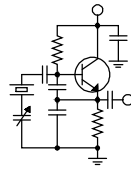


The Local Oscillator



The Newsletter of Crawford Broadcasting Company Corporate Engineering

APRIL 2026 • VOLUME 36 • ISSUE 4 • W.C. ALEXANDER, CPBE, AMD, DRB EDITOR

The Listener Experience

I remember growing up back in the 1960s that radio – and it was all AM radio back then – was a big part of our lives. In the car or at home, there was almost always a radio playing somewhere, usually tuned to KGNC 710, the dominant station in the town where I grew up. KGNC, by the way, is still there, still on the air in 2026.

Radio listening at home was primarily on a tabletop radio in the kitchen, but sometimes on the console in the living room. There were three controls on both those radios: tuning, volume and tone. Not a lot to it. You rotated the dial on the tabletop radio so that the pointer was in the ballpark of the frequency you were after, and then you fine-tuned it for best reception. The console radio had a linear dial, but the process was the same. Not a lot to it, and anyone, even a kid like me, could figure it out.

In the car, the process was basically the same. Rotate the tuning control to put the red marker in the ballpark of the frequency you wanted on the linear dial and fine-tune for best sound.

As we upgraded our vehicle, we got one with a “pushbutton” radio, which was the best thing since sliced bread, or so it seemed at the time. Tune in the station you want, pull out the button to which you wanted to assign that station (it was really more of a slider than a button), then push it all the way back in. Rinse and repeat for other stations. Then to tune your favorites, just push the button that you had assigned to that station. It really was ingenious and provided a “mechanical memory” that was very handy. For my folks, it was cool to have, but they seldom if ever changed the car radio from KGNC, so the pushbuttons didn’t get a lot of use.



Fast-forward some 60 years to 2026. Radio today is a totally different animal. Probably the biggest difference is that it is no longer the only available source of aural entertainment; it’s one of many. It’s also no longer just an aural medium. Text scrolls of title and artist and even album art are displayed with music, and during commercial breaks and at other times, advertiser messages and graphics are provided.

Back in the day, you pretty much just had to be on the air and not sound too bad for people to listen to your station. If you were in a market with multiple stations, you had to be louder and different than the competition, offering different programming that people wanted to hear and catching their attention as they rotated that tuning control by your station, to have listeners.

Today, you’ve got to have the programming that people want, and it has to sound good. It has to be available and consistent. And those visual add-ons have got to work and be right. We call all this, collectively, the “*Listener Experience*.”

To gain and hold listeners, we’ve got to be different and better than all the competing sources of aural entertainment. The “different” part is our programming. It must be something that people want to hear, not just an also-ran juke box playing the same thing as countless others. I’ll leave that part to our programming gurus, folks that study and pay attention to listener demands and preferences.

I will say this, though – in my experience, if you build it, they will come. It never ceases to amaze me when I look at the streaming performance numbers on our “Legends” format radio station. Clearly people, most all of them my age or thereabouts, love it and consistently listen

The rest of the *Listener Experience* is what we as broadcast engineers must pay attention to.

Does the station sound good? This entails audio processing as well as transmitter performance for over-the-air (OTA) listeners, and it entails audio processing, encoding, bandwidth, latency, jitter and a whole lot of other factors for our stream listeners. Do you regularly listen to your station's OTA audio and streams, and I mean more than a quick tune in? You should. Listen long enough that you will pick up on

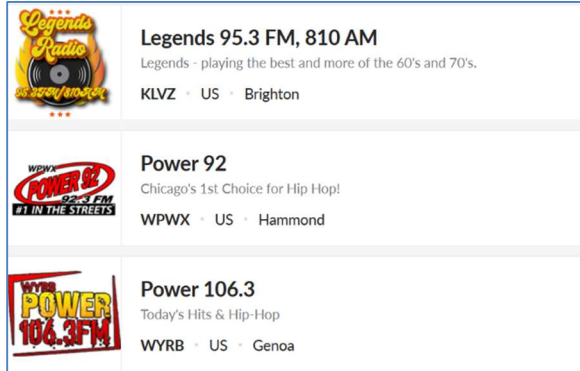


Figure 1 – A few of our stations' DTS Autostage settings from the DTS Broadcaster Portal.

any issues with the audio and delivery.

Is the metadata functioning correctly? This includes presence (is it there?), applicability (does it match what is being played?), time alignment (does it appear and change with program material?) and consistency (does it update as it should or does it get "hung up" sometimes?).

Listeners today *expect* metadata, and it's a tune-out factor if it's missing, wrong or out of sync with the program material. Our job is to make sure it's right, and that means checking it regularly, both OTA and on the stream, and of course on the stream the metadata is also used for performance royalty reporting, so it's doubly important there.

For HD Radio stations (and I'm talking FM and multicasts here), do Artist Experience graphics

display properly and at the proper time? What about advertiser graphics? And what about the station logo? Is it current and correct?

