The Local Oscillator

The Newsletter of Crawford Broadcasting Company Corporate Engineering

JANUARY 2014 • VOLUME 24 • ISSUE 1 • W.C. ALEXANDER, CPBE, AMD, DRB EDITOR

A Year of Change

The past year was one of change in our company and the industry.

In February, KBRT left its Santa Catalina Island transmitter site of 60 years for a new state-of-the-art transmitter facility on the Southern California mainland. That represented much more than just a geographical move for the station. It included a shift in the coverage, with a stronger signal in many areas and a weaker signal in others. We have had to learn the new signal and coverage area along with our listeners.

We sold KJSL in St. Louis last September, a station we had owned for twenty years. It has not been often that CBC has sold a station (and to date, all the sales have been ñin the familyò), so this was a new experience for us.

In July we added a new ñoldò signal via a time brokerage agreement, bringing 50 kW WDCD(AM) in Albany back on the air with CBC programming.

Joe Huk, our Detroit chief engineer of several years, departed in the spring, and we brought Aaron McEachern aboard in his place in July.

We upgraded the WYRB(FM) transmitter facility with a new transmitter and new STL equipment, bringing that station up to the same level with our other Chicago facilities in terms of equipment and redundancy.

Throughout the company we continued the conversion from conventional 950 MHz analog and hybrid STL links to Part 101 licensed high-bandwidth microwave links, providing our facilities with full connectivity to the outside world.

In our industry, 2013 saw the implementation of new AM antenna protection rules that are all-encompassing and reasonable. This has changed everything in the way we deal with potential reradiators.

At the end of last year, the FCC opened an LPFM window in which thousands of applications were filed. Many new low-power FM signals will be on the air in the coming months as a result.

AM Radio gained an ally at the FCC in commissioner Ajit Pai. He has taken an active role as a supporter of broadcast radio and AM in particular, and as a result the FCC released a Notice of Proposed Rulemaking on AM Revitalization late last year, proposing several short- and long-term measures in what we hope will be the first of several such actions.

Throughout the year we saw Mission Abstract Data and its successors continue to pursue patent claims against users of computer-based broadcast automation systems, even after a couple of patent reviews significantly curtailed the claims.

As the year ended, another ñpatent troll,ò Wyncomm LLC, filed patent infringement lawsuits against several broadcasters claiming that HD Radio infringes on a wireline telephone technology patent.

Overall, it was a pretty good year for our company, especially on the technical front. We ended the year stronger and better than we started it, and we begin 2014 with some real momentum with upgrade plans and projects on the drawing board that will continue to strengthen our technical plants. I look forward to implementing new technology in some of our facilities, and my hope is that the new year is one of steady growth in terms of revenue and service.

Upcoming Projects

We have several projects on the books as we roll into 2014. One of those is the replacement of many of our old Burk ARC16 remote control systems with new ARC Plus Touch units. We have several ARC Plus units in service in Denver and at KBRT, but we have not yet installed any of the new touch screen units, so that will be a new experience for us. While our local engineers will no doubt enjoy the convenience and ease of operation of the touch screen interface, the bigger change is that these are

IP-based units, and wherever they are installed that has Ethernet connectivity back to the studio we will benefit from browser-based control, anywhere/anytime access from the outside world, and system programming from a dedicated application on any computer on the same subnet.

Later this month, Wheatstoneôs Jay Tyler will be in Denver to train Amanda and me on installation and use of the new IP Blade units we plan to install in Denver this winter. This is the first step in a long-term plan to equip all our large market clusters with this technology. We are starting in Denver because I want to thoroughly understand the technology and equipment before implementing it elsewhere.

Another project that I plan to participate in is the rewiring of the KLZ transmitter site. The site dates back to the early 1960s, starting out with a pair of RCA 5 kW transmitters that together with the phasor and CONELRAD filled the whole building. In the years since, the old tube rigs have been replaced with a couple of waves of modern solid-state equipment, and as gear has been changed out and added over the years (including adding an entire new frequency and directional array at the site), the remote control, audio and Ethernet wiring at the site has gotten rather messy.

Amanda has procured a cable ladder and associated hardware, and the plan is to eliminate the tangle of PVC conduits that crisscross the room and make all the inter-rack wiring using overhead cable ladders. All the remote control wiring will be redone and simplified using new multicable, and we will replace every piece of CAT5 cable in the facility. All of that will make for a good winter project, working snugly and warmly indoors while the snow flies outside. Did I mention that the KLZ site has a working bathroom?

AM Revitalization

Last month, CBC filed comments in response to the FCCôs AM Revitalization NPRM. If youôre interested in what we had to say, the link to the filed comments is http://apps.fcc.gov/ecfs/document/view?id=7520962075. The Readerôs Digest version is that we generally agree with the FCCôs proposals but have a few comments and additions.

The FCC proposed an AM-only translator filing window, and while we endorse that proposal, we also believe that major changes to existing translators should be accommodated in that window as well ï again, only for AM licensees. Our thinking is that there may be some existing translators out there that could work well for certain AM stations, and if those AM licensees could make major changes to those translators that would bring their contours within the 25-mile/2 mV circle that would result in ñpairingò with an AM station. That would likely eliminate some de novo applications and leave some spectrum available for others down the road.

We endorsed the FCCôs proposal as presented for a reduction in daytime principle community coverage requirements for incumbent AMs. We also agree with the FCCôs elimination of nighttime principle community coverage requirements for incumbents, but we offered a counterproposal for new stations ï 50% principle community coverage with the 50% interference-free contour. That would seem to be a good compromise that takes real world interference into account.

We endorsed elimination of the AM ñratchet rule,ò we supported the proposal for notice-only MDCL (no FCC authorization required), and we agreed with the FCCôs proposal to reduce minimum antenna efficiencies by 25%, all of which are helpful, good sense proposals.

