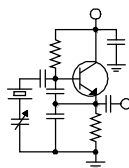


# The Local Oscillator



*The Newsletter of Crawford Broadcasting Company Corporate Engineering*

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## Software Upgrades

Seems like everything these days has a microprocessor, some sort of operating system and firmware or software that defines what it is, what it does and how it behaves.

I wasn't all that surprised, then, when I got an email from Ford telling me that there was a software upgrade for my car and that I needed to go to a website, download it and do the update. The process turned out to be fairly straightforward, as it should be for a consumer item like an automobile. I went to the Ford website, logged in with the credentials I established when I bought the car a few months ago, and was taken to the page with the update instructions.

First, I had to provide an empty, formatted USB drive and plug it into a USB slot on my PC. Then I had to download the file. Next, I had to extract the files from the download to the USB drive, then eject it. After that, I had to start the car, plug the USB drive into one of the USB ports in the car and let it do its thing.

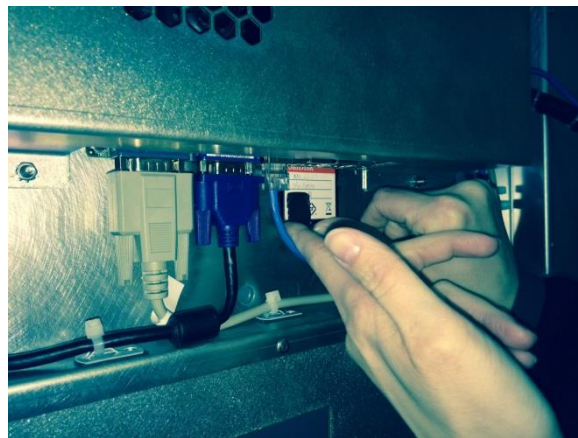
The actual update process took about half an hour and was a piece of cake. Essentially I just sat there and watched it happen on the central touch screen in the car. After it was done, it rebooted, then I had to re-pair our phones with the car, and that was that. The upgrade provided some new features and fixed some bugs. It probably introduced a few new bugs, too, but I haven't noticed anything yet.

The point is that the process was easy for even a consumer with no real technical expertise to follow.

I couldn't help but contrast that software upgrade with another one I did last month, this one on the KBRT Nautel NX50 main transmitter. That upgrade required a good bit of technical skill and know-how, and that's okay for the most part of this is, after all, a specialized piece of broadcast transmission equipment that is presumed by the manufacturer to be

cared for by a competent, qualified radio engineer.

The process started with purchase of a compact flash card, something you don't see a lot of. These aren't the little memory cards you use in digital cameras and GPS units but are much larger and thicker. Then I had to download the upgrade file (a .tgz Linux image file) from the Nautel FTP site, unzip it and then run a checksum comparison on it to make sure it was not corrupted. After that, I had to use a special program to write the image to the compact flash card. Thankfully my home desktop PC had a slot that fit the compact flash card, although we had a USB adaptor I could have used with any machine.



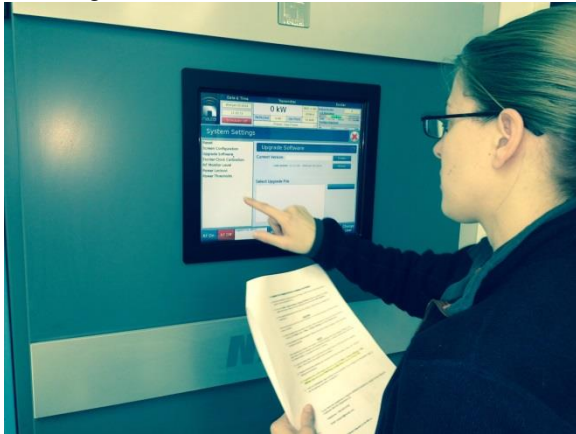
**Inserting a CF card with the software upgrade into the slot in the NX50's single board computer**

None of that process was particularly hard, but it was out of the ordinary. The thing that bugged me was that I had no way of looking at the contents of the imaged compact flash card to make sure that it contained what it should, something that is a function of burning a Linux image in a Windows environment.

I just had to trust that all was well as I placed the card in my bag and got on the airplane of

but just in case I burned a second card as well!

Once at the site, I put the aux transmitter on the air, powered down the main, pulled the old CF card and installed one of the ones I burned. I powered the transmitter back up and watched it boot. Once the AUI (user interface) was up, I had to plug a USB mouse into the single board computer in the transmitter and use it to calibrate the touch screen. With that done, I was able to unplug the mouse and use the touch screen on the transmitter to set the network parameters and a few other items before flashing the transmitter with the new software.



#### **Amanda resets NX50 settings from her notes following the software upgrade**

That software flash took about 20 minutes and a reboot, and after that I went through all the settings, and I mean every single one (which I had recorded to paper ahead of time) to make sure everything was still correct. With the interface considerably changed from the old software, a bunch of the settings were in different places but I found them all. The only things I had to change were the AES reference levels on all the presets (they were set at 0 dbfs and I had to change them to -6 to get proper analog modulation depth) and set the AMC

compression level to 3 dB (it defaulted to zero, which was worthless). After that, the transmitter was operating normally and we put it back on the air.

While I was at it I updated the software in the transmitter's engine and Exporter. Both those updates were a little different, too, and involved a TFTP server which I had to install on my notebook PC, but both took just a few minutes and presented no issues.

So in contrast to the software upgrade on my car, the NX50 upgrade took about the same amount of time but required more work and more steps. That being said, I don't think it was unreasonable, and I'm confident that any competent radio engineer with decent computer skills could follow the very detailed directions and get it done.

Contrasting the KBRT NX50 upgrade to the KLTT NX50 upgrade that we did over the summer, KBRT was an order of magnitude easier. It seems that we were on the bleeding edge with the KLTT upgrade while the KBRT upgrade was much more refined. All the issues we had with the KLTT upgrade had been taken care of by the time I got around to upgrading KBRT, which is a very good thing indeed if KBRT is not a 30 minute drive from the office like KLTT is!

In late January, Amanda and I did another software upgrade on the KLTT NX50. I'm happy to say that this time, the upgrade went like clockwork and took a very similar amount of time to the KBRT upgrade.

Next up: KCBC. Steve Minshall plans to do that one in the coming days and I believe he will have no issues at all. We also have some NV40 upgrades to do that should be similar in process to the NX50 upgrade.

Remember when upgrading a transmitter required soldering, drilling and hardware? My how the times have changed.

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

Hello to all from snowy Western New York! The city of Buffalo made world news headlines again this past month with a predicted blizzard, which lasted nearly two days and nights. It wasn't so much the fact that we received right at two feet of snow or that we can handle it but the temperatures bottomed out at minus 5 degrees and with wind speeds at 30 mph, produced a wind chill of -28 degrees. Meteorologists explained that this bitter cold air was driven by a shift in the polar vortex, meaning that the air mass being pulled into the region and even as far down south as the Gulf of Mexico, is originating in Siberia, Russia and being pulled over the North Pole and into the North American continent. This event is considered to be a cyclical event, occurring roughly every twenty or so years. The blizzard of 2014 is one that will go into the record books, but not for the obvious cold temperatures or snow depth, but the fact that not one human life was taken by this weather event was a miracle in itself. In comparison, the blizzard of 1977 recorded 29 deaths contributed directly to that super blizzard, and the now famous St. Patrick's Day blizzard of 1936 saw 14 deaths and property damage at nearly one-half million dollars.

