The Local Oscillator

The Newsletter of Crawford Broadcasting Company Corporate Engineering

JUNE 2007 • VOLUME18 • ISSUE 6 • W.C. ALEXANDER, CPBE, AMD, EDITOR

Catalina Fire

You had to be under a rock in New Zealand somewhere to miss the news coverage of last month's Santa Catalina Island fire. The cause of the fire is still under investigation. It began just after noon on Thursday, May 10 and swept through the KBRT site very quickly but did little damage because CE Bill Agresta has been so diligent in creating and maintaining fire breaks and "defensible space" around our buildings, tuning houses and tower base fences.

KBRT's problems have all come as the result of infrastructure damage. Some 64 Edison power poles were damaged or destroyed, putting the three-phase power feed to the KBRT transmitter site in the dirt (along with the transformer bank located on the hill above our site). Also on the power poles was the AT&T trunk cable that brought phones, T1 (STL), ISDN and DSL to the site. Those trunk cables were also put in the dirt and burned. That left us with some real challenges.

Because we have a generator and fuel supply at the site, we were able to power our transmitter (more on that later), but the STL situation was another matter entirely. We have a KU-band uplink at the KBRT studio location, so it would seem to be a simple matter of activating a downlink at the site to restore the program feed. It turned out to be not so simple. We were unable to locate the feedhorn and LNB for the Channel Master antenna we had at the site. Art Reis came to the rescue by shipping out a spare LNB he had, and our friend and mainland consulting engineer Joel Saxburg came up with another antenna and LNB as well (thanks to Burt Weiner, another mainland friend of KBRT). Joel and Burt made several trips to the island but were for a couple of days unable to get the downlink working. The problem, it turned out, was not one but two defective LNBs. What are the odds?

While Joel was working to get the satellite link working, Todd Stickler took a boat over to the island with some pre-produced programming he had prepared to get us through the weekend after the fire. He stayed at the site and worked as a board operator during that time, freeing Bill up to tend to other matters. Todd was also able to repair one of the tower base fences, the corner post of which had caught fire a day or so after the big fire, the apparent result of an ember that landed on top of the post and smoldered its way to life.

With the satellite link up at long last on Monday evening, KBRT operations returned to some semblance of normalcy the following day. The only remaining STL-related problem was one live satellite-delivered program. Normally we receive our satellite programs at the transmitter site and backfeed them to the studio over the T1. With that no longer an option, Todd had to resort to Internet FTP downloads of most programs, but obviously this wouldn't work for the live midday program. Tom Gardull in Detroit came to the rescue, receiving this program there and putting it back up on another KU-band channel for reception at the KBRT studio.

The next problem we had to contend with was fuel for the generator. Our 20-year-old generator

is fueled by LP gas (propane) and we have a 500-gallon storage tank at the site. But propane-fueled generators are notoriously inefficient and as expected, we ran through our fuel supply in only a week. Bill managed to get the tank refueled a couple of different times, getting us through the next couple of weeks – well, until the generator stopped generating, that is.

On the morning of Tuesday, May 22, Bill fired the generator up as he had every morning (he shut it down at sunset every night to conserve fuel, powering the residence with a small gasoline-powered single-phase generator), and things came up as normal for a couple of minutes before the power went out. The engine was running fine but there was no output from the generator. I was en route to the island that morning anyway and with Todd Stickler's able assistance, we got a mainland generator repairman to the island late in the day. He found that the field coil was open. He had to disassemble the generator itself and get the field coil pack out where we could look at it. The problem turned out to be where the end of one of the coils connected to the field wire. The #24 solid enameled wire had corroded in two at the point where it soldered to the binding post. Thank God there was enough good wire available to solder in a splice! Within an hour or so, the generator was back producing power again. That whole episode demonstrated for us, however, that with us relying on the generator for power full-time, we needed a backup. So we ordered a rental trailer-mounted diesel generator and had it barged over to the island.

It turns out that was a good move because we were unable to get another delivery of LP fuel the week of May 22. The supply on hand saw us through Memorial Day weekend, but Bill had to wire in the rental generator after that to power the site. The diesel-fueled rental has the advantage of much greater efficiency, burning just a couple of gallons an hour, and Bill can in a pinch fuel it himself with five-gallon cans. So as of this writing, we continue to operate KBRT from the rental generator and work on getting the main generator's LP gas fuel supply replenished.