In wrapping up our comments, we proposed several additional measures. One is to eliminate skywave service protection for class A stations. Who really needs it in 2014? Another is to provide some measure of interference protection for AM-linked FM translators. And finally, we proposed some measures to better regulate unintended radiation from power lines, compact fluorescent lights and other devices that produce ñhashò and raise the noise floor in the AM band.

It will be interesting to see what others have to say in response to the NPRM, and it will be interesting to see what the FCC does, both now and down the road. You can bet that we will be following the process closely.

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

Hello to all from Western New York! By the time this reaches press, we will have yet again ushered in another new year! My wish for all of you is that you enjoy health and happiness, and may 2014 be the year that you accomplish everything in your engineering to-do list!

We often start out the New Year with many well intentioned resolutions, many of which fall by the wayside by the first monthôs end (at least thatôs true for me). Each New Year, I vow to lose weight, eat healthier and exercise regularly, and by the end of February, I am 12 pounds lighter, tired from exercising, and can be found on a regular basis at McDonalds chowing down on Big Macs and apple turnovers! As for those New Yearsô resolutions to lose weight, hey, what was I thinking? My rationalization is that if the Lord wanted me skinny and fit, he would nave made me that way from the beginning, or, if I wasnôt fat, it would put all those Weight Watchers people out of work! And all of that new exercise equipment winds up down in the basement to be lawn sale fodder later in the year. Looking for a good deal on a slightly used treadmill or glider? See the fat guy over there by the fenceé

In all seriousness, though, this year I do vow to eat healthier and take better care of myself. As I get older, I find that things I could easily do ten years ago are not so easy anymore. That brisk five-minute walk around the block now takes 12 minutes with a five-minute breather mixed in. Heaven forbid should I run into my backyard neighbor in front of his house doing lawn work ï it may be weeks before I get back home!

Another area in which I prognosticate every year is continuing my education. We never get too old to learn, and in our business, if you donôt keep up with technology, you will get left behind! I think I do a pretty good job of keeping up with new engineering trends, but in doing so, I tend to forget many of the basics I learned years ago. I used to be quite skilled in repairing most all types of broadcast equipment, but it has been so long since I have performed a bench repair on a piece of equipment, I donôt know if my repair skills would hold up today. We used to troubleshoot and fix equipment. Now we simply replace the defective module or reload the software to fix the problem. Not too much thinking going on here ï ñplug and playò seems to be the new norm. I honestly can say that adjusting to the newer technology hasnôt been too toughé itôs the ñliking itò part that I tend to have a problem embracing. Want to hear some good stories on how engineering was done back in the day? See the fat guy over there by the fenceé .

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

We have been experiencing a lot of electrical issues as of late in our shared Rochester facility. Twice in the month of December, we lost a phase in our electrical service to the studios we share with DJR Broadcastingôs WLGZ-FM. Normally this would not be a problem, as the majority of the equipment, i.e. computers, servers et al, are connected to an uninterruptable power supply (UPS). The problem arises when the outages last longer than the UPS can hold the load and the batteries are drained down. We have several, smaller rack mounted UPS units in the engineering room which primarily protect the NexGen file server and the two audio servers, one for each station, and not much else. It would take a sizeable UPS to power all of the computers and support equipment, and there is not enough room in an already crowded space to install a larger UPS.

Each time we have these electrical issues, the NexGen computers end up shutting down and losing connection to the server, resulting in my talking someone through the procedure of getting everything back up and running again. We need to

take a good look at our present configuration and see what can be changed or moved to present an easier load to the current UPSes, so the run time can be maximized for any future lengthy outages.

New security gate at WDCZ

One other strange issue we had in December was that the WDCX(AM) transmitter went down in the early morning hours one day but the remote control failed to call anyone alerting us of the problem. Once I received the off-air call, I made the trek over to Rochester to troubleshoot the issue. I found that the Nautel Exporter Plus had locked up, which shut down the transmitter due to no drive. After a quick power reboot, everything came back up with normal readings. I am still at a loss as to why the remote control didn't dial out with the outage. I checked the programming in the Burk VRC-2500, and all of the information/numbers were there. The phone line checked out OK, so I simply cannot explain why the remote didn't call.

We had a similar issue here in Buffalo at the WDCX-FM transmitter site. On Saturday the 7th of December, the board op called and reported that there was no audio going over the air. The transmitter was on with normal readings, but no analog or digital audio could be heard. A quick check of the STL system ruled out any problem there at the studio, so the issue must be at the transmitter site. Upon arriving, I found the Nautel IBOC unit had locked up, cutting off all audio to the transmitter. I rebooted the Exporter Plus and all came back to life, with no issues to note. This is the first issue we have had with the Nautel NV-40 since it was installed over two years ago. Until now, the performance of the Nautel system has been rock solid.

The only incident I have to report on from the WDCZ transmitter site is the failure of the tower light beacon on tower 3. I called tower climber Don Boye to check out the beacon failure, and arranged for him to climb the tower and replace the beacon lamps if necessary. As Don is very familiar with this site, he suggested checking the tower light flasher before changing out the beacons. As luck would have it, he found that the output had burnt on the old motorized flasher, causing the beacon to go dark. I suggested to Don that we should replace the old Signatrol motorized flasher with a solid state unit. He agreed, and installed the replacement in a matter of minutes. We will eventually replace all five towers with solid state devices, as the old motorized flashers get near to the end of their life.

Also in December, we had a new security gate installed across the driveway into the WDCZ transmitter site, to help keep out any potential burglars or copper thieves from driving onto the property. As there is a sizeable ditch that runs the length of our property adjacent to the road, only a small portion of fencing needed to be installed between the driveway gate and road to keep people from driving around the gate to gain access. We do have neighbors who keep a good eye on the site for us, but they can't always be there to watch out for intruders. Hopefully the new gate will help deter any un-wanted traffic onto the site.

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!

News From The South

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

Merry Christmas and happy New Year! Sandy and I took a few vacation days over Christmas and just relaxed. Hope you and your loved ones had a blessed holiday and Iôm praying that 2014 will be the best year yet.

