on this Earth itself? Nah.

For example: that training center that I mentioned a couple of months ago? I had some old jars in which I had various cleaning chemicals; alcohol, carbon tet – this was before it was politically unacceptable – stuff like that. We had recently hired another technician (whom it was my sad responsibility to "train," but that's for another article). He noticed my little jars and asked if I had any spares. "Sure," I said, and tossed him a couple.

He poured alcohol into one, then took a marker and put a bold "X" on the lid. Then he poured some carbon tetrachloride into the other one, took a marker and put a bold "X" on that lid. Satisfied, he arranged them on his bench and leaned back with smile. Naturally, I couldn't stand it, so I asked, "how are you going to tell which jar is what?"

He replied -- I'm not making this up – as he tapped a jar. "Oh! I marked this one first." He didn't last long with our company. Go figure.

Phishing, Phishing

... so don't get caught! Figure 1 is a phishing scam that popped up with some of our users in the past month. Fortunately, I use Firefox, which has all sorts of plugins that can be installed with a click or two. Thunderbird, my email client, shows the actual link if I hover the mouse over it (circled at the bottom of the image). The link might say "Go to My Bank" or "Click Here For Home Depot deals!" but with this plugin, I can see immediately that it goes nowhere near a legitimate address.

With VPNs and all the other cross-connected stuff that we're doing nowadays, I'm starting to think about the weakest link. Good antivirus and a good firewall will help, but I still have nightmares about this sometimes. A part-time board operator who's bored and starts poking around the Internet on the weekends could possibly cause damage, not just at his facility, but in several others across the company!

A quick Google search didn't find any info on forced disconnects after inactivity in Wireguard. A true VPN won't do that, anyway. Remember, the whole idea is that you've run a very long cable to that remote site and have "virtually" plugged into a network switch there. So, just as a normal LAN would do, if you're inactive (even for days), the connection is still there. Maybe I need to craft some scripts that will do it ... hmmm. For now, I strongly recommend that you wg-quick up, do your work, then wg-quick down when you're done. Don't just make a connection and leave it up forever.

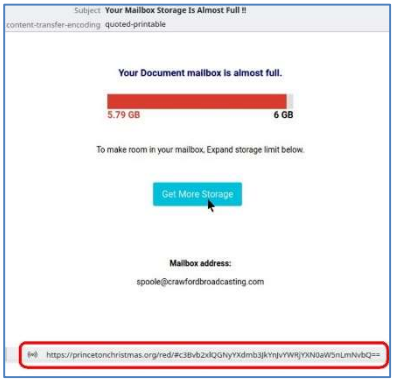


Figure 1 - Thunderbird shows me where the link actually goes.

Wireguard

We're not the only ones using this for quick-and-secure VPN stuff. Many commercial VPN providers (ex., NordVPN) are using it. It's

ridiculously lightweight (about 4,000 lines of code, compared to 70,000 for OpenVPN), fast and uses top-of-the-line encryption. Here are a few things about it that you may not know.

First, Wireguard uses Universal Datagrams, UDP, rather than TCP. With the latter, a solid connection has to be established between sender and receiver, and you're going to have problems when using a smartphone while driving. If the link drops for even a moment, or as you move between "cells," the connection may break and need to be reestablished.

UDP is a "connectionless" protocol. One end sends some data and has no way to confirm that it ever arrived. But that's not really a problem; the receiving end can use UDP to send back a quick, "Hokay, boss, got it" to the sender.

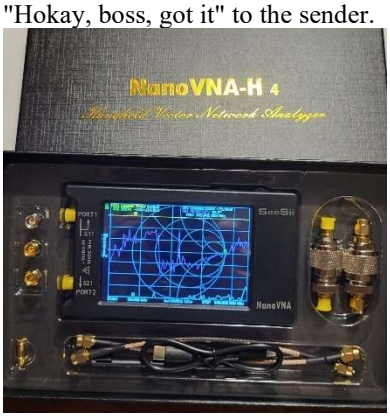


Figure 2 - All sorts of network analysis for about $100!

What this means to us, simply put, is to make sure that our firewall can pass UDP. Most can, and this isn't a big deal. But if you set up a Wireguard server without thinking, you might choose "TCP" as the connection type – some firewalls have this as the default. That won't work; choose UDP.

Second, Wireguard sets up a true VPN. (What you hear advertised on the radio is really more of an obfuscation/privacy service.) With a VPN, once you link up, you are on that remote network and can access it as though you were sitting in that facility.