For stations that are part of DTS Autostage (all our stations are), is all the information correct and up to date on their station portal? This would include station callsign, logo artwork, station name and slogan, and market (see Figure 1). This is the information that will appear on the screen of many user radios when they are looking for something to listen to. Is it eye-catching or boring? It's all part of the *Listener Experience*.

At the end of the day, it still all boils down to being different and better than all the competing choices for aural entertainment. There are a lot more considerations than loudness and programming these days, and we must pay attention to them all.

So how are we doing in your market? Are we different and better in every respect?

NanoVNA Revisited

Last month in these pages, I told you about a new and inexpensive vector network analyzer (VNA) that I had purchased from Amazon. At that time, I had only used it to look at a piece of RG8X coax running from the Denver TOC to the roof, but the results were promising.

Subsequent to that writing, I took the SAA-2N VNA out to one of our Denver tower sites and tried it out in the real-world. I set it up next to our

Agilent E8061A VNA, which is a laboratory grade analyzer and the one that I have used most often to make impedance measurements, calibrate sample line lengths and the like.

I sent Amanda out to one of the KLVZ night towers and had her disconnect the sample line at the

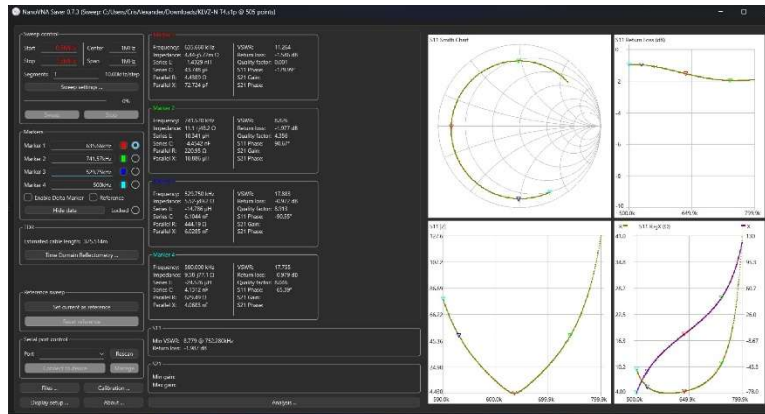


Figure 2 - SAA-2N sweep of the KLVZ-N tower 4 sample line.

ATU. Then I did a sweep of the open-circuited line from the antenna monitor end, starting below what I knew the 90-degree frequency is and extending to beyond the 315-degree frequency. I noted the exact frequencies of the zero crossings, then calculated the 225- and 315-degree frequencies and made impedance measurements at those frequencies.

Next, I repeated those measurements with the SAA-2N. I found that the zero crossings were very close to those I had measured with the Agilent, within a few Hertz in fact. Then I repeated the 225- and 315-degree impedance measurements, converted to polar and took the arithmetic average. The results: the characteristic impedance number I got from the SAA-2N was within a quarter of an ohm of what the Agilent showed.

That little experiment told me that the SAA-2N is entirely adequate for the kinds of measurements we typically do around AM antenna sites. That's great news, and with the cost of the SAA-2N about the same as it costs to insure and ship the Agilent analyzer, the obvious thing to do here is to purchase one for each of our AM markets, and that's what I have done. So you guys in those markets should be watching for those to arrive.

Next on my agenda is to see how the SAA-2N stacks up against the Agilent at FM frequencies. That's a bit more of a challenge, since it has a

maximum input level of +10 dBm. Many of our sites are close to other FM stations and could well have a significant amount of RF coming in. But I'll find a good way to evaluate it at VHF to see if we can trust it there as well. My guess is that we can.

I should note that while the built-in touch screen is useful and you can do most measurements right on the unit itself, the PC app gives you a lot more granularity and options. Calibration is easy in the app using the calibration assistant. Figure 2 above shows the app screen of the T4 sample line measurement I made.

All the markers are visible at once, making it easy to see the frequencies and impedance numbers for each. The Smith chart displays the sweep as well as the color-coded markers. And the app allows you to save the sweep and reload it later. You can, after loading a saved sweep, create or move markers to further analyze the measurement.

The New York Minutes
By
Bill Stachowiak
Chief Engineer, CBC – Western New York

Greetings from Buffalo!

I have been thinking about events that happened during my career that all of you might find interesting. Hopefully you will be able to use some of these things to help you in the future when you encounter strange issues in the field.

One morning, I got a call from WPHD informing me that they had gone off the air. I told them that I would look into it and get back to them. Shortly after, they called back and said that someone had reported flames shooting out from somewhere on the tower! When we got there, we discovered that the feedline was on fire and the dehydrator was fueling the fire with a great supply of air! After turning off the dehydrator the fire went out.

It was clear that the station wouldn't be returning to air for quite a long time, so I had to come up with a quick solution to restore at least some semblance of normal operation. The first thing I did was to purchase a citizen's band (CB) ground plain antenna and cut it to the proper length for 103.3 MHz. We mounted it on the roof of the transmitter



building and ran a piece of RG8U coax to it. We had an old Collins 1 kW transmitter for our aux, so we put that on the air while I worked out a more permanent solution.