One other item that factored in to the whole disaster recovery situation is that Bill was hit with the bucket of our tractor/front-end loader when the fire was burning through the site. A tower crew member was trying to create a quick fire break and evidently did not see Bill, who got some cracked ribs in the deal. To add insult to injury, the smoke from the fire evidently contained the oils from the poison oak that grows wild on the island. Thankfully, Bill and his son had on respirators while fighting the fire, but Bill got a nasty case of poison oak on all just about all the skin that was exposed during the fire. So all through the recovery process, Bill has been operating with cracked ribs and raw, itchy skin. I know he has appreciated the prayers and assistance of everyone.

At this point, we hope to have power restored sometime in early June. There is no firm word on when (or even if) we will get our telephone, T1, ISDN and DSL circuits restored. For the time being, we will continue to operate on the satellite channel. Bill is working on getting a permanent 1.2-meter antenna installed and working. The link is presently using a borrowed portable antenna temporarily mounted on the roof of the transmitter building.

The other thing is that Bill is effectively tethered to the site. With no telephones there is no remote control, so Bill is the full-time transmitter duty operator. For several weeks he had to drive to an overlook above Avalon to even use his cellphone. Now, one of the interior cellphone sites has been restored, so he can go to the top of the hill above our site and get service. But that also means he cannot generally receive calls at our site. Keep this in mind as you try to contact him.

Gaining Traction

Early last month, the AM Directional Antenna Performance Verification Coalition, a group of which we are a part, filed a petition for rulemaking that would permit antenna modeling to verify AM directional antenna performance. This proposal came after several years of meetings, proposals and revisions. The idea is that with the current state of the art in numerical computer modeling of antennas, it is possible with most directional arrays to model the array, adjust the model parameters carefully, and come up with a set of operating parameters that will, in the real world, produce the desired pattern. I have done this myself in the past, tuning up a complex directional array in just hours. Some of the coalition members have a great deal more experience with this than I and they aver that it works and it works reliably.

The advantages of this are numerous. The biggest two are cost and time. Because the great unknown variable of how long it will take in the field is removed from the equation, costs can be controlled and accurately predicted. In essence, self-impedance measurements are made of the array elements. The model is then adjusted so that the predicted impedances match the field measurements. At that point, the entire array is synthesized in the model and a set of operating parameters is derived. Experience has shown that when adjusted to the predicted

operating parameters of a properly-constructed model, the pattern will be right. So the engineer can accurately budget for a certain amount of time in the field measuring self impedances (which doesn't take long at all), calibrating the sample system and adjusting the phasor and ATUs for the proper parameters. The rest of the work is done in the office. And all that paperwork that goes with the documentation and filing of a proof of performance is eliminated.

On May 23, the FCC released a Public Notice on the coalition's proposal, seeking comments. Interestingly, the rules proposed were exactly as submitted by the coalition. Perhaps that shouldn't surprise us too much. Three FCC engineers attended our meetings and gave us good input. We hope that the proposal will be adopted later this summer, giving us options that we have never had in the past.

How will this affect CBC's AM directional arrays if adopted? Immediately, it will have no effect, but as I said, it gives us options. Very likely, I will work with several of you to model our arrays. In several cases, I will probably file form 302-AMs with the models and new operating parameters. In doing so, we will do away with monitor points as we know them. We will then have to recertify our sample systems every 24 months.

If you're interested, take a peek at the petition online. On the Engineering page of www.crawfordbroadcasting.com, click the link for Engineering Papers at the bottom of the page. The document is entitled, "AM Modeling Petition."

Still Waiting

We're well past 60 days and counting since the full Commission approved the new terrestrial digital rules, including AM nighttime digital, and yet we have not seen the Report and Order on the new rules. We heard in late May from the FCC's Peter Doyle, who said at an NAB panel last month that they were "finishing up on the IBOC rules" but the Commissioners want to determine "whether or if digital stations should have additional public interest obligations to meet." I thought all that was settled months ago. Hopefully they will settle it soon. This is quickly becoming ridiculous.