Tarrant STL Work

As usual, the 850 AM site in Tarrant has thrown us a curve. We have had a time scheduling a tower crew to get this project finished before the end of 2013. Once we finally found an available crew, we had trouble with the microwave radio, and with condensation inside the sealed NEMA box that we put together for the power supplies.

Figure 1 - Mounting the 11 GHz dish at 100 feet on tower #2

The plan was to do what our company has done at several other sites: we would use the Dragonwave for the main haul from the WDJC-FM site on Red Mountain, then use a little Nanobridge to get the signal from the base of tower #2 into the building. The Nanobridge worked like a champ (those little things are amazing, you know it?), but the Dragonwave was a different story.

Having learned (and having been burned) the hard way on previous installations, we thoroughly tested everything before we brought in the expensive tower crew. Todd had everything talking and communicating just fine; we could see through the Nanobridges into the Dragonwaves and could pass data from end to end ï on the ground. Once everything went onto the towers, we started having problems.

Figure 2 - Sealed NEMA box for the power supplies

The latest, and the one that has caused work to screech to a halt at Tarrant, is the Dragonwave radio, which refuses to pass any data. Todd has been dealing with Dragonwave support. Thereôs a way to

reset the radios by cycling the power several times very quickly, but that hasn't helped. That radio will need to go back to Dragonwave. Net result: it looks like we'll have to wait until early 2014 to declare the Tarrant to Red Mountain link finished.

Web Tracking

The remainder of this article will focus on something that I've been dealing with (rather personally) for the past several weeks: unwanted email messages. I'd like to share some background, then provides some tips to stop the SPAM in your inbox.

Incidentally, Hormel, which owns the trademark "Spam" for their tasty meat product, is actually amused by the use of that name for unwanted email. Provided you make it clear that you're not disparaging their mouth-watering Slab Of Salty Pork, they're okay with it.

Now, a little background. The whole concept behind this goes far beyond just email. The fact is, the entire time that you are online nowadays, you are being tracked. I've got an add-on called "Ghostery" for my Firefox web browser, and it's amazing to see how many web sites track where you've been and what you've viewed. *Even our own Zimbra website uses a Facebook Plugin tracker!* I didn't even know that... and Todd and I are the ones who built that mail server!

This tracking explains something that you've probably noticed: you will go to an appliance website to check out some washers and dryers. You're not ready to buy, you're just looking. But for the next several days as you browse elsewhere on the web, you'll keep seeing advertisements for washers and dryers. That's proof that you're being tracked.

See, when you went to that appliance website, it used a service like Google Analytics to record your visit. From that point on, Google provided advertising to other websites targeted to appliance purchases. This happens all the time and generally without your knowledge. As long as it's not too obtrusive, you probably won't care, either.

As I write this, many people are up in arms about Edward Snowden and his revelations that the NSA is tracking everything we do. I'm not going to get into the rights or wrongs of that. But I do find it ironic that some of the same people who complain loudly about the NSA won't say a word when Google, Yahoo and others are arguably just as invasive.

The So-Called Cloud

Next, we get to the so-called "Cloud," which is simply a lofty name for central servers located on the Internet. Instead of using Word on your personal computer and storing the documents locally, you can use a web-based editor and store it on that central server. It's awfully convenient: the document that you edit at home is instantly available at work and vice-versa.

You may say that you don't want your personal data stored elsewhere, but I have news for you: if you own a tablet or a Smartphone, you're already in the "Cloud." Information about every phone call, all of your contacts and all of your messages is stored. That's why your personal data can be restored when you upgrade to a new device: the central server simply downloads the already-stored information into the new gadget.

This has some implications for security. Our company maintains its own mail server primarily because we sometimes need to send proprietary information between markets. However, I honestly don't know how effective that is nowadays, because most of our employees have Smartphones... and as soon as they set up their Crawford mail account on that device, that data could be mined for information.

(If Edward Snowden is right, it IS being mined for information.)

I honestly don't know what the answer is for this, either. Like you, I depend on my Smartphone nowadays. I've got to have it. Cris or Laura might send me an important email while I'm at a transmitter site and I can reply right then and right there. All I can say is, just be aware of it.

Spam

And now we get to unwanted and unsolicited email. SPAM. I can provide some tips, specific to our Zimbra server, that might help.

We can divide SPAM into two general categories: the outright scams and unwanted advertising. The first is obvious, and the infamous "Nigerian Prince" scam is probably the best-known. "Dear Sir, I have zillions of dollars that I'd like to send you for free!"

Why do scammers even attempt stuff like this? Because sadly, it works. A scammer can send millions of emails for a few bucks and if he only gets *one single response* – or even just one response *per 100 attempts!* – he's made a huge profit.

You'd think everyone would know by now that if it sounds too good to be true, it's probably too true to be good, but not everyone has gotten the message. From time to time, you'll read in the news about some poor guy or gal who sent their banking information to one of these crooks.

The second type of SPAM is what Iôll focus on here. These are unwanted advertisements, typically for refinancing, pharmaceuticals and other products and services. Some of these are outright scams as well, but the email might actually be very slick-looking, with nice graphics and different fonts.

Hereôs the first tip: remember what I said about tracking? The fact is, spammers know how to track as well. If your email client is set to render in HTML and to display images (and most are, by default), a professional spammer can get immediate confirmation that your email address is valid. How? Look at the source for the email. Note how the images have names like ñdoodat.me/23423d223?DFd.jpg.ò That string of gibberish is unique for each address... and once your email client requests that image, their server can say, ñAh! Another valid email address.ò Then youôll really get hit with advertising. Combine this with web tracking and it really becomes invasive.

Once again, I donôt know what the answer is. Most of our employees are going to object (loudly) if we tell them that theyôll have to plow through plain-text email. Some email clients donôt even offer that option, or make it very difficult to find. Zimbraôs own web client and desktop software want to display images by default. So does my Android Smartphone.