I decided to run a length of RG8U coax up to the antenna as a temporary replacement for the burned-out feedline. Fortunately, I had a reducer to type N that I could use. There was an AM on that tower, so I had to also take that into consideration. We were using a method known as "bazooka" matching. This method uses the fact that a short on an open line at a quarter wavelength will produce a very high impedance at the feed point. In this case, the tower is one half of the line and the coax is the other. I had to make sure that the tower crew bonded the coax at the proper place so that the impedance of the tower wasn't substantially affected. I was able to successfully get the station back on into the main antenna with low power by the end of the day. The coverage wasn't bad. A few weeks later we got the line replaced and returned to normal operation.

In Buffalo last month, we had a problem with the WDCX-FM Nautel Exporter Plus. We kept

getting alarms on our modulation monitor indicating that the HD channels were dropping out. We found that the cooling fan in the exporter was not working. After replacing the fan, we thought we had solved the problem, but no. I thought that the problem might be the compact flash memory card, so amazingly enough, we were able to purchase one here at a local camera retailer here in Buffalo. Those cards aren't

easy to find anymore. We flashed a new image to the card and put the unit back in service. It has been running now for a couple of weeks with no problems.

Josh and station manager Brett went out to the WDCX-FM transmitter to remove some trees that were precariously hanging over one of the guy wires. They removed around seven trees. We are going to hire someone to come in and clear more.

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

Cisco Not Perfecto

I always like to think that Cisco equipment is infallible, an absolute rock, no faults, no failures, reliable as the sunrise. For the most part, that's true, and here comes the "but." On a Saturday morning, our ops manager called to tell me that in one of our control rooms, the console meters were sweeping from left to right and that there was no sound. Not long after he mouthed those words, he said, "Oh, everything is back." I checked around but didn't see anything that stood out as a possible cause. I was headed out of town for the week, so I told Steve what had happened, offered a couple of theories and hopped on a plane.

Everything was fine until just one day after I returned home. I got an alarm saying the backup audio source was on the air for that station. I grabbed my laptop and logged in. All of that studio's assets were online, the STL looked fine, and the transmitter was obviously okay. Remembering what had happened a week prior, I decided to jump in my truck and see for myself what was going on.

Upon my arrival, the first thing I could see was that everything was powered up, Wheatnet blades were on, up, and showed no audio. The console's meters were not sweeping, indicating that it had a network connection. I even checked the profanity delay unit for the telltale NO WNET message – it was fine. Zetta was fine, too, so I bypassed the studio using the Umixer to get regular programming back on air (should have thought of that earlier).



More checking and I noticed that of the four Wheatstone blades in that studio, one had assumed the role of Route Master and another Clock Master. I have our system set up so that blades in the studios have a very low priority compared to that of a TOC blade, ensuring that the duties of Clock and Route Master are never left to edge devices. I also noticed that PTP master clock errors were on some Wheatnet devices. Seeing this suggested network issues, but I could communicate with everything on this network – odd.

I pulled the panel where the affected studio's Cisco 2960 CX lived and could see all of the connected ports' network lights were solid, showing no activity. A power cycle of this switch fixed the issue, but it brought to light a possibility I'd scarcely considered; a switch could enter a state that allowed switching of traditional IP traffic, but not IP multicast traffic. Could this be a failure of the switch to send multicast packets from the datalink layer to the network layer? Perhaps IGMP failed? I didn't start rooting through the logs – hey, a win's a win, plus I won't pretend I could understand a Cisco log anyhow!

Nautel Multicast+

After a fairly long wait, a new Nautel Multicast+ HD Radio importer/exporter combo landed on my doorstep. I already have one in place and have been thrilled with it. I continue to find the Gen4 HD Radio system to be a huge improvement over the previous versions, which always felt like prerelease lab development software. With Gen4, XPERI/DTS has made the system more user friendly,

so it follows that initial setup is also much more intuitive.

One issue that has been dogging me for the last year has been the short duration of the album art and other program associated art coming from TRE+. TRE+ is a system that dynamically sends program associated data along with artwork. It also allows us to push advertiser artwork and other promotional items to HD Radios equipped with The Artist Experience add-on to HD Radio.

While setting up the new Multicast+, I found that I had been sending the default station logos directly from the importer. The problem with this is that it was sending the logos at random, clobbering the information that was recently pushed from TRE+. Also notable is that you cannot simply unselect the station logo from the Multicast+ software. There is a known bug which will just reenable it. Truly disabling it requires you to edit the software's XML initialization file by removing the logos path for each station on which you use a third-party system like TRE+. This cured the issue. It also cured the issue with many pieces of art never being triggered even after they were sent to the receiver.

Genny is Not Happy

Recently, severe weather knocked power out at our studio building. The generator started up, stalled and restarted repeatedly after about 40 seconds. Why?