But one problem that you may run across is that many, many small office networks just use the default 192.168.1.0 IP addresses in their own routers. My home Spectrum Internet uses that, and I can't change it. I ran across this a few months ago when I tried to connect to one of our LANs that uses that same address block. It just didn't work, because the routing was confused. For serious work, the quick and easy answer is to ensure that each end has a different subnet.

One other tip: if your local network doesn't support IPv6 (mine doesn't), edit the configuration file and remove references to IPv6 addresses. It seems that the easy "build a config file" feature in Wireguard's user tools invariably inserts this. Your connection will fail unless and until you clip that out.

An Example

I used Wireguard to establish a temporary link to our Denver facilities. My local routing table, without Wireguard, is typical ...

localhost:~ # ip route list
default via 192.168.1.1 dev em1 proto dhcp metric 100
192.168.1.0/24 dev em1 proto kernel scope link src 192.168.1.22 metric 100

The default gateway, again utterly typical, is 192.168.1.1; that's where anything that doesn't fall in the 192.168.1.0/24 subnet will be sent. But after I executed a "wg-quick up [config file name]" ...

localhost:~ # ip route list
default via 192.168.1.1 dev em1 proto dhcp metric 100
10.139.xxx.xxx dev Stephen-Denver proto kernel scope link src 10.139.xxx.xxx
192.168.1.0/24 dev em1 proto kernel scope link src 192.168.1.22 metric 100

I've "x'd" out some of the Denver IP address info, but you can see that a new route has been inserted for the "Stephen-Denver" VPN that Wireguard established. I can ping, query, or connect as needed to the computers and other stuff in Denver. It's amazingly fast, too. Over any decent Internet service, you'll hardly notice that it's any slower than actually being at that remote site.

Figure 3 - Yet still another toy for the home studio ...

(For those who want the absolute best performance, use some flavor of Linux or BSD for your Wireguard server. As you might guess from the word "kernel" in the Denver route listing, the routing magic is built into the latest versions of the Linux kernel. It's not an add-on driver.)

Finally, here's an important point for those (especially in the FBI and CIA) who still insist that IP addresses can positively identify someone on the

Internet. Before you start your daily Wireguard session, browse to a site that will show your public (WAN) IP address – "whatismyip.com," for example. Note the number. Now connect with Wireguard and repeat: you'll get the WAN address of the remote end.

That's expected, of course. After all, you are on that remote network. But keep that in mind when trying to determine where an attack came from. (And especially when listening to the FBI, CIA, et. al., claim that an attack came from a certain country.) Most of the IP addresses in the attack logs on our servers come from the usual sources – Russia, Iran, North Korea, China – but lately, I've seen quite a few coming in from North American IP blocks, from Amazon, Digital Ocean and other providers that lease server/cloud space to clients. It's entirely possible that one of their clients has been compromised and is being used to obscure the IP address. Fun, fun!

And Speaking Of Fun ...

Finally, a couple of personal items. First, I sprang (sprung? See Figure 2) the $100-odd bucks to get one of the little NanoVNA analyzers. Just as the Array Solutions stuff was really popular a few years ago, now these little bargain-basement gadgets have become all the rage, especially with hams. I want to try this one out to see how it acts.

For my home studio (Figure 3), I've bought several different digital effects units. The one pictured is a Boss GT-1; I also have some Zoom boxes. This Boss is amazing, with modeling that will imitate the sound of classic amplifiers and speaker cabinets. For that matter, there are plugins available now for most Digital Audio Workstation (DAWs) that are surprisingly good, too. My only complaint about most of them is that the default "presets" (i.e., sounds) are pretty bad; the GT-1 seems to be an exception, but we'll see.

Until next time, keep praying for this nation and take your ministry seriously, but not this ball of rock!

The Chicago Chronicles
by
Rick Sewell, CSRE, CBNT, AMD
Engineering Manager, CBC–Chicago

As if we need it, here's another reminder that nature doesn't always favor transmitter sites. It seems we just get past the time we are reducing transmitter power for iced antennas when along comes the thunderstorms with their electrical arsenal. This came into play for us late last month.

One night we were reducing the transmitter power, and the very next afternoon we were taking lightning hits at our Lansing, Illinois site. This was all in less than a 24-hour period. The kind of temperature changes we were seeing is usually accompanied by storms because it is usually being pushed in by some kind of front.