Second tip: donôt use your Crawford Broadcasting email address for personal business. If you have to, create a separate Yahoo or GMail account for that. I know youôll be shocked to learn that some websites arenôt completely honest. You can check the ñdonôt send me special offersò buttons when you sign up, but theyôll do it anyway. (Heh. Imagine that.)

Third tip: donôt post your email address online. Iôve mentioned this before and itôs even more true nowadays than ever. For example, suppose you visit a forum online and chat with others about needlepoint or model trains. If your signature on that forum includes your email address, youôre fair game. The spammers use robot programs to scan the web. They can then send a test email to each address that they encounter, as mentioned above, with a unique image or some other marker embedded in the message. If their server gets a response, that email address goes onto the official Sucker List.

(I would love to tell you to avoid from websites that use your email address as the login name, but I realize that this just isnôt realistic. Too many of them do it. But I believe that my own current SPAM slam, which is running about 200 unwanted messages a day, came after the *Zimbra support forums* were hacked. I believe the spammers got my email address that way. Yes, taste the irony...)

Fourth tip: youôre really not going to like this, but if youôre only going to be out of work for a day or two, donôt use the Autoreply to send an ñout of officeò message. Why? Because spammers love the things. They donôt even need the embedded images to determine if your email address is valid. As soon as they get that Autoreply, theyôve confirmed that youôre legit. You go on the spam list.

Iôve stopped using Autoreply. This means that I have to answer some emails while Iôm on vacation, but in return, Iôve at least slowed down the rate at which I get spammed.

Quasi-Legitimate Spammers

Youôve seen these: dozens and dozens of emails, all advertising the same thing (for example, E-Cigarettes or health plans). Each email looks almost identical, but closer inspection shows that the sender and domain names differ. In fact, the domain names might look like nonsense, such as ñ123.doodat.meò or ñxjy1.gibberish.us.ò

Remember what I said about email costing almost nothing to use? Sadly, thatôs even true of registering domain names. Itôs very inexpensive now (if youôre spending more than a few bucks for each domain name, youôre getting ripped off). Therefore, our spam filter canôt simply note the names or domains of spammers and block them, because the spammers do this nowadays:

1. Register a domain name. This can be automated, with an automatically-generated name like, ñmail.asdfasdf34.tv.ò
2. Send out a bunch of email using that domain.
3. Once the spam starts getting blocked, simply switch to a new domain name and start over. Move the servers around. Change the physical address in the contact info. Whatever. Rinse, repeat, wipe hands on pants, ad infinitum.

This is the key reason why everyone (not just us!) is having trouble with SPAM nowadays. Not only does a lot of it look quite legitimate to an automated SPAM blocker, the things that give SPAM away can easily be changed. For example, for a while, I added a negative score to any email that included the word ñunsubscribe.ò The spammers simply change this to, ñif you no longer wish to hear from us, click here.ò If you block that, theyôll just

reword it again. Now, consider that even legitimate websites include an ñunsubscribeò link in their email, and youôll begin to see the problem.

There are so-called SPAM Block Lists online. Iôve tried using those, but most of them are too aggressive. Once a domain gets a reputation for sending SPAM, they add it to the block list and thatôs that. The famous Spamhaus list (look it up online, if youôre curious) is one example. Theyôre good, but... *too* good. I had to stop using them, because they were blocking quite-legitimate news services like Radio Ink and Inside Radio.

In closing, you might ask: why do these spammers do it? Sure, the ones that try to steal your banking or credit card info are obvious. But whatôs up with these other folks who simply send you to a page filled with advertising?

Ah, we get to finish with more Google and Yahoo and tracking. They have programs whereby which theyôll pay you per-click if youôll display their advertising. If a spammer can get just a few people to click links this way, considering that theyôre sending zillions of spam messages per hour (at virtually no cost, remember), they make a tidy profit. Ainôt free enterprise great???

Until next time!

Valley Notes
By
Steve Minshall
Chief Engineer, KCBC

The end of the year has brought a couple of projects to fruition at KCBC. One of these projects was to repair and upgrade the buildings that contain our antenna tuning units, hereafter referred to as ñdoghouses.ò These buildings were built in 1987 using standard 2x4 stud construction with 3/8 plywood sheathing.

The plywood siding requires a lot of paint to keep it from deteriorating and despite several paint jobs over the years much of the siding was rotten. We also had a pesky woodpecker that punched some holes in the buildings. The original doors were not much more than sheets of plywood that did very little in keeping the insects and varmints out.

We decided on placing new doors on the buildings, replacing the bad sections of siding, and thoroughly painting the structures. Last year I estimated what it would take to make these repairs and upgrades and the budget was established for the project. This year I contacted a number of contractors to bid the project.

I found that most, all but one, did not even bother to return a call. The one that did came out, took a look, and gave an outrageous price. I could build a small house for the amount he wanted! I decided that this would have to be a ñDIYò project.

Saturdays were the only time we could run low power, and that was the only time to do the work on the doghouses safely. The more we worked on the siding the more we found needed to be replaced. The doors we purchased were pre-hung exterior doors from Home Depot. We found that straight doors donôt fit exactly right into twisted openings, but with some ingenuity and a generous amount of caulking, we were able to get a nice fit.

What followed was a ton of painting. After it is all done I must say that I did figure the costs way too tight, at least for an outside contractor. We were able to complete the project under budget, but just barely under. One thing I did learn is that there is no cost savings by not buying outdoor tuning units in the first place. Itôs the old saying: pay now or pay later.

The other big project was to replace the fencing at the east end of the property and the fences around the towers. The property fence is close to ¼ mile long and we chose to use five-strand barbed-wire for that. The tower fences were to be wood, for obvious reasons, at a size dictated by RFR standards.

I estimated the fence projects by researching fence pricing on the internet. When it came time to actually do the project, the first hurdle to overcome was the same as the dog houses, trying to get a

contractor to return a call. Eventually we were able to communicate with a few. The pricing was a bit of a problem at first but we eventually were able to fit it all in right at the budgeted amount, or so we thought.