Since day one, this generator has had problems due to its fuel supply. Its engine is a spark ignited natural gas turbocharged 9-liter monster with, yes, a carburetor, which for this is little more than a variable orifice connected to a governor.

For the unfamiliar, a generator must maintain its RPM within a very tight window to ensure that the electricity produced is precisely at the correct frequency, which in the US is 60 Hz. This is done with a governor that monitors the engine crankshaft or the electrical output frequency. Should the engine or alternator's speed vary due to changes in electrical load, the governor increases or decreases the engine's fuel thereby stabilizing its RPM.

What if the load increases beyond the governor's ability to increase fuel? Ideally, that won't happen until the generator's rated power is reached.

When our generator was installed, we tested its limits, its ability to sustain a load at its rated

output of 150 kW. It did fine. Early on, I was disappointed with the unit's performance upon startup. The engine would surge and take a very long time to stabilize before the building's load could be transferred. The solution turned out to be the addition of one more natural gas regulator set so that the unit's gas supply pressure stayed below the manufacturer's recommended maximum, which solved the surging issue. Multiple weekly exercise cycles proved the surging was gone. The recent power failure uncovered an unexpected side effect of the new regulator's addition, which seems to be a restriction on the amount of gas the unit can receive.

Fortunately, I happened to be at the studio when this power failure occurred and was able to detect the stalling and restarting. What was happening was that the generator could happily carry the building's load, but once the transmitter ramped up its output after its power was restored, it reached a point where the generator could no longer keep its engine running, RPM decreased, the transmitter reacted to the low voltage and frequency condition by shutting down, and the generator recovered – wash, rinse, repeat. Once I figured this out, I reduced the transmitter's output to a point where the generator could keep up and waited for the utility power to return.

We've scheduled a trip by the generator service vendor to bring a suitable load bank to test the unit offline and hopefully point to a reason why the fuel source is being restricted. Stay tuned..

Miscellaneous Ramblings and Goings On

March has been a whirlwind of little nothing-burgers. Little issues and tasks that just kept me running but are not too much of anything real interesting to anyone else. Reboot this, figure out that the producer had the wrong console bus selected, deal with upcoming show changes – the lot. I also took a week off and went to San Antonio, Texas with my wife and a few friends. My wife and I had always wanted to check out their iconic River Walk. It was relaxing, and of course I ate too much. They have a Bubba Gump's there, so I got to have my favorite shrimp, shrimp, and shrimp! It was cold here when we left and it's warm here now – mission accomplished.

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

How old are you anyway?

Can I tell you that I hate feeling like I'm on the edge of a great conspiracy? Maybe you can call me suspicious or crazy, but trying to read the tea leaves of what is happening in computing leaves me feeling a bit uneasy about what the future holds for everyone that is a part of this digital age. If you've been keeping up at all, two trends have emerged recently that have the capacity to fundamentally change how society as a whole interacts with the web.

The first are a couple of laws in California and Colorado (AB1043 and SB26-051, respectively) that are going to begin requiring operating systems and third-party software API calls to digitally age-bracket their users. Essentially, using the argument of protection of children, the laws want to shift the burden of verifying ages from websites to the actual OS on the hardware that the user is sitting in front of. Seems legit.

Of course, the benefits are clear. One would only be required to verify age one time and then the OS would allow more openness to the user as they cross various age thresholds until they reach adulthood. I'm sure it would also automate a number of parental controls and protections for minors. I also assume that this would be in place for gaming consoles like PlayStations, Xbox and Nintendo switch handhelds.

The arguments from the other corner are worth considering as well. One could easily believe that this might create a surveillance ID system. How would the birthdate information be collected or used?

Before you start to think that it certainly wouldn't be used for anything more than age verification or something more nefarious, check your internet search history or the conversation you just had with someone about new shoes and the advertisement on the side of the web page you're browsing. If retailers have figured it out, hackers will certainly make use of it.

What about families or people that have

shared devices in their homes? Will I be able to use my Alabama iPhone or laptop that didn't require age verification and travel to Colorado or California with them? It seems that it would be so easy to work around.

In this world of AWS cloud services, virtual machines and VPNs, one can quickly and easily be in another computer system where the age verification would be open. I suspect entire business models might be made to skirt these up-and-coming laws.

What about business environments? What standard will they be held to and how will it be implemented when the next new computer is purchased? For radio, how would it affect being able to use the software we use, whether it is Adobe Audition, RCS Zetta or even software that we use that is highly hardware specific (Autopilot,

anyone?).

Of course, these laws aren't local to the United States, Brazil has a law that came online March 17 called the Digital ECA act. Also, in response to the United Kingdom's Online Safety Act, Apple implemented age verification on their devices by prompting for a credit card or a scan of an ID.

Being familiar with open source software, the core principles of many Linux operating systems is "We don't collect privacy data on our users." GrapheneOS (a Linux operating system that has gained traction as an alternative to Android or IOS on cell phones or handheld devices) has already stated that they will simply not allow their OS to be downloaded or installed, using geo-location, in geographical places where the laws are in effect.