That Friday afternoon, we saw some really serious lightning in the area. I was expecting to have some effects, but the only site to be affected was the Lansing site. We got disconnection alarms from the other interconnected remote controls from the rack room and the other transmitter sites to the Lansing remote control. I found that I couldn't connect to anything at the site through the network.

I figured this meant a trip to the site to reboot the Ubiquity PowerBeam ethernet link there. I was able to log into the PowerBeam at the studio site, which was good, and even more surprising was that I was able to get to the PowerBeam at the Lansing transmitter site, but I still wasn't able to get into anything on the network at the site.

I was guessing there was an ethernet switch problem at this point, since the radio portion of the PowerBeam was working. However, it was a stormy Friday evening, and I really didn't want to make a drive to the site if I didn't have to. I thought, why not give the Power Beam a soft reboot remotely first? Couldn't hurt, right? What do you know, the network came back up and I'm not having to get in my car during the heavy storms.

It wasn't until that following Monday that we realized we couldn't dial the POTS line to the very same site remote control. It turns out the storms also took out the Magic Jack VoIP phone line. This was attached to our renter's ethernet switch, so it would be separate from our over-the-air network. Their ethernet switch was also taken out by the

storms and had to be replaced.

We replaced the Magic Jack and the phone portion of the remote control was back in business. It was a bad storm and lightning event, so if a Magic Jack was the worst of the damage, then it was not that bad an event.

Well, like a lot of bad lightning events, there is immediate damage and then sometimes you'll get latent damage. This is usually realized when you turn off a piece of equipment and then turn it back only to find that it has a problem that wasn't there before you turned it off.

In this case, I don't believe that is what occurred. This time it was damage to something that doesn't get used on a regular basis. Our auxiliary transmitter at the site serves as a backup transmitter for two stations. It's a Nautel GV20 (pictured here), which is attached to a dual frequency antenna for 106.3 and 92.3.

We use the presets to quickly change the frequency and audio input to the station you want on the air with that transmitter. The "normal" station, 106.3, is on the digital MPX input, and the auxiliary site station, 92.3, is on the analog MPX input. The 106.3 operation is tested weekly. We don't really have an official testing schedule for the auxiliary site operation for 92.3, but we probably should. In this case, we were testing because we will need to use it in the coming months for a new transmitter installation at the main site. This test didn't go well. We made RF, but we didn't have audio.

After diagnosis and making sure we had audio coming from the audio processor, we determined that the exciter on the transmitter was working in all aspects except for the analog composite connection that the 92.3 operation needed.

After talking with Nautel's support department, it was determined that there was an issue with the input assembly card and it will be replaced. In this case, we are still under warranty.

Now am I positive that the particular storm caused this issue? Not really, but we had used the transmitter with the analog composite mode a few weeks before the storm and we had not noticed any problems with the audio.

Valley News
By
Steve Minshall
Chief Engineer, KCBC -- Modesto

At KCBC, our Nautel NX-50 transmitter is now about 15 years old. It is one of the most reliable transmitters that I have ever worked with. Since installation it has never had a failure that took it off the air, until a few weeks ago.

I received the alarm call during the 4:00 AM hour. I tried to get it back on the air via remote control, but it wouldn't come on. Our good old ND-50 transmitter took over until the NX-50 was repaired.

The failure turned out to be the simultaneous failures of two 15-volt, 100-amp switching power supplies in the NX-50. The purpose of having two of these power supplies is to provide redundancy in the event that one should fail. If that happens, the other power supply will carry on until the failed supply can be replaced. If one had failed before the other then there would have been an automatic log entry of the event, but there was no supply failure in the transmitter's event log. There was a log entry indicating a power failure at the time, however.

In order to get the NX-50 back in operation as quickly as possible, we ordered a pair of power supplies. These are Mean Well RSP-1500-15 power supplies, and the price is around $450 each from Mouser Electronics and from other sources as well. Since the power supplies were an exact replacement, that were no issues of incompatibility.

The chances of two power supplies failing at the exact same moment would seem to be astronomically low, but it happened. It turns out that there is a failure mode which is not so astronomical at all.

After the crisis was over, I put the power supplies on the bench and applied power. They actually worked on the bench. However, I found that

they did not always come on when power was applied. Further investigating found that the fans in each power supply were in poor shape. Turning them by hand revealed that the ball bearings were rough and they could get stuck when they stopped. These fans have a rotor lock detector that tells the power supply that the fan is not turning and, if that's the case, the power supply will not function. The only explanation for the simultaneous failure is that when the commercial power failed the fans stopped and when the power came back on the fans were both stuck.