When the crew arrived to start work on the tower fences, I discovered that they intended to do only two of the three. This brought an abrupt halt to the work that day. It evidently was a misunderstanding and we were able to make some changes and renegotiate the contract. The fence project recommenced the next week.

I did all I could to make sure that they did not bore into our conduit with transmission lines, sample lines, control lines, and AC power. I made sure that they understood that it would be a very bad day for all involved if they hit that. I got the point across and we got the posts in without incident.

I was also concerned about the ground radial wires, but they cannot be avoided and I was prepared mentally to see number 10 copper wires popping up at every hole. To my surprise, they missed almost every wire. In almost every post hole a ground wire could be seen but most remained intact! A few were severed, but we brought the ends up to the surface so that they could be identified and repaired.

The fence project actually went very smoothly and we are now the proud owners of some nice new fences.

New tower base fence

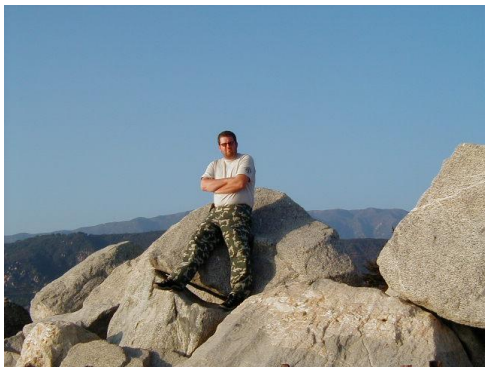
Newly rebuilt tuning house

The Blackstar Bill Report

By
Bill Agresta
Chief Engineer, KBRT

Greetings from Oak-Flat! We here at KBRT had a great month in December and are looking forward to an awesome New Year 2014!

In my part of the woods, most of last month was spent working on projects related to organization and things to smooth the flow of work for the long haul, things like a workbench in my office, a storage container up at the transmitter site and organizational lists so I can easily evaluate and keep track of priority projects.



KBRT is a busy station and we are always looking into ways to make things flow more efficiently and 2014 is going to be a big year in doing that. With some of the new things we have been putting into place, our workflow should increase substantially and issues will be easier to identify and resolve, making for a much more efficient workplace. Part of our problem has always been that we are so busy and have had to juggle projects, sometimes leaving many of them to sit for quite a while, but with this increased planning and efficiency, that should become a thing of the past.

In other news, the new KBRT towers have been good to us, though we have had a few adjustments to make. One of those has been with the Slatercom LED beacon monitoring system on tower three. It was intermittently giving us false beacon light failure alarms that gradually became more frequent. We figured the cold weather was to blame in tweaking the impedance of the LED beacon a bit, causing it to give us a false alarm almost every morning. Working with Al Slater of Slatercom, we began making adjustments to the device, eventually changing out the sense resistors, but the problem persisted. Then we went back to the drawing board. Measuring the AC voltage on the tower side of the Austin transformer and the beacon current up the tower, we realized that the voltage from the Austin transformer had varied or was different than what Al Slater had on record. He made up a new module, adjusted it to the resistor that I had already installed and I was very impressed ï he hit it right on the mark, perfect calibration!

The new fiber-optic tower light monitor units look to be very promising for the long term here, Iôm very happy we seem to have found a good solid replacement to our original wireless beacon monitor units that proved to be very unreliable.

We did get a small amount of rain here in Southern California, and the roadwork we have been doing a bit at a time held up great. Our focus on this project has been the easement road that runs between our towers one and two and provides access to the Sierra Peak tower site to our north. That road had been a mud pit since we moved onto this new property, and I felt it was threatening our ground system that runs under that road, so we ordered some dirt and gravel and along with our neighbor, Larry Booth, his tractor and some shovels, we turned the mud-bog into a nice road.

You might recall that we did have quite a show as this project began and our first gravel contractor overturned his trailer on the way up to our site. That put the project down over Thanksgiving but soon as he got his trailer off the hill, Larry and I took his tractor and trailer down, scooped up the dirt that was blocking the road where the trailer overturned and brought it up to our site. That was followed by three more loads from another contractor ï the one we had used to build the site ï and he had no issues. Now, weôll see if it holds up under major rain, something we have not seen here for quite some time.

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.

The Chicago Chronicles

By
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The Auto Parts store as hidden resource

I promised this article quite a while back, and itôs about high time that I wrote it. This is another one of those mentoring articles, aimed that the folks who are just getting experienced in the radio engineering game. Those of us whoôve been around this business awhile already know a lot of this, but the newer ones may not, and frankly, as many of us retire or go home to be with God, a lot of this information is getting lost instead of getting passed on. Iôm going to be making it more of a mission in the future to write such articles as this within these pages as the ideas present themselves.

I had originally intended to write this piece before the incident about which Iôm going to tell you, but the story makes the article even more pertinent. I recently sent a credit application form for a major national chain of auto parts stores to the company home office, for them to fill out and send in for approval. This particular credit app required the signature of the CFO, which is, in my opinion (and his), rather over the top, so in short order I got back an email from him asking what we could possibly use an auto parts store for. Very good question, as it turns out. My response to his inquiry made it easy to expand on the theme and present it here.

There was a time, way back when, when every major city and quite a few of the lesser ones in this country had an electronics parts store. Most of these were complete as one could possibly want for their time. You could get everything you could want from tubes of all types to wire, speakers, project boxes, capacitors, whatever. In Pontiac, Michigan where I grew up, there was a place literally called Wholesale Electronics Supply, which catered to the area hams, auto plants, and other area businesses. Here in Hammond, where CBC-Chicago is based, we had one of these places until just a few years ago. Sadly, they closed up shop as the steel mills dried up and blew away. In their last few days of business I went in and cleaned up on their closeout sale, for both the station and myself. I still really miss that place.

Then there was/is Radio Shack, one of the last bastions of ñwhere to get partsò for your projects. Oh, The Shack, as they tried to call themselves for a time, is still around, but the place is nothing like it was, say, twenty years ago. And the help there generally are more geared to the consumer electronics market than they are to helping you with getting those little parts that they know nothing about. Heck, they donôt even sell stereos, car audio (except Sirius/XM) or TVs anymore. And, for gosh sakes, donôt ask them anything technical. Youôve got questions, theyôve got dumb looks, as Cris likes to say.