Many consider that weather forecasters do a much better job in predicting future weather events because of technological advances in weather-gathering appliances, such as Doppler radar, satellite imaging and computer generated storm predictions. Personally, I don't see any increase in accuracy of weather predicting. Most forecasters seem to be wrong at least 50 percent of the time. I think the difference the newer technology makes is in the timing, WHEN the weather event will occur. Being better able to determine when a storm will hit allows us time to better prepare for the predicted event, resulting in lower property damages and, most importantly, lower death rates.

This time, weather advisories began coming

in days before the actual blizzard hit, which gave us ample time to insure that all of our emergency safeguards were in place. Just days before, I was at

each transmitter site, making sure that the generators were in proper working order, adequately fueled and tested. Building heaters were checked to insure that they would heat properly and turn on/off as needed. Water was turned off at the meter to insure that in the event of a heating failure, the water pipes would not freeze and burst, causing flooding to the interior of the transmitter building.

We were indeed fortunate in the fact that we experienced no power outages or damages to our properties during this storm, and all our Western New York stations remained on the air and problem-free for the duration of the storm and thereafter.

**WDCX-FM/WDCZ(AM) - Buffalo , WDCX(AM) /WLGZ – Rochester**

We don't have a lot to report on this month. Aside from the blizzard, it has been a rather quiet January. I recently had a modulator failure in one of the cubes in the WDCX(AM) Nautel ND-5. A simple swap of the spare module got us up and running full power in record time. We tend to lose one or two modules in this transmitter each year, mostly due to modulator failures, but aside from that, this Nautel tends to chug right along, problem-free.

Another issue I encountered this month is the loss of a couple of computer power supplies. One NexGen audio server, which runs the log for our HD-2 station, failed due to a power supply problem recently, which took that multicast off the air. I checked several local computer stores to see if I could obtain a replacement supply, but each one no longer sells or stocks computer supplies anymore. Aside from the mom and pop operations, there is no one in the Buffalo area that sells replacement parts for computers. All the big-time computer dealers have pulled up their tent stakes and moved on,



leaving us with the only option: online shopping.

In order to get the audio server back up and running, I pulled the supply out of another computer identical to the failed one and installed it in the server until I could obtain a replacement. I contacted our service representative at Tiger Direct, explained what we needed and put him on the search for a replacement power supply for a Dell Precision 380 computer. Several days later, Tiger Direct phoned to tell me that this computer's power supply was EOL, shortened for *end of life*! He was able to locate the

last of two supplies available for this computer, but at a cost of \$150 each. I can't believe that a five-year-old computer is already obsolete and parts are no longer available to keep it running! It's almost to the point that you buy two new computers, use one and save the other for parts.

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

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### The Motown Update

By  
Aaron McEachern  
Chief Engineer, CBC-Detroit

Hello from Detroit! We have been blessed with a new phone system! We just installed an Avaya IP Office 500, the same type of system recently installed in our Chicago operation. We also changed our PRI provider to Comcast.

For the installation, I used a Middle Atlantic 18RU wall-mount rack and squeezed it into our all-too-small telephone room. In the rack I mounted the Avaya phone system, two 48-port port patch panels and the Comcast equipment. I used four lines of 25-pair CAT3 cable to terminate at punch blocks near the existing house wiring.

Once the guys from the integrator, Convergence Solutions, were on site, we were able to quickly run the cross-connects, moving and installing one phone at a time. There was a little juggling of lines and phones as we did most of the installation during the day. We had to wait until night time to move essential lines, like the studio lines and reception desk. The next morning we cut over to the new PRI and ported the main and studio numbers over to the new service.

We did run into some problem with getting the analog lines to the studios for the Telos on-air phone systems. They lines did not indicate to the Telos if a caller dropped the call (õCPCö). This became a big problem when afternoon host Bob Dutko opened the phone lines to calls and callers called in and had to wait to get on the air. Some of the callers hung up, and instead of the Telos

recognizing that the calls had dropped, it showed a caller still on hold. When Bob put the line on the air, we heard what sounded like a dial tone, but at a lower pitch.



The other small problem we had is that about four hours after the cutover, Comcast for some unknown reason turned off our second PRI. The first PRI quickly got jammed with calls, which made outbound calls impossible.

I am really excited for some of the new features of the new phone system. For example the DID's to individual extensions and the emailing of voice mails also with the auto attendant.

Here in Detroit, we set a record for snowfall in the month of January. This has been the coldest and windiest January I can remember.

There have been many days with wind chill readings between -15 and -35. There has also been a lot of blowing snow.

Earlier this month I headed out to the WRDT(AM) day site in Monroe, Michigan. When I arrived at the site, the drive was plowed, but there was some blowing snow over the drive. I continued toward the building and found there was more snow on the drive than I realized! It was too late to stop and back up. I thought if I could just make it to the parking lot near the building, I would be fine. About 50 feet from the parking area I slid to the edge of the drive and was stuck fast. I headed to the building to get the shovel. When I returned to my car I started to



shovel it out only to break the shovel!

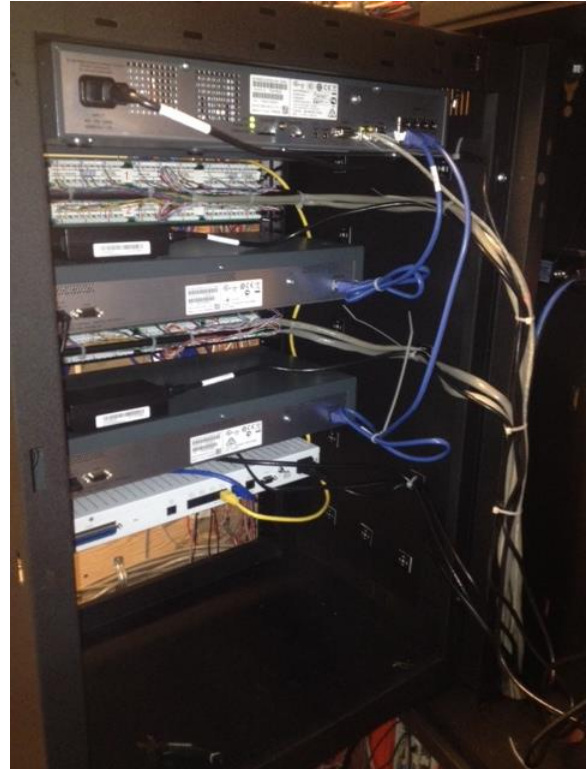
Frustrated as this was the fifth time I had been stuck this year, I got into the car and attempted to rock it out. In the middle of my attempt, I saw smoke coming from under the hood of my car and thought, oh great, what did I break now? Once I got to the hood latch of my car, flames started to come from the edge of the hood. At that time I ran to the building and called 911.



**New Avaya phone system**

Minutes later, the fire truck arrived but got stuck at the end of the drive. Firefighters ran from the truck with shovels and shoveled snow on the fire to help slow it down as they got the fire truck unstuck. By the time they were able to get water to the car it was a complete loss.

At this point, no one has come up with a reason for the car to catch fire, but I know from this point on if I get stuck, I will be calling a tow truck!



**Back of new phone system rack**



**Firefighters shovel snow onto Aaron's burning car**



**Not much left of what had been a nice, late model vehicle**

## News From The South

By  
**Stephen Poole, CBRE, CBNT, AMD**  
**Chief Engineer, CBC–Alabama**

Well, I'm sure by now you've seen news pictures of the Snowpocalypse that we're dealing with as I write this. We were caught flat-footed, because forecasters had insisted that Birmingham would only get a light dusting.