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

Hello to all from Western New York! In the May 2007 issue of *Radio Guide*, I read an interesting article about how some station general managers put little or no emphasis on broadcast preventive maintenance. These "gamblers," as the article labeled them, are totally revenue driven, balk at spending money for any preventive maintenance and are even less likely to keep spare equipment/parts on hand for when the catastrophic failure does occur. In general, a manager of this type does not see the value of the engineering staff and sees every bit of money spent on engineering issues as "wasted money."

I worked as a contract engineer for eleven years, and believe me, there are many of these guys out there. The majority of the ones I've dealt with are owner/managers that portray their stations as barely making it, or the cash flow is so tight that any expense outside the "normal" costs of doing business would bring the house of cards down completely. I recall one station owner who needed parts for his RCA transmitter. He requested the amount for the repair parts from the manufacturer, then decided to raid his auxiliary transmitter for the needed parts! While this took care of his immediate problem, he had no intention of replacing the robbed parts in his auxiliary transmitter. I made the repairs as he requested but gave verbal and written notice that what he expected me to do would ultimately cost him much more. He shrugged, threw the note away, and forgot about it. It

was not too much later that the main transmitter went down from a severe lightning strike and his station was off the air for almost four days because of his earlier stunt. And he was mad at me because his auxiliary wouldn't work when he needed it! It was clear that this station owner did not see the value that good engineering practices would give him.

We are indeed fortunate here at CBC that we have an owner, corporate chief engineer, chief financial officer and general managers that realize the importance of good engineering practices and provide budgeting for those unexpected events.

HD Radio Update

I have heard a lot of positive talk recently about HD Radio and what retailers are doing to promote HD-R. I am sure that the agreement of Wal-Mart and Circuit City to stock HD receivers will help get the receivers in consumer's hands, although in Western New York, both these retail giants have nothing in their stores to promote with. I have visited many Wal-Mart locations in the Buffalo area and so far, none of them have any stock to sell. Circuit City didn't have any HD receivers on display, although they did have the JVC in-dash units in stock. They did have plenty of satellite-ready receivers – I counted 12 different receivers that were satellite capable. Radio Shack didn't fare so well, either. They had one HD-R model on the shelf and it was unable to receive the HD signal using the indoor antenna. Perhaps Western New York has to catch up with the rest of the nation?

WDCX – Buffalo

The new transmitter building project is moving right along. The final drawings were approved for the building and the manufacturer, Thermo Bond, expects to ship sometime in July. I have the contractors lined up for the electrical, concrete and tower work that will have to be done along with the moving company that will move the equipment from the old building to the new one. By the time you read this, we should have all the necessary surveys and building plans for the Boston Town Board to approve the project. I am really looking forward to getting this underway; it has been a long time in coming and is a much-needed improvement to our operation.

We have experienced some really warm days recently, with temperatures getting up into the high 80s. To you guys in the south, I know it doesn't sound like much, but we are not geared for really hot, muggy weather. On Thursday, May 24th, our air handling system that evacuates the transmitter's exhausted air out of the building failed, causing the digital transmitter to shut down. We had temperatures outside close to 90 degrees and the temperature inside the building registered 145 degrees with the transmitter's stack temperature at a whopping 205 degrees, with nowhere to go! I contacted our HVAC contractor and they came right out to take a look at the problem. They found that the blower motor had seized and removed it to take it to the shop for repair. After opening up the motor, they determined that repair was not an option and had to order a replacement as none were in stock at any of their suppliers. On the following Tuesday afternoon, the blower motor was replaced and the air handler is now working again. The BE HD transmitters do not like high temps and will begin to fold back if the room temperature gets into the upper 90-degree range. I can't see how the WDCX transmitter site has operated this long without air conditioning. I do remember several years back, we had a cavity fire (twice) in what is now our auxiliary transmitter. I suspect that excessive heat was the cause of both of these transmitter fires.

WRCI / WLGZ – Rochester

On Saturday May 5th, we finally got the opportunity to relamp all six of the WLGZ towers. This work had been scheduled since the winter, but cold temperatures, snow, rain and other factors had delayed getting the work done. We also had a couple of other issues to deal with. A bad photocell on tower five was replaced along with a broken color filter on the beacon on tower six. Our tower worker noted that all six towers will need to be painted next year and recommended replacing the lighting then with the new LED lighting fixtures.