So, when youôre having something of an emergency at your transmitter site and you need a relay, some wire spade or ring lugs, or maybe a specialty 12 volt lamp or LED for a project, where can you go thatôs local? Believe it or not, the local auto parts store is a very good place to start. They may not have *everything* you want, but they have will dovetail nicely with what Radio Shack has, and doesnôt have, until you can get that parts delivery from Digi-Key or Newark.

Thatôs not all. Many of the national chains provide a rental service for tools that you might not use every day, but that you have to have when you have to have them. Remember a few months ago when I wrote the article on how to repair a damaged coaxial patch bay using an automobile tail pipe expander? That was rented for a virtually nothing from an auto parts store near my house.

And, if you have an emergency power generator in your physical plant (and what serious broadcaster doesnôt?) the local auto parts store is a good resource two ways, in supplying both the parts for the gen if they can get them, or in the alternative when they canôt supply, providing the direction to look for places which can help you. We recently had a problem with a temperature sensor in one of our generators with a Ford engine. While none of the local auto parts stores had neither the part nor the means by which to get one, a clerk at one of them

gave me a couple of web site addresses to drop into the web site search engine when I got back to the office, and thatôs how I found the part I needed. That place, while somewhere far away, was able to supply both the part *and* corrective documentation on the engine, so that I could get the right part, and theyôre now on my vendor list for generator engine parts. (Pitt Auto Electric; on the web at pittauto.com; 800-245-0711) When one considers the cost of having your generator maintained by the factory-authorized generator emporium, itôs easy to see that, depending on the situation, this is a good way to hold down the costs of maintaining your generator, and to also hold down the time it takes you to obtain whatever you need.

Another local auto parts store I used also had a cooling system pressure tester for rent. The deal was, I paid for the item up front on my credit card, and if returned said item in less than forty-eight hours, the card was credited for the entire amount. I returned it in less than three hours, thus making it a free rental! If you check, you may find that many of your national chain stores have something similar to that program as part of their customer service. The idea is that if you do find the problem by using the rented tester, youôll likely buy what you need to fix it from them.

Itôs not a bad idea to just drop by your local auto parts emporium on an otherwise slow afternoon, on a weekend maybe, just see what they have that you can use some day. No kiddingð youôll find that, with a little imagination, thereôs a *lot* there that you can use, or at least more than you thought. And, the storeôs hours of operation are often at least as many as the local ñShackò place, since many of them are open earlier to accommodate the needs of the early-rising local auto repair shops.

For my part, Iôm just thankful that the local auto parts emporium is there to be another resource for the broadcast engineer. And maybe you should let the folks there know that. Iôll bet theyôll be more than happy to be told, and they may be more willing to helping you out in the future.

Finally….

I do hope your Christmas and New Year celebrations were happy. It was my second with Kathy, the first since we were married. I didnôt get much in the way of material things, and I didnôt care, since I already had my greatest gift ï a supremely happy marriage to a great lady. And a surprise: both of Kathyôs daughters became engaged on Christmas Day! Mazel Tov, indeed!

Itôs going to be a fun year, 2014. Hope you can stick around and enjoy it with me and the rest of the contributors to *The Local Oscillator*. Blessing to you all!

The Portland Report

By
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Last month, as part of a restoration of a historic WX2 field intensity meter, I highlighted the IF stages and indicator meter portions of the instrument. At the close of the column the IF portion of the meter had been aligned, and I left the reader with a teaser about historic publications, a reference to the magic meter, and Antenna factor A_F.

Now is a good time to take a moment to review the IF and indicator portion of the instrument. In some ways, this portion of the WX2A is not radically different than a well designed portable radio of the era. The major exceptions are:

- The WX2 IF is normally operated in a liner mode, no AVC (automatic volume control) is used. In place of AVC, a control is provided to allow manual adjustment of the gain of the IF stages.
- The instrument has a meter, scaled in units of 1 to 10, connected to display the output of the IF detector.
- The IF input has two stages of switchable decade attenuators providing meter ranges of 1 to 10, 10 to 100, And 100 to 1,000 units.

What we have with the IF portion of the WX2A is a precision measurement of the 455 KHz signal level over a range of 1 to 1,000 units. What we havenôt yet established is what units ï volts, microvolts, volts per meter, or furlongs per fortnight.

Field intensity measurement prior to instruments such as the WX2 wasé interesting. Measurement by the substitution method required the engineer to deploy a ñstandard antennaò in the field location. A receiver would be connected to the antenna and tuned to the frequency of interest. Using a meter placed at the second detector with the receiver set to manual gain control, the receiver gain would be adjusted for a convenient indication on the meter.

The antenna, which was rotated to maximum received signal, would then be disconnected with no change to the receiver settings. In place of the antenna a signal generator, tuned to the frequency of interest, would be adjusted until the generator output produced the exact same receiver reading as when the antenna was connected.

The generator output, which is the same as the output of the antenna, provides a measurement of the antenna voltage. Finally, consulting the chart or graph for the standard antenna would provide a known value of field intensity based on the antenna voltage.

Clearly this procedure has many steps and is open to procedural and accuracy error. Something better was needed, like the WX2, which eliminated many of those steps. The real magic of the meter is in the RF portion of the instrument. That magic is mixed in with the mundane RF circuitry found in quality portable radios of the era.

Letôs start the RF alignment with the more typical portions of the instrument. We begin by taking an overview of the tuned RF circuits. The most notable component is the ñ365 uuFò variable ñcondenser.ò Itôs a block of three variable capacitors, which were typically available in values between 300 and 450 pF maximum capacity. Each capacitor bank is connected to a common adjustment shaft and has an associated built in trimmer to allow circuit alignment.