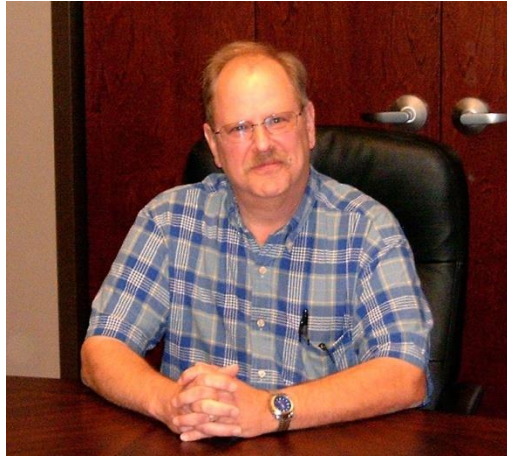
As a result, businesses and schools were on normal schedules. When the snow started falling and it became obvious that we were in trouble, panic set in. I'd be the first to admit that Alabamans (and Georgians – surely you've seen the news from Atlanta as well) don't know how to drive on icy roads. But the people who run the businesses and schools suddenly said, "Okay, we're letting everyone out early." *All at the same time.* Between 10AM and noon, tens of thousands of cars flooded the frozen roads.

As a result, the roads soon became overloaded as the snow continued to fall. Making matters worse was the fact that we were well below freezing. Normally, we'd be at or slightly above freezing when we get snow here. It'd land on the



**This picture of I-65 near the studios was taken by our own Jennifer Paepke.**

road and melt; at worst, you have to navigate through slush. The real danger doesn't come until that evening when the slush refreezes. But this time, the snow packed down and turned into ice. Chaos was the result.



Then, to add icing to the cake (heh), we started getting reports that the school buses were sliding off the road, so the schools *stopped running the buses!* Now we had panicked parents on the road trying to get their kids. More traffic, more confusion.

Best of all, because the forecasters had said that Birmingham and northward would be fine, ALDOT (transportation department) had sent the few salt and sand

trucks available to the south, where it was supposed to be much worse. So, there we were in Birmingham, tens of thousands of cars slipping and sliding on the roads, involved in too many accidents to count (at least four thousand is what I've heard thus far).

It didn't spare those of us who work for Crawford Broadcasting, either. Some of my coworkers were involved in accidents, mostly near the studios at 120 Summit Parkway. Thankfully, none were injured, but they had to leave their cars and walk back to the studios. This was repeated thousands of times over the next few hours, meaning that the roads everywhere are now filled with abandoned vehicles.

### **But Don't Laugh (Too Much)**

The national media has been having a field day, of course, with the usual jokes about inept Southern drivers. Since this feeds their prejudice that most Southerners are ignorant hicks, the *schadenfreude* has been thinly-veiled indeed. "Hah! Two inches?!? We get more than that in July here in Buffalo!!!"

Like I said, I won't argue that most people here can't drive on snow. And yeah, it was only a few inches. Just for the record, it was very frustrating to people like me, who do know how to drive in snow.



It took Sandy and me several hours to get home, not because I was slipping and sliding, but because I was constantly dodging disabled vehicles, accidents, closed roads and stalled trucks the entire time.

The truckers were the most surprising to me. When I was a kid, we called them the "knights of the road" and just assumed that, since they drove for a living, they were the best at it. They certainly weren't this time. If I had to point to one single thing that caused most of the trouble on the Interstates, it was that: truckers trying to climb the hills here in Alabama with heavy loads. They couldn't make it, and when they stopped dead in the road (or even worse, slid backwards and jackknifed), they blocked traffic for miles and miles behind them.

We just aren't set up to handle *any* amount of ice on the roads. Because it happens so rarely here, our standard emergency plan is simple: warn everyone to stay home, then close the roads until it passes over. This time, the warnings were issued too late and we got hammered.

Look at it this way. When barely-a-hurricane Sandy hit New England, it caused chaos that I'm just being honest I surprised some of us who routinely go through tropical storms every year. But that's your lesson: because the Northeast wasn't prepared for it, it hammered them. In the same way, we get hammered by snow. Such is life and that's how it goes.

It's a matter of what you've prepared for. Just as my prayers and support have gone to those who suffered as a result of Superstorm Sandy, I hope you'll pray for and support us here.

And here's one thing I'm not laughing at: our staff. As usual, they did a heroic job during the storm, working around the clock to hook people up with help, food, shelter and more. From Laura Scotti through Leland Whaley and AJ through Michael Hart to Mike Harvard, Roxanne and the rest of the gang, they did their usual splendid job. I was stranded at home, but my assistants did a splendid job, too. Todd was able to keep an eye on the studios, and Jimmy made it to Cullman to check on WYDE-FM. I'm proud to work with such a group of professionals.

### More Thieves

I often joke that if the scientists don't hurry up and fix this Global Warming thing, we're likely to freeze to death. In the same vein, this "economic recovery" that we're "enjoying" has caused a notable increase of crime around here. Frustrated kids who can't find work are back to stealing copper whenever and wherever they can find it.

In a previous issue, I mentioned that

Alabama had finally passed a law that limited who could accept scrap copper and in what amounts. Apparently, with continued economic malaise, unscrupulous dealers have popped up around here who'll take the copper, no questions asked. I guess they've figured out a way to "launder" it, probably by just shipping it across the state lines and scrapping it in bulk there.

At any rate, this most recent incident was very worrying, because the morons broke into the transmitter building at 850 AM in Tarrant. The alarm apparently scared them off while they were trying to grab as much free copper as they could find. They abandoned it outside of the building. Thankfully, all we were left with was a good bit of cleanup and repair.



**The thieves broke in through the emergency vent at 850 AM.**

They also cut the phone line, pulling ATT's multi-pair cable out of the ground entirely. We scheduled ATT to come fix it, but of course, the snow storm and traffic problems have delayed that. Eventually, we'll get our Dragonwave microwave link in place (more on that in a moment), at which point, we'll go VOIP and tell ATT, "Ta-ta!" for good. Until that time, though, we need that phone line.

### Dragonwave Woes

Now for the Dragonwaves. These units, and the Tringos that we've also used, are great. They allow you to ferry many megabits of data on a protected frequency between different sites. They're reliable. But if you have a problem with them, abandon hope: these people have apparently never heard of customer service.

Or perhaps they realize that they're the only ones doing it at present. I guess they don't realize that

if other vendors come along who do understand how to treat a customer, they will quickly go out of business.

The Dragonwave Horizon Compact microwave radio for Tarrant (just mentioned) failed while we were installing it. We called Dragonwave support; once they finally called back, they walked Todd through some steps to check the unit. In the end, it had to go back to them. We've been without it for weeks, with no ETA being given.

We decided to do the 6 GHz data link between WDJC-FM's transmitter site on Red Mountain and the WYDE-FM site in Cullman. I've mentioned this one here in the past: this is the job that will require a "two hop," with a relay tower near Warrior, AL.

To start with, it took forever to get the radios. Once we finally received them, we started programming them while our tower crew began building and mounting the big eight foot dishes. Then the problems started (again).

We like to run our Dragonwave radios with the management "piggy backed" onto the data port ("in-band management"). Because of very long cable runs, we opted for fiber on these units. While we

were trying to set them up, Todd noticed that he simply couldn't get the fiber to work. He then thought he had it working, and made the switch-over to "in-band management." That's when the unit stopped working altogether.

As suggested, we downloaded Dragonwave's "Merlin" software to try to reset the units. Once we did that, the optical ports appeared to go dark for good. After repeated calls to Dragonwave support, they finally contacted us after several days. "Oh, sorry." Turns out that, first, resetting the unit does *not* restore the management port. But even better, and second, *resetting the unit will kill the optical port.*

What!?? The units must be returned to Dragonwave and heaven only knows when we'll get them back. I have to finish up with this: Keith Bergstrom at 3dB Networks in Colorado has been a blessing through all of this. I think poor Keith has been just as frustrated as us. He's been calling Dragonwave and screaming at them. Thanks, Keith!

Until next time, may we not get snow again in the South for a while, and keep praying for this nation!