I have a few notes regarding the replacement procedures that I'll share here. I would recommend taking a picture of the wiring before beginning work. It's not complicated wiring, but taking a picture only takes a minute. The transmitter uses white wires for positive and black for negative. Ground connections also use black wires. These color combinations are not fully intuitive for me. The reason I mention this is that it appears it's possible to mis-wire the output terminal of these power supplies, which I assume would result in catastrophe.

The output terminals use nuts and bolts that require a 10mm wrench. I found that my normal size wrenches did not fit well, but a pair of cheap, shorter, wrenches from a well-known tool store fit very well. A ¼-inch drive socket may have also worked, but I did not try that. The Nautel manual specifies torque specifications for these bolted connections, but I think most of us can handle this without that measuring. Screwdriver length is also an issue, with 7 inches being a perfect length.

The mounting plates that fit the power supplies to the transmitter have four holes to put screws through. The bottom screws are little bit awkward to get started. To deal with this issue, I notched the bottom holes of the brackets so that the screws can be partially inserted before attempting to put the power supplies in place. It's then easy to set the power supply in at an angle, engaging the bottom screws, and then tilting the power supply to vertical. The bracket is soft aluminum and it's easy to notch with just a pair of diagonal wire cutters. You will thank me later.

I did a partial disassembly of the old power supplies and found them to be in excellent shape visually. The only thing wrong with them was the fans.

The exact model number fan is no longer available. The Mouser part number 978-9A0812G4D01 is a suitable replacement fan. At 14 dollars each, it might be nice to have some sitting on the shelf, or even to proactively replace the aging fans. I replaced the fans in the removed power supplies, and they will sit on the shelf as spares. I will try to test them once a year, perhaps on the date that I do the occupied bandwidth measurements.

I thought it wise to replace the rest of the switching power supplies in the interest of transmitter reliability, just due to age. The 12-volt supply used in the transmitter is a Mean Well RS-12-200. This power supply is no longer available, but the RSP-12-200 makes for a good replacement. It is slightly smaller, so the screw holes don't line up on the mounting brackets. You could redrill the mounting bracket, but I found that mounting with one screw, in an existing hole, works just fine.

The 48V power supplies are the problem children. The original RSP–480–48 power supplies are no longer manufactured. We replaced them with RSP–500–48s and they are working well. This replacement is not as straightforward as were the 12V and 15V power supplies. The new power supply has a four-pin socket for the remote control as opposed to the six-pin socket on the original power supply. I took care of this by installing a four-pin plug in place of the six-pin plug on the transmitter wiring. Each power supply requires one connector housing and two female contact pins to make this change. The parts required for the modification are Mouser parts numbers:

798-DF11-4DS-2C connector housing
798-DF11-22SC female contacts

These parts are cheap, so get a few extra in case you mess some up. The female contacts are tiny. If you have a suitable crimp tool, then you are set; otherwise, soldering will work.

The new 48-volt power supplies have a smaller terminal block for the incoming AC power. The lugs on the wiring harness needed to be trimmed to fit, but this was not a big deal. The new 48V power supply also has a different mounting screw pattern, and again, a one-screw mounting has proved to be sufficient.

I talked to Nautel about the 48V power supply situation. They advised me that they understand it is the end-of-life for the power supplies and that they are looking into a solution to that problem. I don't know what they will come up with, but I think my solution is satisfactory.

Upon inspecting one of the 48V power supplies that I removed, I found one of the two fans to be rough, and I also found four capacitors that were leaking. The original fan is no longer manufactured and the replacement fan that we tried

does not flow as much air as the old one. With these problems, and with the price of a new one being only $114, I don't see it productive to mess around with the old power supplies.

I did verify that the 15V and 48V power supplies are used redundantly, so one can fail and the transmitter keeps on going. They are monitored, and they will show a failure status if they quit. Of course, two power supplies quitting at the exact same time is very improbable, but yet it did happen. Keep in mind that if a redundant power supply fails, the remaining power supply will now have twice the load, and if it is weak, it may not hold in there for long.

I think this is the first real expense we have put into the NX 50 since its installation 15 years ago. Not bad at all really, sure is better than buying 4CX35,000s every few years!

Rocky Mountain Ramblings
The Denver Report
by
Amanda Hopp, CBRE
Chief Engineer, CBC - Denver

Happy Spring!!!