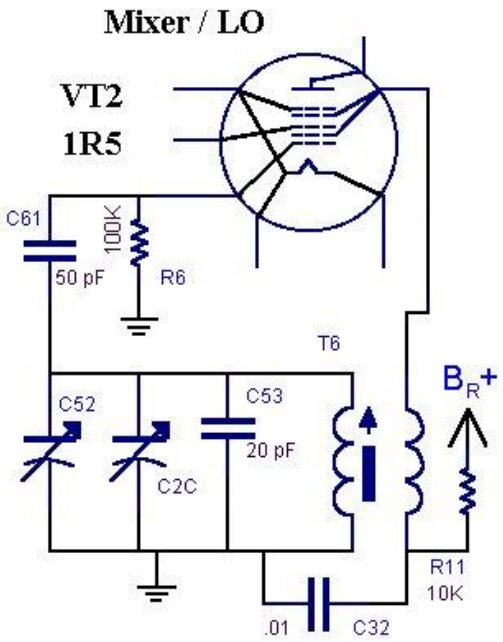

Figure 1 – Mixer/LO Stage

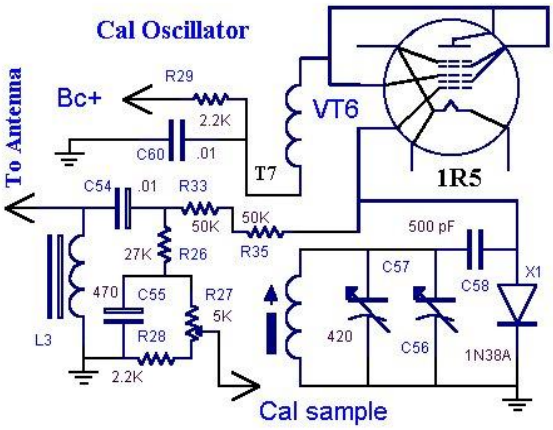

Figure 2 – Calibration Oscillator

The local oscillator (LO) and cal oscillator ranges need to be set first. The LO should be set to 995 KHz when tuned to 540 (540 + 455 IF) and 2055 KHz when tuned to 1,600. The cal oscillator should be adjusted to 540 KHz and 1,600 KHz. An IFR service monitor spectrum analyzer allows sniffing the oscillator frequency with an accuracy of a few Hertz.

First, set the receive and cal dials to 540. Referring to Figure 1, the associated local oscillator variable capacitor C2C will be at or near maximum capacity. The trimmer, C52, capacity is small compared to the value of C2C and will have little effect at this frequency. Changing the inductance of T6 will have a pronounced effect on the LO frequency. Adjust the local oscillator to 995 KHz by adjusting T6. Next, tune the receive dial to 1,600, C2C will be at or near minimum and trimmer C52 will have a significant effect. Adjust C52 to a LO frequency of 2055 KHz. Repeat these two steps until the LO frequency is correct at both frequencies without further adjustment. The cal oscillator is similarly adjusted at 540 and 1,600 KHz using T7 and trimmer C56 shown in Figure 2.

Alignment of the RF amplifier input and output tuning is similar. Consulting Figure 3, notice that L2, a variable inductor, is in series with the antenna. Basically, L2 is standing on the low

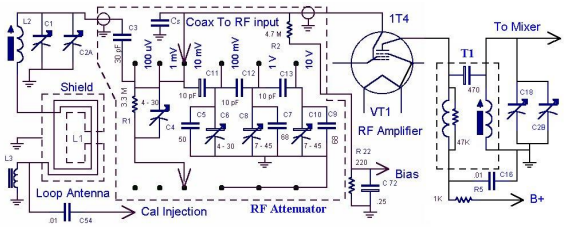

Figure 3 – RF Amplifier

impedance of the antenna. The top of L2 is in parallel with C2A forming a high impedance parallel circuit. The series connection of L1, the antenna, and L2 serve as a match of the antenna to high impedance RF stage input. Notice also that when the range switch is in the 100uV, 1mV or 10mV settings, the tuned circuit of L2, C2A, and trimmer C1 is connected directly to the RF amplifier stage with no attenuation. Also T1, C2B, and trimmer C18 form a parallel resonant circuit at the RF amplifier plate.

To tune these circuits, first set the range switch to 10mV or lower. Tune the receiver to 540 and inject a signal from a signal generator into the receiver antenna. How this injection is done will be described later. Adjust the signal generator to 540 and the generator output level to get an up-scale reading on the indicator meter. Adjust L2 and T1 to a maximum reading. Reset the receiver and generator to 1,600 KHz. Adjust trimmer C1 and C18 to maximum reading on the meter. Reduce the signal generator level to keep the meter reading on scale. Repeat these two steps until there is no further improvement.

Over the years, I have been a book junkie, collecting some of the classics of the electronics industry. The *Radiotron Designer's Handbook*, the

Audio Encyclopedia, and other classics found their way to my book shelf. When I began the restoration, I did some Internet research into FIM calibration procedures to get the latest perspective. Searches for field intensity calibration, standard antennas, and loop antennas produced lots of cheap or expensive antennas for sale, some calibration services, and lots of useless and unrelated hits ï in other words, a large quantity of not very much.

An application data sheet for RF susceptibility test equipment mentioned the name Terman. Well duuuuhé the light went on. A few steps and from my bookshelf I took down my copy of the Radio Engineers Handbook, 1943, by Professor Frederick Terman. That experience served to highlight just how much information and history can be missing from the Internet.

At page 813, Terman describes the receive loop antenna as a coil carrying an RF current. Terman states ñ[t]he ordinary loop is so designed that its dimensions are small compared to the wavelength, in which case the currents are in the same magnitude and phase throughout the loop.ò Under those conditions Terman indicates the loop antenna relationship between field intensity and voltage induced in the receive loop antenna is shown in Eq. [40].