### Valley Notes

By  
**Steve Minshall**  
Chief Engineer, KCBC

This month's highlight at KCBC was tower maintenance. We were due for a beacon bulb change on the three towers. The lamps needed to be changed but what was more of a concern to me was one guy anchor.

The anchors on these towers utilize a rather slim galvanized rod that enters the ground and terminates at a concrete block about 5 feet below the surface. These towers were built in 1987 and I have seen three other tower anchors, of similar design, fail due to corrosion. Of the failed towers one was an FM, one an STL, and one an AM. These failures were all on towers from the same company as ours and built around the same time.

We have one anchor that is located in wet ground. The ground stays wet all year because it is located near an irrigation drainage ditch. My mind was working overtime on the possibility that this

anchor rod could be rusting through.

When the contractors came to change the lights they brought their own backhoe and unearthed the anchor rod. They inspected the rod from top to bottom. Fortunately they found it to be in nearly perfect condition. They cleaned it and applied cold galvanizing. To complete the inspection they replaced and compacted the soil.

The site has nine anchor points so doing an inspection on one is not a full inspection, but since this anchor is in good shape I am confident that the others are also. The inspection was relatively inexpensive since the crew was scheduled to be on site already. This is the first inspection that I have done that went all the way down to the concrete block. It is nice to have peace of mind about the anchors.



## Mainland Memoirs

By  
Bill Agresta  
Chief Engineer, KBRT

Greetings from Oak Flat! I trust you are all enjoying this New Year that God has given us and looking forward to the great things He has in store for each of us. The KBRT operation continues to move forward with the new transmitter facility working very well while finding a little this or that each week as we fine tune it to perfection.

One of the issues that I was very glad to finally be able to complete the repair of is our tower beacon monitor system. I know I discussed this last month but, to my surprise, we were still not out of the woods. We started out with a system that communicated, or at least tried to, with our Burk remote control via a part-15 wireless link. After many false alarms, Cris and I realized it was time for something a lot more robust and reliable. We went with a Slatercom monitor system with a fiber optic link. This allowed us to get the signal off the towers without making electrical contact and the system seemed quite simple, effective and reliable.

Unfortunately one of the systems, the one on tower #3, did not want to cooperate. It began to give us false alarms in cold weather and we were unable to adjust it to bring it back within spec. It wasn't the fiber optic link; the trouble was with the beacon current monitor module on the tower. We called Al Slater at Slatercom and he sent us out some new sense resistors. After some back and forth (or should I say up and down since this is a radio tower we are talking about here), we realized these resistors still were not bringing us to where we needed to be.

I got back on the phone with Al for another try, and this time a new module was sent out. I installed it, a few zaps on my hand here and there since this was done during a Santa Ana wind storm, and the new module worked great. Al got the preset calibration set perfectly from the voltage and current measurements I provided him with, and I was very impressed. It worked perfectly for a few weeks, but then all of a sudden, it was back to false alarms, but this time the alarm was present even during the day

with the lights off. The monitor module LEDs showed all was well, but the output alarm contacts had a short across them.



I could have easily become quite frustrated by this point, but hey, in what other kind of job would I get to climb onto a radio tower in the cold wind, at night, get zapped with static and low-power RF, and come down with my hands smelling like burning skin? Seriously, it was at the point it sort of became a bit comical to me.

Well, another call in to Al Slater and he decided to send me out a couple IC chips. This made sense because the day before that module died I had gone into the control box on that tower and it was during some very dry winds, so I figured the old IC got zapped by static electricity.

The ICs arrived in an envelope, and the postman must have run over it because the pins were all smashed flat. I managed to straighten them out and installed one of the chips. That was a big fail. We still had a short on the alarm contacts.

The following night I brought someone up with me to hold the flashlight as I hung off the tower with one hand and worked with the other. The failure was my fault this time - one of the legs of the replacement IC was weak and bent underneath when I pushed it in on the night prior and I was unable to see it under the poor lighting I had at the time. This time I used a pair of very small needle-nose pliers to push the weak leg in first, then I pushed in each of the others. Hurray! Success!

I wish people would use a firm piece of foam to put ICs into when they send them but, I guess this is not a perfect world. My thanks to Al Slater for putting up with me through all of this. Together we got it figured out and done, and I'm hoping it will run for a very long time now.

We finally installed an 8x10 storage unit up at the transmitter site, really a steel shipping container of the type you see on container ships and running up and down the highway on semis with flatbed trailers. With the help of our good neighbor

and friend Larry Booth, operations manager Todd Stickler and I poured the concrete piers and hired a crane set the container onto the concrete pilings. This is a very welcome addition to our new site as we acquire and move in tools and equipment for our ongoing site maintenance tasks there such as weed abatement, road maintenance, erosion control etc.

Thanks to Bob Tracy, a friend and supporter of KBRT from Catalina Island, one who was also a huge help during our move off that island, for donating the steel shelving units that we installed in

this new storage unit. Now that everything is organized and tidy, I am able to work a lot more efficiently.

All in all, that new site has been a major blessing to us all at KBRT. It has allowed us to better utilize resources and manpower and to run the KBRT operation with increasing excellence.

Until next month, the Lord bless you and keep you; the Lord make his face shine upon you and be gracious to you; the Lord turn his face toward you and give you peace.

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### The Chicago Chronicles

By

Art Reis, CPBE, CBNT, AMD  
Chief Engineer, CBC–Chicago

#### DigiCart/EX as Emergency “On-Call” Audio Source

We recently acquired a new 360 Systems DigiCart/EX as an emergency local audio source for our WYRB Rockford/DeKalb transmitter site. With the distance from the studio to that site being long enough that microwave STL isn't practical, we had to rely on not one but two T-1 circuits to operate as main/alternate-main audio paths to the site. But then we discovered the hard way that there is a considerable distance where both T-1s are in the same fiber optic cable. Read that as, one case of backhoe/trencher fade works to kill both. In some cases that phenomenon also takes out the ISDN feed we would normally use as the emergency backup. Of course, it's happened. That's always a day which will live in infamy, hence the need for a truly local backup at the transmitter site.

Having dealt with the DigiCart/EX while preparing it for deployment, James Kelly and I learned a lot about it, starting with this: it is a marvelous box for the purposes for which it is intended. What we needed to do was to figure out how to make it work for *our* intended purpose. As you might guess, James especially was burning up the phone lines to the folks at 360, and while they have been truly helpful, they're quick to point out that there are some limitations to the DigiCart/EX's functions. That was the genesis of this article.

For a sense of perspective, we know of no piece of equipment out there which will do exactly what we wanted it to do *in this application* (hint to

you broadcast equipment designers out there): that is, sit out at a transmitter site, be loaded with audio files from a remote location, have the ability to *delete* audio files from the remote location at will, and be configured to allow songs to be played in whatever order is desired, complete with EOMs in place and trims intact from the station automation system, and with the song order indicated by a playlist which is either sent remotely from the studios or sneaker-netted to the box at the site.

Alternatively, loading the DigiCart/EX by sneaker-netting audio files recorded on an SD card would be desirable. We tried that. An early plan was to produce a whole passel of audio cuts on an SD card recorder in either a PC or a Mac, then load them into the DigiCart/EX through the front panel SD card slot. Now that would be way cool.



That led to the next thing we discovered: the SD card format on the DigiCart has a formatting scheme which is quite different from the formatting scheme on either the PC or the Mac (and, to be fair to 360 Systems, the formatting setup on those latter two



platforms don't agree, either). Put an SD card which has been recorded on from any other type of machine into a DigiCart/EX and the first thing it will do is ask if you want to format it to its standard. Don't freak out. Just answer no because saying yes tends to mess up a whole lot of work, which *will* cause you to freak out. So, forget 'sneaker-netting' via the SD card as an option. Before you ask, the use of USB flash drives for 'sneaker-netting' in this application doesn't work either.