Because the laws are regulatory in nature, the ability to fine companies for non-compliance creates an entirely separate issue. Most open source operating systems are highly budget constrained and do their best to maintain high quality software with next to no resources.

I anticipate some legal challenges to the laws, but I'm convinced that standing on principles won't last long when the viability of their existence is



in the balance.

What is your internet router hiding?

The second shift that came along this month is that the FCC made the same moves that they did several months ago with UAV drone market with the consumer internet router market. That is, they've told companies that make internet routers that unless there is a clear security visibility from beginning to end in the hardware and data stack development that any future products will not be approved for usage in the United States.

This isn't a recent political occurrence. Huawei products, the forced sale of Tiktok to an American company, and even suspected TP-Link routers came up three or four years ago. They're all examples of the steady movement toward these product lockdowns. There has been a trend toward limiting a foreign country's ability to somehow monitor data streams and sensitive information.

Similarly to the DJI ban, any routers that currently are made and have received FCC approval will continue to be available for manufacture and sale from any of the companies that make routers. Current routers will still be able to receive firmware upgrades until March of 2027 when there will be a reassessment of that allowance as well.

The question that might be in your mind right now is, "Todd, are there any manufacturers of routers that are end-to-end completely based in the US?" Taking a few seconds to think it through, likely the first answer that crossed your brain is the right one. Nope. NetGear is American owned, but all assembly and parts are created somewhere else.

As I mentioned in the first sentence of this section, this only affects "consumer" level routers. Obviously, at Crawford Broadcasting, we've settled on putting PfSense firewalls and routing in place on Dell Poweredge machines. So we're clear. Or are we? How many of us have consumer level routers at our tower sites? I know I do in Birmingham. Also, the router ban includes "anything that routes data packets." That includes WiFi access points and any mesh routing equipment you may have. Does anybody have a wireless access point in the building?

Some of you may remember when we were switching to PfSense away from ClearOS that we sent around a tiny 4-port computer that already had PfSense on it that effectively routed packets while we rebuilt the firewall machines. Is that a router? The answer is no, it was marketed as a computer, with four network ports on it. In fact, look on Amazon for any number of mini-PCs that have two ports, that's enough to be a router, with the right software.

Changing that box into something that routed data packets was trivial, but it wouldn't be considered a router for the purposes of this ban.

Some of you also may be familiar with DD-WRT which is an open source router project that has been around since the time that the CEO of Linksys had a dream about a famine of router cases and purchased 1 billion blue cases with four feet and two WiFi antennae and used that same form factor for seven years until the famine had passed.

At present, DD-WRT is now a pretty feature-rich firmware that can be placed a healthy number of older routers, and it receives security updates on a regular basis. In most cases, it can breathe real life back into older routers and make them way more secure than they were coming out of the factory.

It's got a nice web interface called LuCI (Lua Configuration Interface), and I think most would find it similar to what you are accustomed to seeing from a manufacturer's web interface on a purchased router. There are plenty of tutorials on their site (<https://dd-wrt.com>) for each supported router that will help you get DD-WRT onto your older router.



The Linksys generational, ubiquitous blue injection-molded case.

I mention all of this to simply say that it's becoming imperative that there is a need to have a router that you control behind your home modem/router combo just like you do at work that has no possibility of sniffing your data.

It will be interesting to see how this all plays out. My brain turns a couple different ways over these developments. Most people likely won't care much about what I've written about. They just need the internet to work when it is required, whether it's on their phone, at home or at work. We're not most people. I think the people that read these pages know that we need to be wiser and ready for what is coming our way.

That includes doing the work on any of your internet routing hardware to make sure that security updates and patches are in place or changing it out to something that you are sure is more secure. We can't be vulnerable to such things and can't allow our hardware to be controlled by entry level hackers,

whether at work or at home. Be on guard, a brave
new world is coming our way.

Until next time, may the Lord bless the work
of your hands.

Tales From Cousin IT

by

**Stephen Poole, CBRE, AMD
CBC Corporate IT Specialist**

Ah, another month floats past, and the operative term here is, "floats." Lots of rain for the first part of March, with several severe storms, including one that destroyed my Spectrum modem. We even had some snow the other day. It didn't stick around for more than a few hours – this IS Alabama, after all – but it was pretty while it lasted (Figure 1).

Actually, it's a good thing that the snow doesn't last here. We rarely get more than an inch or two, but this doesn't stop folks from building sad-looking, muddy "snow men" that are filled with sticks and leaves. When these misshapen gargoyles melt, you get a surreal-looking, shrinking brown lump that ought to be screaming like the Wicked Witch in The Wizard of Oz.

But we have a joke that goes, "if you don't like 'Bama's weather, just wait a day or two; it will change." Looking at the National Weather Service forecast for the next several days, it will be warm and sunny, breezy with little chance of rain. In fact, we're under a fire watch. April in Alabama can get quite smoky, in my experience. When we don't have storms and tornadoes, anyway.