I can finally say that. Here in Denver the clouds are beautiful, and we are finally getting rain and not snow (the mountains are still a different story). As I look at the cameras at our transmitter sites, I see hints of green. Soon that green will turn into a variety of grass and weeds to be mowed. Colorado Rockies baseball has not disappointed. Mind you, I began the season with very low expectations, so the fact that the team is 8-18 as of April 27, and I expected nothing different from them. It is still fun watching baseball. The hockey playoffs are upon us as well. I'm not a big fan but do enjoy watching a game when it's on at a restaurant. Our Colorado Avalanche are back in the playoffs, but at press time they are one loss away from getting the boot.

Cold Air!!!

We were able to get the new air conditioning units installed at the KLVZ transmitter site. I know the guys doing the installation struggled a bit. Keep in mind the building itself stands 11 feet or so off the ground. The ground was soft from the snow, which prevented them from bringing a hydraulic lift in, so all the work was done on ladders and a hand-cranked lift. The new units probably weren't too heavy, but removing the old Marvair units, which were beasts, was probably the difficult part.

The new units run great! We are still waiting for a wireless module to go in each of them to allow us the ability to control them with a smartphone app. As I was at the site recently, I was trying to get one of the units to run. What I failed to realize was that it was running, it's just so much quieter than the old unit!

Under Construction

Welby Road is the street that the KLZ tower site is off of. The county approached us a few years ago wanting land because they had plans to widen the two-lane road. Years ago, the road wasn't bad, but it has become a major thoroughfare for commuters living in the new neighborhoods north of the site. The road backs up often and can be difficult to travel on.

Long story short, they got their land, and we got our money. They have been working for the past couple of years on widening the road closer to I-76, south of the site. Now they're continuing north.

Last month we met the site supervisor for the civil contractor doing the project and discussed what we needed from them as they began the work. Mainly, keeping our site secure, and no driving where you aren't supposed to. They brought in some cranes and began cutting down the big cottonwood trees that ran along the canal. They have been moving dirt around for the better part of a week. I think it's for providing slope to the sides of the agricultural canal that they are having to relocate. I keep the security cameras open on my laptop at my desk every day so I can keep an eye on things. Because of this I have been able to watch things progress.

Hot Air!!!

While out doing some other work nearby one day, I received a text that the KLDC J1000 went to the B exciter. I was driving, so my dad, who was with me, began looking into it. After a bit he found the J1000 wouldn't come up at all. Thankfully we were close by.

When we arrived, we opened the door and could smell electronics burning. The room was hot, and I mean *hot*. The air conditioner had failed and the two transmitters in the room were blowing hot air, building up the heat to a dangerous level. I never got the exact temperature, but once we were able to get the thermostat to respond, it was showing over 100 degrees (it pegged at 99). The J1000 didn't like the heat and shut down.

The two new Fujutsu 3-ton A/C units on the KLVZ transmitter building.

We put the station on low power on the ND-1 and put the other station's transmitter on low power, too, to help with heat.

I do not know how to work on air conditioners. My dad though, he opened it up and began looking at it. I don't think he knows what he did, but after giving up hope, we went into the building just in time to hear the unit kick on and blow cold air.

This got us thinking, while it's not our site, we know that Wi-Fi thermostats are great. I have one at home and KLTT has two (one for each unit). I can set an alarm that can get pushed to my phone when the temp gets too high or low (that temp is set by me). This could've helped us get out to the site faster, before the temperature reached damaging levels, had we known the unit was failing.

The next day we purchased a Honeywell Wi-Fi thermostat and went out to install it. I set it up so alert several of us that go to the site. While out there someone from the other station stopped by to check on the temp and told us the AC repairman found the condenser coils dirty and clogged. We hadn't looked that closely to find out the cause, plus we didn't have the tools needed to clean anything. They had a contract at some point with this company to allow them to come out and clean the unit up periodically to help avoid failures like this. Somewhere along the line, there was a breakdown in communication and the contract lapsed. It has since been renewed and will hopefully mean no more issues. We are prepared though with the new Wi-Fi thermostat.

I should mention that once the building cooled back down, the J1000 came right back up. Thankfully it looks like nothing was damaged, at least not that we can tell, for either station.

The inside components of the new A/C units -- not a lot there!

Temperature Monitoring

It is important to monitor the temps at transmitter sites. You obviously don't want it to get too hot for obvious reasons. I highly recommend a Honeywell Wi-Fi thermostat. Keep in mind, you must have Wi-Fi, so if you don't have Wi-Fi, all this is pointless. A thermostat app that will allow notifications when it gets to a certain temp is critical. We all get busy and will forget to check on things so having it set up to email, text or push notify you as soon as a certain temp is hit is helpful.