So, there are three choices left. The first is to acquire a second DigiCart/EX and use it with a Virtual Private Network (VPN) using the CAT-5-style IP connections in the back of the unit, through the T-1 circuits, from end to end. Of course it can be done, and that's how 360 Systems envisioned the system when they designed it, I'm sure. But please understand that the DigiCart/EX is not cheap, and in the near term, we're not ready to acquire another one 't yet. Besides, I like the challenge of a creative solution in a situation like this.

The next alternative: 'sneaker-netting' the DigiCart/EX itself back and forth between transmitter and studio site to update its audio files on, say, a bi-monthly basis or whenever. The disadvantage to this option is easily understood. Murphy's Law dictates that, during the time the unit is back updating at the mother ship, the transmitter site is running naked audio-wise, and the T-1s will often pick just that time to die. It isn't worth the risk of a total-off air situation in case some backhoe operator gets overly frisky right at that time! or Julie (or Miss Dig or whoever that utility locating clearinghouse is calling itself these days with its new 811 number) gets it wrong 't which happens. I've seen it 't here. Not to mention, the costs attendant to travel time and monetary allowance, plus the slight risk of damage to the unit itself, makes it not a particularly wise option in my book.

The final option left is to operate in what might be called 'file transfer' mode. We've tested this mode extensively here in house, and believe me, it works. In our case, we are commandeering a very non-fancy but serviceable Dell Optiplex 320 PC for the task of receiving files from the studios (we picked the computer we wanted from the office of a fellow employee, by bribing her with a brand new replacement workstation). The new computer should be here by the time you read this. For the studio side, we've reassigned another computer already within our NexGen system as the VPN machine. Thus programming will be able to pick the songs desired from NexGen, and modified for the right audio format to work in the DigiCart/EX. The files are then

sent to the transfer folder on the hard drive of the studio computer and sent to the new computer at the WYRB transmitter site. Most of you already know the drill. The DigiCart/EX is configured to point to its partner computer, looking for those new audio files. When new material (songs, image liners, PSAs, whatever) appears in the VPN machine's hard drive, the DigiCart/EX will copy the file into itself, assign it a number in its own system, and it's ready to go.

Remote control starting and stopping of the DigiCart (from a local audio loss relay within our STL) is easily accomplished. The audio loss alarm on the RDL ACL 3 which is used for loss of audio detection has its output state normally held high, going to and staying low when the audio dies. The DigiCart/EX wants to see *pulses* at its control inputs (and two of them for stop, which is why we use the pause function instead). The solution here is the RDL LCR-3, which is precisely designed to operate in those circumstances, at the leading and trailing edges of a long pulse.

That leaves the question of how to load playlist into the DigiCart/EX. Obviously, the DigiCart/EX has to have an idea of the order in which the audio cuts are to be played, so a playlist, loaded in the machine is mandatory (duh!). However, the protocol for loading playlists (which are merely text files, created in Notepad) is a whole different procedure from loading cuts, and not as easy to do. Also, a new playlist must be created to handle any changes made in audio cut inventory. On this issue, we are stymied for the moment, since the DigiCart/EX seems to only want playlists loaded locally. If and when we crack the secret of doing the procedure remotely, we will let you know how it's done. For now, as the playlist changes, it is 'sneaker-netted' to the Kirkland site on the next maintenance day. This part is still a work in progress.

I have a few suggestions for the nice folks at 360 Systems, who have really been helpful to us during this whole process: It might behoove them to develop an accessory software package for such a purpose as this, to be sold as an accessory or add-on.

Such a package would do the following, at the least: first, add GUI or AUI to the DigiCart/EX for remote site operation, so that the files within and the operation of the DigiCart/EX can be viewed directly, via Ethernet. Many broadcast-oriented products have that ability, and let's face it: inclusion of a GUI makes any widget's usefulness far greater than anyone would have imagined before said AUI/GUI was added. What if everybody did it? Well, almost everybody *is* doing it. What a blessing! The DigiCart/EX should benefit from such an accessory,

too.

Second, there should be an available software option to allow for the unit to enter play mode whenever a certain pin on the remote control is brought low, and to also provide the option for the unit to either pause or stop when that input goes high again. That option would be configurable in setup, and eliminate the outboard solution. This control pin would be separate from the normal play and pause or stop pins. There are unused pins on the remote connector now which may be available for the purpose.

Finally, I would suggest the idea of adding into software the ability to upload playlists remotely, without having to resort to "sneaker-net" mode. Passing the playlists through the remote site computer, as is already doable with audio cuts, is just fine. While this would possibly eliminate the need to have a second DigiCart/EX in the studio for the

purpose, it might be offset for higher demand from folks who want or need the ability to originate an emergency backup audio from the within a transmitter site, but who can't afford to buy that second DigiCart/EX. And remember, in my business plan, the remote site option would be available at additional cost.

One of the signs of genius is the ability to determine what it is that the market really wants well before the market knows it wants it. Steve Jobs had that ability. I don't, but maybe such an idea as this may have an appeal to more than a few of us broadcasters. We won't know until we try.

Next month, I'll let you in on a quick solution to a very nasty problem: how to quickly figure out the loss of both of those T-1 lines that I mentioned earlier and get the telco service folks out there soonest.

Until next month, blessings!

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## The Portland Report

By

John White, CBRE

Chief Engineer, CBC-Portland

At the end of last month's column we had nearly finished with the alignment and calibration of the vintage WX2 field intensity meter. This month we will talk about how to inject a test signal for receiver alignment and how to create a calibration reference field for final calibration. In the process we will learn more from Professor Terman.

Previously we looked at the Figure 4b in which Professor Terman showed inserting a test signal in series with the antenna. We now will turn to Figure 4a, in which "the signal generator voltage can be introduced into the receiver loop by use of a known mutual inductance." That's how we inject the RF signal for alignment. I used the antenna shown in Figure 5 next

to the WX2 antenna for comparison. It's actually a receive antenna for a Stoddart NM20B field intensity meter that I used for this project. Note Figure 5 shows the two loop antennas side by side for comparison. This is not the actual orientation when they are used for alignment or calibration.

For alignment, simply hold the primary coil

or antenna face to face close to the WX2 antenna as shown Figure 4a. We don't care about absolute levels during alignment; we only need to adjust levels to keep the WX2 meter on scale.

The design of the WX2 includes some attention to detail. Looking at Figure 6, the RF input, we had previously adjusted the RF input parallel

resonant network L2 and C1.

The inductor, L2, was adjusted to the highest meter reading at 540 kHz and C1 was adjusted at 1,600 kHz. Note: insure both the A and B battery voltages are within the green on the instrument meter for all tests and adjustments.

Now look closely at Figure 6. Note capacitor  $C_s$ , which is the stray capacitance associated with the coaxial cable

connecting to the RF amplifier grid. Even though the cable is low capacity cable, this stray is significant. In the 100  $\mu$ V, 1 and 10 mV positions,  $C_s$  appears as a capacitance to ground at the input to the attenuator assembly. The capacitance  $C_s$ , in series with C3, appears in parallel with the RF input parallel resonant network L2 and C1. Initially, C1 was adjusted with



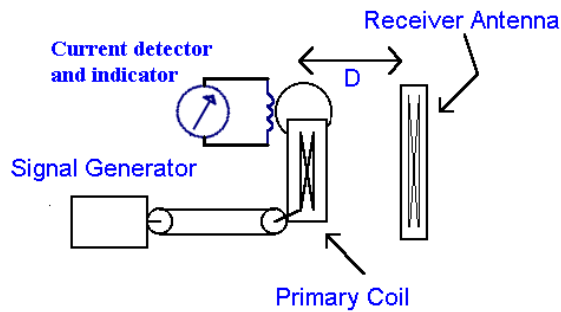


Figure 4a – Introducing a voltage into a loop

$C_s$  present, which eliminated the stray as an issue. However, notice from Figure 6 what happens when the range switch is changed to the 100 mV or higher position.  $C_s$  is no longer in parallel with the attenuator input.