Gilding A Rusted Bucket

Those of you who live in larger metro areas have your own hassles with air travel: huge terminals, long TSA lines and flight delays. But those of us who live in Alabama have our own woes. The "Most Hated Regional Jet in America" (to quote a headline from the online site View From The Wing) is what most airlines use to fly from Birmingham-Shuttlesworth Airport (BHM) to their various hubs.

To borrow from Cris Alexander who said, "You don't fly in a CRJ, you wear it," I have "worn" these terrible CRJs many times, because that's usually what's available. To Delta's credit, they sometimes use 737s, and in the past, 717's, to get me from BHM to ATL. But more than once, even after my ticket has been issued, they've substituted a CRJ200 or 900 for my nice 737. First class doesn't help much, either. You're still smished into the seat and it's so noisy in

flight, you can't even hear your ears pop when you climb and descend.

Back to the headlines. United has taken some older CRJ200s and has refurbished them, calling them the CRJ450. I guess adding 250 to 200 makes it sound better. Yahoo's headline crowed, that this "... could change how you feel about regional flying." Not likely. Yes, a few seats have been removed (41 instead of 50) and there's a bit more room, but it's still an old, half-worn-out CRJ.

The last time I wore one, it rattled like a garbage truck. And my opinion of United Express isn't high, anyway, given that the CRJs that I've worn between

Birmingham and Denver weren't truly clean. I'm not planning to fly again anytime soon, but if I do, I'll probably head up to Nashville or hop to Atlanta. That adds travel time (and the madness of Atlanta's huge terminal), but it's worth it to ride in a real airplane that doesn't have diseases that haven't even been named yet.



Figure 1 - From my back porch: a surprise!

The AI Report

Maybe I should make this a regular feature. To be fair, I'll admit that Artificial Intelligence (AI) seems to be getting a bit better. Just a bit, but better.

Still, if you need a good chuckle, ask your favorite AI how accurate it is. The best numbers I've seen lately hover between 60-80%. Google has long since upgraded their search page to display AI results, now with this disclaimer: "AI can make mistakes, so double-check responses." Heh. No kidding!

Gartner and some other IT consultants also warn that AI results must be checked carefully. 80% sounds good, but if you happen to fall into the 20%, it could bite you badly. Using AI to generate software code is by far the most prone to mistakes. And judging at the way that legal briefs are being rejected right and left in the courts for being AI-crafted, I suspect they're running a close second.

Oh! In the midst of this, Intertech Media – who hosts our own websites – is now offering AI-generated ads, ready to load into Zetta and play on air! What could possibly go wrong?

Public/Private Key Encryption

If you're like me (and if you are, you should seek professional help), you've probably wondered: how can a negotiated connection be truly secure? Yes, any encryption can theoretically be cracked; the goal is simply to make it difficult enough that even a super-duper computer can't crack it in a reasonable time frame.

I'll focus on SSL/TLS-encrypted network links here, especially those for web browsing and email. Since we use GoDaddy for certificates, I'll use them as my authority in this example, but of course, there are plenty of companies now selling verified commercial certificates.

The Certificate

The first step is to generate a "signing key," which is then sent to GoDaddy. This automatically creates your private key, which will be stored locally on the server in question. These are unique blocks of data that have one "key" thing in common: when passed through some rather complex math, they will provide an identical result. The Internet only sees your public key; the private remains hidden on your server.

When your certificate is issued, there are tools that you can use to verify that everything will work together: the OpenSSL toolkit in a terminal, or a GUI application that checks things for you. Most web browsers also display a little lock icon up in the address bar; click that to get more info. It will tell you if anything is wrong.

Finally, the certificate authority will have its own keys; with GoDaddy, it's usually a single file

called something like "gd_bundle.crt" and it'll be included in the download.

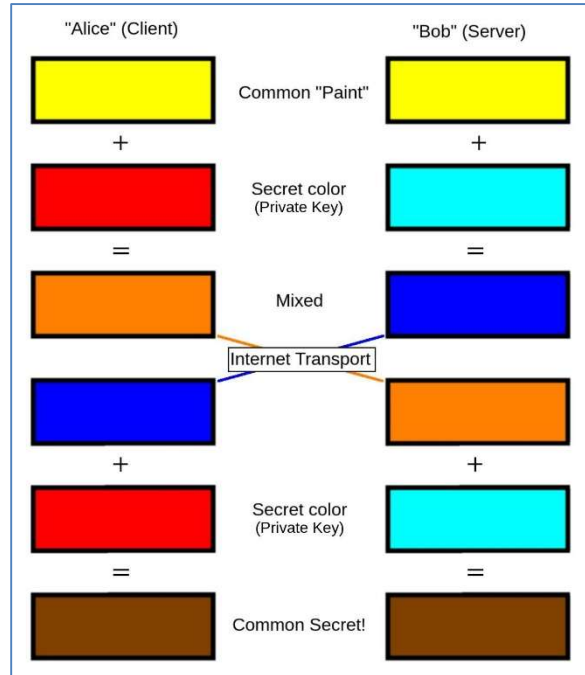


Figure 2 - The TLS Handshake. Tastes Like Chikken.