This introduces the concept of Antenna Factor (A_F), a known linear relationship for a particular antenna between field intensity and antenna terminal voltage. Fortunately, users of the WX2 and later instruments wonôt find any reference to Antenna Factor anywhere in the documentation for

[40]

Voltage induced in a loop = $2\pi e N \frac{A}{\lambda} \cos\theta$

Where:

e = Field Intensity, volts per meter

N = Number of turns

$\cos\theta$ = cosign of the angle with respect to the plane of the loop

$\frac{A}{\lambda}$ = Area in wavelengths

Terman's "Equation 40" - Loop Antenna Formula

the instruments.

Users of the WX2 are interested only in the ñon axisò measurement, which allows the cosine term in Equation 40 to drop out (cosine equals 1). The remaining variable terms are then the number of turns in the loop and the area of the loop. These variables do not age and even with rough handling are stable over time, resulting in a reliable relationship between field intensity in volts per meter and antenna terminal voltage.

The WX2 further improves the antenna by use of an electrostatic shield. At page 877, Terman states ñ[t]he accuracy with which electrostatic balance to ground can be obtained and maintained in a loop antenna is increased by enclosing the loop in an electrostatic shield. Such a shield insures that all parts of the loop always have the same capacitance to ground irrespective of the loop orientation or of the presence or absence of nearby objects é Shielding of the loop also has the advantage of preventing induction electrostatic fields [E Field] from affecting the loop.ò

The WX2 shields the antenna in the aluminum frame of the instrument lid. At the bottom (cover closed) of the lid a gap in the frame can be seen. This gap prevents a shorted turn.

The WX2 loop antenna provides a linear relationship between field intensity and terminal voltage. A receiver with the proper gain will indicate directly the field intensity as a function of antenna voltage. The WX2 receiver with its decade attenuator switch provides a direct reading of field intensity in volts per meter, provided the gain of the receiver is properly set. Setting and maintaining a fixed known gain in a receiver over a wide frequency range is notoriously unreliable. In fact, the gain of the WX2 can be adjusted by a front panel control.

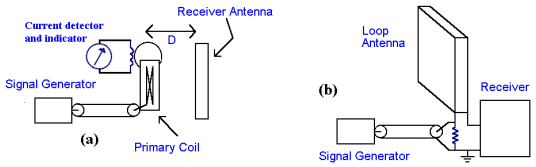

Figure 4 - Inserting a signal in series with an antenna

How reliable is that?

So now we come to the magic of the WX2, setting the gain correctly. Beginning on page 973, Terman discusses measurements on receivers. Two methods of testing are shown in Fig. 4. At 4a, the signal induction is via the known mutual inductance and at Fig 4b by placing the signal source in series with the loop antenna. Both methods are key to the operation of the WX2.

Consulting first Figure 4b, Terman notes a test signal can be induced in series with the antenna. Now look at Figure 2. The calibration oscillator has a ñcrystalò diode placed at the grid of the oscillator, which conducts to set a reliable hard upper limit on

the magnitude of the oscillator output at around 0.3 V peak. In doing so, the oscillator generates a negative DC grid voltage which is proportional to the output of the oscillator.

Note that the series connection of R33, R35, R26, R27 and R28 form a voltage divider in with which cal adjustment potentiometer, R27, provides an internal adjustable cal oscillator DC magnitude sample. Small variations in oscillator output will be reflected proportionally in the magnitude of this sample as indicated on the instrument meter. The sample serves as an absolute reference for the oscillator level.

Note also that R33, R35, and R26 act as an RF voltage divider and that RF sample is inserted in series with the antenna via C54 and L3. The RF sample is injected into the receiver via this path and will display as a level on the indictor meter.

In this way, a sample of the cal oscillator is sent via two paths through the instrument. By comparison, the injected RF sample can be adjusted via the front panel gain control to indicate the exact same level as the cal oscillator DC sample. Thus the gain of the receiver is calibrated to display directly the field intensity in volts per meter.

We are nearly finished with the alignment and calibration of the WX2. Next month we will talk about how to inject a 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.

Rocky Mountain Ramblings
The Denver Report
by
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As I write this, it is already 2014. I cannot believe how fast the year went by. It was full of various small projects and issues. December seemed to slow down a bit because everyone tends to quit working right around Thanksgiving. To be honest, not much happened.

KRKS

In December, my dad and I helped Cliff Mikkelson, chief engineer of the Denver Salem cluster, install his new Nautel NV-20LT transmitter for his KRKS-FM site. He took time to come and help us a couple years earlier to install the Nautel NX50 transmitter at KLTT, so it was only fitting that we would help him with his project.

I must say, it is different going to a transmitter site for a station Iôm not at all familiar with. This is a site that has had engineer after engineer after engineer come in and do work. Much like some of our stuff used to be, nothing was labeled. When we arrived, the movers had already come and the transmitter was in place. It was ready for the RF plumbing, AC power, control and audio wiring.

Dad got the 3-1/8ò rigid line cut and the RF output plumbed into the motorized switch within a couple of hours. The electrician took all day to do his part in getting power to the transmitter and installing a couple of ¾ò conduits for control and audio. We found I would not be able to do anything with the remote wiring because the wire in place already was not long enough to reach the new transmitter (Cliff had hoped to re-use the existing R/C wiring). To get the transmitter so that it could be used as an emergency aux during the holidays, we decided to run a wire simply for on and off.

By the end of the day, we had the transmitter making full power and ready to go. Cliff still has to complete the permanent R/C and audio wiring, but he can do that anytime.

Looking Ahead

2014 brings forth numerous things for us here in Denver. We will be doing a fairly major upgrade of our Wheatstone system. We will be installing the new IP Blade system in our production rooms as well as in line with our audio servers. We will also be getting a new Kubota tractor to replace our early 1800s tractor. Okay, maybe itôs not that old, but it is time we get something that will be more reliable and something I can use. Those are just two

of the many projects we will have this upcoming year. I look forward to it all.

I hope everyone had a wonderful holiday season and a happy new year!

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
KLVZ • 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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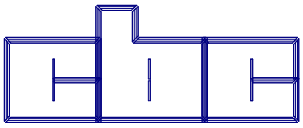

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