Figure 5 - Loop antenna test arrangement

Granted, the resulting error would be small and only at the high end of the frequency range. However, the degree of attention to detail with the WX2 is apparent. Notice  $C_4$ , which is switched in place of  $C_s$  at the 100 mV and higher positions. The adjustment procedure for  $C_4$  is simple.

First, with the range switch in the 10 mV position, check the RF input stage. Parallel resonant  $L_2$  and  $C_1$  is peaked by adjusting  $C_1$  at 1,600 kHz.

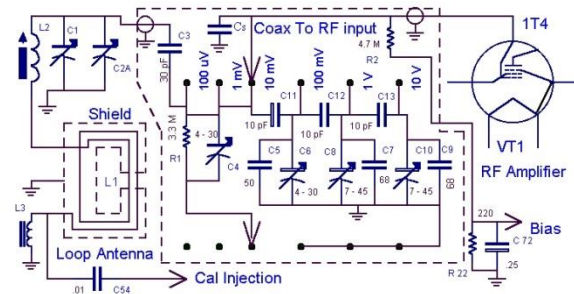


Figure 6 - WX2 RF section

Look at last month's column for details on this step. Once the alignment is correct at 1,600 kHz, switch to the 100 mV range. Now while still at 1,600 kHz, adjust the signal generator output to bring readings on scale and, making no other changes, adjust  $C_4$  for a peak on the WX2 meter. This will adjust  $C_4$  to compensate exactly for stray  $C_s$  that is no longer present.

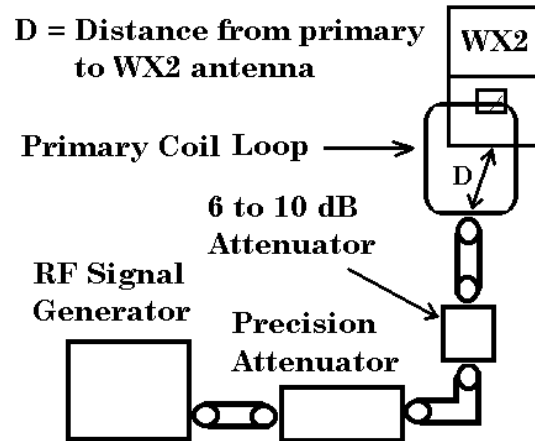


Figure 7 - Test equipment setup

The final remaining alignment task is setting the proper attenuation at the 100 mV, 1V and 10V positions. Assemble the test equipment as shown in Figure 7. A few comments about this arrangement are in order. Precision is needed for the ratio of the unattenuated 10 mV to the 100 mV, 1V and 10V positions. The antenna spacing  $D$  and the generator output are not critical so long as they remain unchanged.

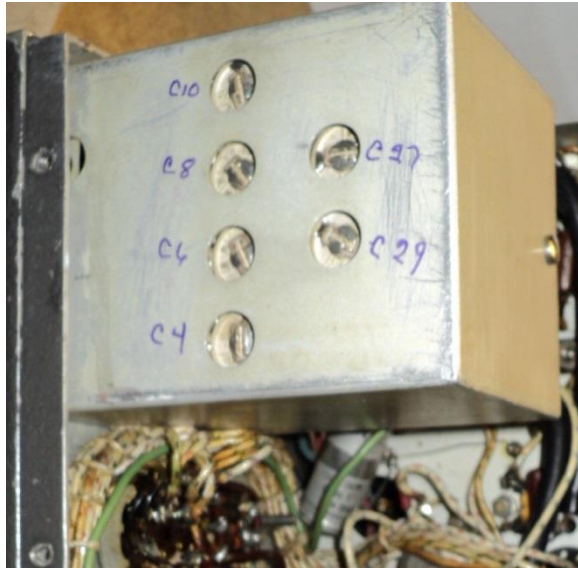
What isn't obvious is that the primary coil loop is unlikely to present a precise 50-ohm load. When presented with an inaccurate termination, a precision attenuator isn't accurate, that is. The inclusion of the 6 to 10 dB pad eliminates that difficulty as the input impedance to the pad will normalize the load impedance presented to the precision attenuator to 50 ohms.

As the alignment of the range attenuators proceeds, prior to adjustment the 100 mV, 1V, and 10V ranges the readings should be very close unless a component is defective, has been replaced or the instrument was previously misadjusted. If not then the test equipment configuration is suspect.

Once the test equipment is connected, proceed as follows: Set the calibrated step attenuator to 60 dB total attenuation. Set the WX2 receiver and



generator frequencies to 1,600 KHz and the WX2 range switch to 10 mV. Adjust the generator amplitude, antenna spacing D, and the WX2 gain to full scale deflection (10) on the instrument meter.



**Figure 8 - WX2 attenuator box**

Next, with no other changes, set the range switch to 100 mV. The reading should be at or very near to 1 on the meter. Now set the attenuator to 40 dB (20 dB less). The meter reading should now return to full scale deflection of 10. If not, then carefully adjust C6 to a reading of exactly 10. Figure 8 shows the location of each of the trimmer capacitors in the attenuator compartment. The remaining range attenuator steps are adjusted in the same way as shown in Table 1. The adjustments must be made in the order shown in the table. We have now completed alignment with only one critical step remaining: calibration.

Range	Attenuator	Adjust	Adjust to
10 mV	60 dB	RF output, WX2 gain, Spacing	Meter = 10
100 mV	40 dB	C6 (see Fig 6)	Meter = 10
1 V	20 dB	C8	Meter = 10
10 V	0 dB	C10	Meter = 10

**Table 1. RF attenuator adjustment chart**

Here is a good point to take a moment with a point that is confusing. Throughout this discussion I have described placing the primary and receive loop antennas face to face. On its face, (no pun intended), this would seem to be a contradiction since field measurements are made in the field when placing the

meter antenna face 90 degrees to the direction of the transmitter. A key to understanding here is that these field measurements are far field. Our test and receiver antenna are in conditions that are so close to near field they are downright intimate. A quick review of Professor Terman's text finds a reference to coupling via mutual inductance suggesting the arrangement has characteristics similar to an RF transformer.

Once alignment is complete, final calibration is one single simple adjustment and, at the same time, the most complex part of the procedure.

$$e = \frac{18.85 N_p r_p^2}{d^3} \frac{E}{X_p} \quad [42]$$

Where:

**e** = Field Intensity, microvolts-per-meter

**N<sub>p</sub>** = Number of turns

**r<sub>p</sub>** = Radius of coil. Cm

**d** = Distance in meters

**E** = Signal generator applied voltage, millivolts

**X<sub>p</sub>** = Reactance of coil L

The question to be answered is, how do we create an accurate reference field intensity for the meter calibration?

With a known reference field intensity, the gain of the receiver can be adjusted correctly. For this we once again consult Professor Terman and the mutual inductance method he has shown in Figure 4a. Terman states that the field intensity at the receive loop antenna can be calculated using Equation 42.

The formula looks complicated but actually it is quite simple. Notice the formula contains three variables that are very stable or easily determined: the number of turns N, the radius of the coil (loop), and the distance or spacing between the primary loop and the receiver loop antenna. So, how many turns, how big, and how close all effect the reference field intensity.