Now: How It Works!

There are images available online that demonstrate the process with colors, and hilariously, most of them use "Alice" and "Bob" as names for the two ends of the encrypted connection. Some of the better illustrations even have cartoons of Alice and Bob at the top. It leaves out the details, but the idea of mixing colors to come up with the same "common secret key" illustrates how this works (Figure 2).

Anyway: for this walkthrough, let's call Bob the server. Alice is your web browser or email client that will connect to Bob. When you first connect, it is not encrypted; this is called the "TLS Handshake." It's in plain text and tells each end which versions of SSL or TLS are supported. For example, our mail server only offers TLS 1.2 and 1.3; the older SSL versions have been "deprecated" by the Neck Beards for being insecure. Being Neck Beards, they've also made them unusable now, so if you have an old client, the server may refuse your connection.

This initial handshake also includes a string of random bytes known as the "client random." The server will respond with its certificate, which (as already noted) includes the server's public key, and its own "server random" string.

The client verifies the server's certificate. Assuming all is well, the client sends one more random string, the "premaster secret." This is hashed into the server's public key from the certificate. Both the client and the server then generate identical session keys and full encryption from one end to the other begins.

Let's Mix Paint!

It's actually kind of clever, as shown in Figure 2. Of course, we're actually swapping and "mixing" strings of bytes; some mind-bending math is used to derive the various secrets. But colors will show the principle.

Both the client and server have chosen yellow to start with. Alice adds her private key red to it, giving orange. Bob adds his private cyan, creating blue. Here's the slick part: adding the secret colors together at each end gives the common secret (brown in Figure 2)!

Unless you have the private keys, you're reduced to guessing. If the keys are large and random enough, it will take even a super computer thousands of years to guess these private, secret session keys. Even if you sit in the middle of the connection (the old "man-in-the-middle" attack), you never see the private keys. Without the right keys, you won't get the same "colors" when you "mix" at each end.

Incidentally, if you use a packet capture program like TCPdump or Wireshark to view TLS data, once the initial handshake and negotiation is done, all you'll normally see is gibberish. But Wireshark offers a way to save and use the common key to decrypt the data back into something (hopefully) understandable. If people express an interest, I might do a walkthrough on how to use the common secret to decrypt data packets in Wireshark.

But until next time, keep praying for this nation! God's still got this!

The Chicago Chronicles

by
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As I have written in past issues, we have been working on a project at our Lansing transmitter site where we are attempting to resurrect a 100-kilowatt generator that was formerly used at our Burnham site so that we have a unit that can handle the increased load we now have with an offsite auxiliary for WPWX now collocated at the Lansing site.

The infrastructure there would not handle going from a 30-kilowatt generator to 100 kilowatts. This meant both physically and electrically. Last spring, we started by installing a new automatic transfer switch in the building that will handle 200-amps.

The next step would be to provide a new concrete pad and have conduit large enough for four, 3-ought wires, installed from the pad to the building. Since this is largely going to be a project that we are doing most of the work on, it is not going as quickly as we would like.

After the Zetta installation and transition to that took up most of the engineering time last summer, we ended up digging the hole for the concrete pad in early November of last year. By time the forms were put up, we were hit with early snowfalls, and that halted the work until the weather turned this spring.



In the meantime, the current generator had a bit of ticking time bomb problem that might cause it to not work when needed. The radiator in the unit has some clogged tubing that would cause the unit to overheat. It didn't show up until it carried a load. The cost of replacing the radiator was very prohibitive, especially in light of it being a short-term investment in consideration of the other unit taking its place.

So, we have been nursing the situation to make do until we get the other unit ready. We have the remote control automatically put the transmitter at half power when the site goes to the generator for power. Additionally, one of the engineers must get to the site and take some of the doors off the generator cabinet to keep the unit from overheating and shutting down. While this is not fun, it has served us so far.

Fast forward to this March. We started getting shutdowns when the unit was just exercising. So, now this has given us a bit more urgency in the situation. However, knowing that we are still quite a bit away from finishing the project, I wanted to see how we might keep the current generator ready to go in case we lose power at the site.

I considered purchasing a truck radiator and figuring out a way to do an “ugly mount” so that we could keep it going for the short term. That was when our maintenance manager suggested that we might want to try flushing the current radiator before replacing it.

At which point I said, “Great! When can you do it?”

He took this on and used some rust penetrator and a hose and a whole lot of gunk came out. The hope was it bought us a little more time. We immediately tested the unit by exercising it for an hour and it didn’t shut down due to an over temp alarm. So, we are optimistic that it will be ready.

Of course the real test will be when we lose power and actually have the unit under load.

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

Weather

To say the weather patterns across the United States have been anything but usual would be an understatement. I don’t think winter ever really showed up in Colorado. In the Denver/Metro area, I think it only snowed three times. I enjoyed the warm weather, but the truth is we really need the moisture. We are in an “exceptional drought,” the fire danger is very high, and they are talking about some serious water restrictions all over the place. We are praying for a very wet spring.



it was 78 in the building when the unit was set to cool to 70.