The KLZ transmitter site has an evaporative cooler (they work great in Colorado's dry, thin air) and it does not use a conventional thermostat. Because of that, I purchased an AcuRite hub with a wall mount small temperature sensor. I have it mounted on the wall, and it talks to the hub which then talks to the AcuRite app. It uses a hard wired ethernet connection to get to the internet. I also have that app set up to email me at certain temperatures.

This has helped me out when the power fails at the site. I always forget the evaporative cooler does not turn on automatically, so we found a way to wire it into the Burk ArcPlus Touch to allow me to turn the unit on and off. So, when I get those alarms, I can easily turn the unit back on, and usually watch it cool off fast.

Then at KLVZ, as mentioned above, we will have a Wi-Fi module installed in each unit. I have

not been able to look at the app I have to use for the units, but once I am able, my hope is that I can set some notifications. Thankfully the building came with some temperature monitors that we have wired into our Burk ArcPlus, so I can at least be notified of high/low temps.

When you monitor the temps, you can help avoid equipment damage by getting to the problem sooner. Rather than it running days or even weeks blowing nothing but hot air, you can know in a matter of hours and can hopefully take steps to protect your equipment.

Spring is Really Here

As noted above, I think I can say that spring is really here. Things are getting green. I don't know what May will bring other than the ability to go to my mountain home on the weekends. I will watch the growth at the sites closely and will figure out what I can do to take steps to keep it at bay.

I'll also be helping our Buffalo stations with getting two new production machines set up. It's been fun and interesting helping them replace all their NexGen computers. I'm always amazed with how, despite taking the same steps each time, each machine has a different problem that I need to seek support's help with.

I think that about covers it for this edition. I pray you all stay safe and well!

KBRT • Costa Mesa - Los Angeles, CA
740 kHz/100.7 MHz, 50 kW-D/0.2 kW-N, DA-1
KNSN • San Diego, CA
1240 kHz/103.3 MHz, 550W-U
KCBC • Manteca - San Francisco, CA
770 kHz/94.7 MHz, 50 kW-D/4.3 kW-N, DA-2
KLZ • Denver, CO
560 kHz/100.3 MHz, 5 kW-U, DA-1
KLDC • Brighton - Denver, CO
1220 kHz, 660 W-D/11 W-N, ND
KLTT • Commerce City - Denver, CO
670 kHz/95.1 MHz, 50 kW-D/1.4 kW-N, DA-2
KLVZ • Denver, CO
810 kHz/94.3 MHz/95.3 MHz, 2.2 kW-D/430 W-N, DA-2
WDCX • Rochester, NY
990 kHz/107.1 MHz, 5 kW-D/2.5 kW-N, DA-2
WDCX-FM • Buffalo, NY
99.5 MHz, 110 kW/195m AAT
WDCZ • Buffalo, NY
950 kHz/94.1 MHz, 5 kW-U, DA-1
WDJC-FM • Birmingham, AL
93.7 MHz, 100 kW/307m AAT
WCHB • Royal Oak - Detroit, MI
1340 kHz/96.7 MHz, 1 kW-U, DA-D
WRDT • Monroe - Detroit, MI
560 kHz/107.1 MHz, 500 W-D/14 W-N, DA-D
WMUZ-FM • Detroit, MI
103.5 MHz, 50 kW/150m AAT
WMUZ • Taylor - Detroit, MI
1200 kHz, 50 kW-D/15 kW-N, DA-2
WPWX • Hammond - Chicago, IL
92.3 MHz, 50 kW/150m AAT
WSRB • Lansing - Chicago, IL
106.3 MHz, 4.1 kW/120m AAT
WYRB • Genoa - Rockford, IL
106.3 MHz, 3.8 kW/126m AAT
WYCA • Crete - Chicago, IL
102.3 MHz, 1.05 kW/150m AAT
WYDE • Birmingham, AL
1260 kHz/95.3 MHz, 5 kW-D/41W-N, ND
WYDE-FM • Cordova-Birmingham, AL
92.5 MHz, 2.2 kW/167m AAT
WXJC • Birmingham, AL
850 kHz/96.9 MHz, 50 kW-D/1 kW-N, DA-2
WXJC-FM • Cullman - Birmingham, AL
101.1 MHz, 100 kW/410m AAT

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