In the text, Professor Terman makes an important requirement that the reactance of the primary inductor is at least three times the internal reactance, R<sub>p</sub>, of the signal generator. Since the signal generator internal impedance is in series with the loop reactance, the generator becomes a factor in the primary loop current, and a source of error. The fourth variable term in the formula, E / X<sub>p</sub>, looks very much like a current term, and as we shall see it is.

$$E = \frac{(47.15 \text{ N d}^2 \text{ l})}{D^3} \quad (3)$$

Where:

$E$  = electric field intensity in volts-per-meter at the center of the receiving loop.

N = number of turns in the transmitting loop.

$d$  = diameter of transmitting loop, in meters.

$I = RF$ , current flowing in the transmitting loop, in amperes.

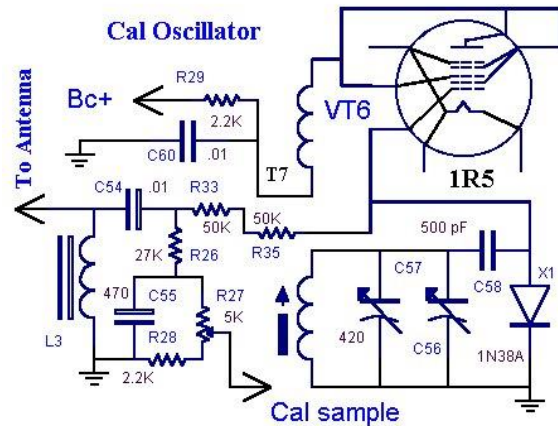
D = hypotenuse distance "h" from the periphery of the transmitting loop winding to the center of the receiving loop at the axis in meters.

Solar Electronics, a manufacturer of EMI susceptibility test equipment, uses the modified formula shown in Equation 3. Using somewhat different units and a different expression for the separation distance, this equation calculates generated field intensity as a function of the current impressed on a loop and the current  $I$  replaces the  $E / X_p$  term. Primary loop current can be controlled and measured reliably and accurately, which improves the accuracy of the test and calibration field intensity. This is shown as the RF current indicator  $I$  added to Figure 4a.

I have a Tektronix CT2 current sampling transformer and a P6021A current probe available, which can be calibrated to perform a precision loop current measurement. With careful attention to the primary coil characteristics, spacing, and current, a highly accurate calibration field can be generated. I may do so in the future. Nevertheless, this project was originally to restore a historic broadcast industry instrument to proper functioning order. In order to simplify the calibration process, I used a modern Potomac FIM to calibrate my reference field.

I carefully calibrated my reference instrument at 1,070 KHz (mid-band). Either a FIM-21 or FIM-41 can be used for reference. Place the reference instrument in a fixed location. Mount the primary coil in a location approximately 1 meter from the FIM. Adjust the spacing and generator power to produce a convenient FIM reading. 1 V/m is a convenient reference, although any reasonable level will suffice. Now that the reference level is set, place the WX2 in the exact same location as the FIM. Carefully tune the WX2 to the test signal in the FI switch position, and set the range switch to the proper range. The meter should indicate up scale and similar to your chosen reference field intensity. Next adjust the WX2 front panel gain to indicate the reading from the reference FIM, 1 V/m in my example.

At this point, the WX2 receiver gain is set correctly, the calibration is nearly complete and it's time to make the calibration adjustment. Turn off the signal generator prior to making the final adjustment and make only the following changes: Turn the WX2 switch to cal and the range switch to 1 volt if it is not already. Adjust the cal oscillator frequency for maximum reading on the meter. The meter should be somewhere near mid-scale. If not then there is some



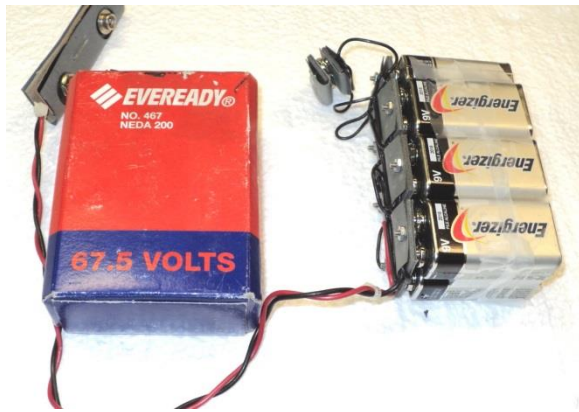
### Figure 9 - WX2 calibration oscillator

defect that must be corrected.

Once the cal oscillator is adjusted and the meter is on scale, change from the FI position to the OSC position. The meter reading should be on scale and near the same reading. Referring to Figure 9, locate R27, which controls the meter reading in the OSC position. Carefully adjust R27 so the meter reads the exactly the same in the FI and OSC. This calibrates the calibration oscillator reference to the correct value that reflects the proper gain setting for the receiver

My experience with the WX2 / 120E series of field strength meters found them to be the reliable instrument I remembered them to be. Probably the most difficult aspect to keeping one of these meters operating is obtaining the 67.5 V batteries that are no longer produced. The usual solution is a series stack of 9V batteries as shown in Figure 10.

Early on in this series of columns, I described early field intensity measurements via the substation method as a way to measure field intensity using a standard (reference) antenna and a receiver of unknown and nonlinear sensitivity over a range of frequencies. The WX2 solved many of the problems with that earlier method.



**Figure 10 - Using a 9V battery stack in place of the obsolete B battery**

Moving forward in time, the Potomac FIM-71 and FIM-72 instruments solved the unknown receiver sensitivity problem allowing a standard reference antenna to be used with an accurate receiver and a corresponding antenna correction factor table.

Most recently, the spectrum analyzer has been pressed into service as the tunable receiver measuring field intensity. Modern analyzers are computer-based, allowing the automatic compensation for sensitivity variations based on an internal correction factor versus frequency table. In these instruments, inclusion of an additional correction factor table for the standard antenna is

simple. This combination is very common in the EMI testing environment. The latest Potomac offering for MF and lower HF field intensity measurement is a more familiar example for broadcast engineers.

I would like to pull out the editorial soap box for a moment. Over the years, we all have come to rely on the Internet as a technical information resource. A search for nearly any technical subject will produce cornucopia of products.

I was speaking with a friend recently about forgetting the past. In this case, the comment was prompted by the observation that when I was in high school, I was required to take 16 quarters of US government, history of western civilization, US history, the US Constitution and more. My daughter in the same four years of high school had one two-week unit discussing US government / history which included almost nothing prior to the end of WWII. My friend observed the tendency to think of history only in the context of what we and our parents remember. Older history disappears.

The same is true for technical knowledge in which new knowledge is created while standing on the shoulders of those who went before. The Internet is both a blessing and a curse. As we become complacent, we are in danger of losing the knowledge contained in books that are gathering dust in disused libraries, waiting for disposal while forgetting the knowledge base upon which our modern technology is based.

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### **Rocky Mountain Ramblings The Denver Report**

by  
**Amanda Hopp, CBRE**  
Chief Engineer, CBC - Denver

#### **Wheatstone Blade Project**

We have in the budget this year to upgrade some of our production rooms and Nexgen infrastructure. For each of the production rooms, we will be getting Wheatstone E6 control surfaces as well as a mix engine and IP blade. This will provide the production rooms with a oboardo very similar to the G6 surfaces in the control rooms. It



will provide our producers with tremendous flexibility, all digital production rooms and no sound cards!

The small size of the 8-channel surfaces will really free up space in the rooms as we go from big analog Mackie mixers that takes the whole tabletop to the small Wheatstone surfaces that takes up about a third of the space.



We will also put some IP blades in the engineering room to replace the audio server sound cards and the outboard Broadcast Tools ADMS 44.22 switchers.