The other unit had an alarm on it that can only be cleared by doing an extended power cycle, so I had to go to the site to deal with that. I flipped the breaker and waited about five minutes before powering the east unit back on.

Meanwhile I looked at the west unit. I know nothing about AC units, so I didn’t do much. The unit did have cool air coming out, but not cold air. Thankfully, the east unit came back on and cooled easily and quickly.

We called a company to look at the west unit, and they found there was a leak at the service valves. We are waiting for a quote for that repair work, as of course it is not under warranty. I am very grateful that we have two units on site to allow easy switching to keep things cool.

Winds

We’ve had some very windy days of late. I had to make a trip to the KLVZ tower site to fix a fence panel. I have a program on my laptop that allows me to watch all our security cameras. I have them on a tour and on one of the stops at tower two out there, something looked off. I put the PTZ camera on the tower and zoomed in some and could see the panel was not on the back side of the fence. It’s a panel we remove often in order to store the tractor inside when it’s on site. The fix was easy. We will cut up a two-by-four soon and put it on the panel to allow new mounting points that aren’t stripped out.

Crackheads

On Friday, the 13th I was having a girl’s night with my sister-in-law. We were sitting down at the movie theater, and since we still had time before the movie started, I pulled my phone out and noticed an email from our security camera system at KLZ for motion at our back door. I get a lot of false alarms from the system, but this one caught my attention. The time of day is usually when I would not expect a shadow to cause an alert.

I looked at the picture it sent, and I was looking at the security light that’s mounted above the camera instead of the door and porch. I knew immediately this wasn’t right, so I got on the camera app and began looking.

A random guy had shown up shortly after 6 PM and laid on the steps to the back door and

AC Woes

With warm weather comes the usual air conditioning issues. For the first time since having them installed a few years ago, one of our mini-split system units at the KLVZ tower site wasn’t cooling efficiently. I will switch the units once a month, so each one gets about the same amount of use.

I had switched to our west unit and a few days later I received a notification from Burk alerting me to high temperature in the building. Sure, enough

smoked crack. He ended up noticing the camera and went and found a piece of PVC conduit that had been on the side of the building for years and used it to move the camera. He was a real genius, as we have about 50 minutes of video of him lying around smoking before he noticed the camera.

After he moved the camera he walked around to the front of the building, looked in our dumpster, walked up our road to the barn, and messed around there a bit with no luck and then went on his way.

The next morning at 4:47 AM, I got a motion alert for the front area and I saw someone walking onto the property, walking up to our building, and then leaving. I only saw him on the front camera. We have some blind spots, as most systems do, so I am unsure what he did, I'm just glad he left quickly.

We went out to look at things and could see that the fencing that was installed after the road project was complete allowed for easy access. The barbed wire was loose and could be moved easily, and someone could squeeze through without issue. I had Daniel go out and remedy that situation. I have not been back out to look at what he did, but I do know we have not had anyone else at the site.

Looking Ahead

At the time of this writing, yesterday was Major League Baseball's opening day. Unfortunately, I am a Colorado Rockies fan, and these last several years have been painful to watch. This year, I am making it a goal to pay attention to MLB as a whole to keep up with what's really happening and watch different teams play, not just the Rockies. I do hope that the Rockies won't be the worst team in baseball for two years in a row. I will continue rooting for

them and watching them, but I am looking forward to cheering for other teams like the Dodgers.

Things around town are greening up, which is wonderful. I love spring! I would like to mow at our sites. Thankfully, I have Daniel who can do that for me. He has proven to be an immense help. He even spent several days working on our brush hog, getting it welded where it had been damaged by hitting prairie dog mounds. Sometimes you just can't see them. Those and random debris that showed up had caused the side of the brush hog to come apart. I wish I had a picture so you all can see the beautiful work he did on it.

We will have to wait and see if the sites grow up this year. At the very least, we need to mow to knock down the rest of what I didn't get last year.

I may use April as a time to spring clean at the studios. Let's face it, as engineers our jobs are more than just working on transmitters. It includes cleaning up equipment. I have no doubt the cabinets need a good vacuuming on top, and the equipment inside could use a wipe down. The consoles need to be cleaned up; keyboards need cleaned or replaced.

Working in studios is absolutely disgusting to me. Some are worse than others. Keyboards caked with substance no one knows. Crumbs from food (that's not allowed in the studios) are all over and inside the console along with all that dead skin that's fallen off people. I hate having to clean it up, but for some reason, no one will do it.

I will also do some more UPS battery replacements to get all our units up to date in hopes I can avoid a failure. My dad has become very good at removing the four batteries in the bigger, rackmount UPS units, and replacing them with the new ones.

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

The Local Oscillator
April 2026

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/100.7 MHz, 5 kW-U, DA-1

KLDC • Denver, CO
1220 kHz, 1 kW-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 • Brighton-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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