**Wheatstone E6 Control Surface**

I must admit I am excited with the fact that this will allow us to eventually replace most of our computers with pretty much whatever we want. Our existing audio servers and workstations use full-size HP tower computers that are coming up on eight years of service. They have been great and continue to run very well for their age. However, with Windows XP being phased out in every aspect, we need to move on to Windows 7 which means new computers.

This Wheatstone project is a bit daunting, though. It will require us setting up a new machine to run Wheatstone Navigator (control software) that will allow us to create the sources and destinations and make those audio connections needed to get each working.

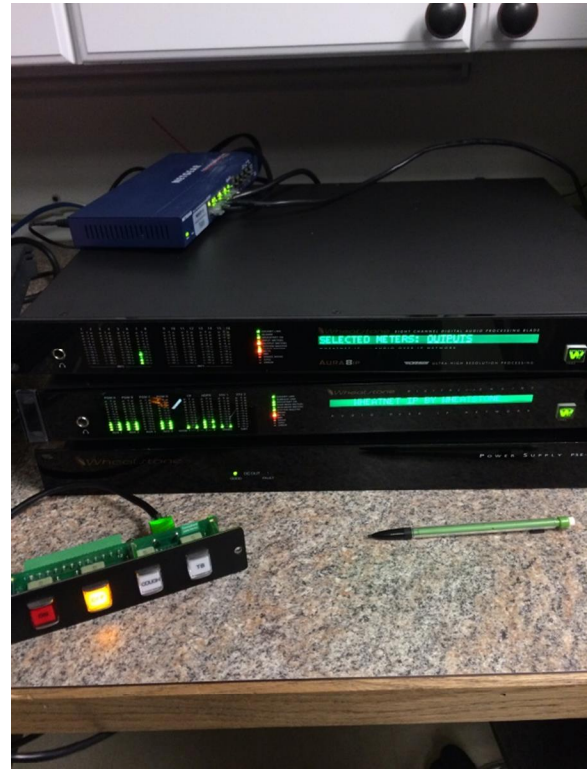
The new surfaces are a little smarter than our G6s. They come with an integral touchpad mouse and a VGA port for a monitor (all meters, indicators and setup controls are provided on an external monitor). I think we can make these surfaces start the coffee maker in the morning too!

### Satellite Shows

Having satellite capabilities really helps make a radio station, providing programming opportunities from a wide variety of sources. Now as we all know, some stations have lots of live local broadcasts. Here in Denver, KLZ relies on satellite-delivered programming for some parts of the broadcast day, from Laura Ingraham to Dave Ramsey, top-of-the-hour newscasts and so much

more.

We have two XDS receivers that we own and use for Cumulus Satellite, one XDS that is owned and provided by Premiere Networks, a Wegener iPump 6420 that we own for Dial Global/Westwood, and a couple of Wegener Unity 4000 receivers that we own and use for CRC (Christian Radio Consortium) programs. That's a lot. Of those, one is only used as a backup in case the other fails. These units are the heart of KLZ. They are what hold the station together. When one goes down, we lose programming. Without that



**Demo/test setup with gigabit switch, IP blade, mix engine, surface power supply and GP-4 cough/talkback panel**

programming we lose listeners.

I must say, it is getting difficult to find space for new programs. As some of you may know, Talk Radio Network is going through change, and many of the TRN programs we have aired for years have gone away or moved. For those that went away altogether, we have been working to find other programs to replace them. The trouble is, we are out of room in our backhaul infrastructure to bring in new shows. I know you are thinking but if you just replace those shows from TRN, wouldn't that give you room? Yes

it would, if we were bringing new shows from one of our existing receivers. The Intraplex unit we use for backhaul of satellite programs from the KLZ transmitter site (where all our satellite receivers are located) are full up. I have had to rearrange some things to get a couple new shows on the air.

### **Wireless Routers**

We have had complaints that both our CBC wireless and our Client Access wireless have been acting up. Some days, we were lucky to get 2 mbps download speed. This is ridiculous, especially since we have a 50 mbps Internet pipe in the facility. On a normal day the wireless connection should be 8-12 mbps.

Both wireless routers are approximately the same age, so I began wondering if they were failing. I purchased two new Trendnet wireless routers. I set both up and in my office things worked great. I plugged them in our engineering room and when I went to test, they no workie. I reset the units and reprogrammed them and they worked. But as soon as I would connect to a different network or disable/enable the wireless on my laptop and try to reconnect, it wouldn't work; I could not connect to either new router. I worked on this for several hours with no luck. We desperately needed our wireless working. Employees needed it and clients who do

live shows and rely on the connection for tweets and Facebook messages needed their wireless working too.

The next day, my dad decided to take both routers to work on the issue. He got them working. What we found was a Windows 7 issue (he was using XP). I am still not exactly sure what my computer was saving that was hosing things up. I disabled the wireless, deleted saved networks and for those two networks, it would not work. I could go home or go back to my office and connect with no issues. But the second I would reconnect to CBC wireless or Client Access, I got no Internet access. The whole thing was bizarre ó especially since my computer decided on its own to start working and I no longer have any issues connecting to any network!

### **Coming Up**

January has flown by. Where has the time gone? I am hoping to purchase a new Kubota tractor for our 115 acres of site maintenance before March. It will be nice to have a tractor that is new and should be very reliable. The wiring project at the KLZ transmitter site will happen eventually. We are going to take an afternoon soon to go out there and start planning it.

That about wraps up this edition so until next time! that's all folks!!!

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The Local Oscillator  
February 2014

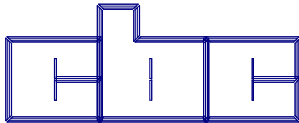
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**KBRT • Avalon - Los Angeles, CA**  
*740 kHz, 50 kW-D/0.2 kW-N, DA-1*  
**KCBC • Manteca - San Francisco, CA**  
*770 kHz, 50 kW-D/4.3 kW-N, DA-2*  
**KKPZ • Portland, OR**  
*1330 kHz, 5 kW-U, DA-1*  
**KLZ • Denver, CO**  
*560 kHz, 5 kW-U, DA-1*  
**KLDC • Brighton - Denver, CO**  
*1220 kHz, 660 W-D/11 W-N, ND*  
**KLTT • Commerce City - Denver, CO**  
*670 kHz, 50 kW-D/1.4 kW-N, DA-2*  
**KLVS • Denver, CO**  
*810 kHz, 2.2 kW-D/430 W-N, DA-2*  
**KSTL • St. Louis, MO**  
*690 kHz, 1 kW-D/18 W-N, ND*  
**WDCX • Rochester, NY**  
*990 kHz, 5 kW-D/2.5 kW-N, DA-2*  
**WDCX • Buffalo, NY**  
*99.5 MHz, 110 kW/195m AAT*  
**WDCZ • Buffalo, NY**  
*950 kHz, 5 kW-U, DA-1*  
**WDJC-FM • Birmingham, AL**  
*93.7 MHz, 100 kW/307m AAT*

**WEXL • Royal Oak - Detroit, MI**  
*1340 kHz, 1 kW-U, DA-D*  
**WLGZ-FM • Webster - Rochester, NY**  
*102.7 MHz, 6 kW/100m AAT*  
**WRDT • Monroe - Detroit, MI**  
*560 kHz, 500 W-D/14 W-N, DA-D*  
**WMUZ • Detroit, MI**  
*103.5 MHz, 50 kW/150m AAT*  
**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, 5 kW-D/41W-N, ND*  
**WYDE-FM • Cullman - Birmingham, AL**  
*101.1 MHz, 100 kW/410m AAT*  
**WXJC • Birmingham, AL**  
*850 kHz, 50 kW-D/1 kW-N, DA-2*  
**WXJC-FM • Cordova-Birmingham, AL**  
*92.5 MHz, 2.2 kW/167m AAT*

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