On Sunday morning, May 13, our Nautel transmitter failed to come on after the power change. I tried to bring it up via the remote control but it would not come up. A trip to the site found that the NE IBOC computer had locked up; a reboot took care of the problem.

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 and happy engineering!

The Motown Update

By
Tom Gardull, CBRE
Chief Engineer, CBC–Detroit

As we move forward into summer, I have been trying to identify some big projects that can be tackled over the next five months.

First, we are starting the summer remote schedule. We did not do any remotes last year for a variety of reasons, but this year we have several of our regular clients back. We are not able to use ISDN for our remotes, so we use Comrex Hotline and Marti RPU for our originations. This will be our first remote broadcasts since the 40-second delay was installed. We will be doing a live talk show (with callers) on the road, so I will have to use an FM subcarrier for the mix-minus feed back to the host. Our first remote of the year will be in the parking lot of a law office for a belated "Law Day" tie-in.

A big project with a connection to the "Listener Experience" improvement is the adjusting of the on-air sound of WMUZ's analog, HD-1 and HD-2. We have loud-sounding stations, but the tonal quality, which is subjective, does not compare as well with other market stations. We have a number of new programming people involved here since the processing was originally setup several years ago. Their ears will give a different perspective so we will adjust the processing as a group effort.

We have one monitor point slowly increasing, so I want to do a partial antenna proof for WEXL. The biggest issue there is about gasoline prices for driving the radials. These days, an antenna proof is expensive even with fewer points that must be read.

I always said I went into engineering so I would not have to dig ditches for a living, but digging ditches does occasionally become part of the job. We have a water runoff problem near the back door to our office building. Our property is lower than all the surrounding neighbors, so we get a ponding effect along the backside of the building. We have a buried perforated drainage pipe and it does take care of the water, eventually. We are going to dig a small culvert and extend a drain pipe down to the drain tile, which is under the sidewalk. This will take the excess water away more quickly so the back area does not flood.

At the WRDT transmitter site, there is a lot of building maintenance to catch up on. This includes everything from landscaping the front bushes which have grown to the point of almost blocking the entrance, to sealing some holes in the soffits, which have allowed bird nesting. The generator shed could use a new coat of paint. The vandalized door could use a new lock.

At the WEXL transmitter site, there is cleaning and removal of old cables that used to run out to the two towers. All the tower cabling runs above ground, hung on posts so we have easy access. Our landlord lets us use his dumpster as long as we do not overuse it. So we will have to cut cable away one foot at a time.

There is a lot of outdoor work on the schedule, which can be a welcome, healthy change from the indoor wiring that has been our major focus over the past years.

News From The South

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

Hey, you get several rants for the price of one this month – a true bargain!

Rant One: You Need Some Perspective

It's hard sometimes, as a Christian and a conservative (in that order), to watch society go to the dogs. But something struck me awhile back that I thought I'd share with you. We need to do two things.

First, just chill and wait it out. Remember the 60s and early 70s? Hippies, yippies, the Summer of Love, draft dodgers and all that other stuff? Folks, what you're seeing now is simply these people hitting middle age. They've long since brought their liberal philosophy to middle-tier offices and agencies all over the country. And if that doesn't explain it for you, consider this: *these are the same people who once tried to levitate the Pentagon*!

Yep. It was in October of 1967 that a group of hippies led by Abbie Hoffman tried to "exorcise" the Pentagon, singing and chanting until it levitated and turned orange, thus ending the war in Vietnam. Truly an impeccable chain of logic (except for the "orange" thing; I never could grab that one). For those too young to remember that era, if you've seen the movie *Forrest Gump*, Hoffman was the "angry young man" at the big anti-war rally in Washington.

Second, and on a more serious note, it's sad, in a way, that many of these same liberals so vehemently reject God and are convinced that science has supplanted the supernatural. They like to pretend that they, and not us "poor, deluded Christians," have reason and logic on their side.

It's sad because, on the one hand, they bend and stretch the evidence to fit their preconceived notions (the very thing that they accuse us of, mind you). For example, there's a lot of evidence that global warming may be caused by solar variations. In plain English, the sun may be putting out more energy of late. Since that doesn't fit with their foregone conclusion that man is dangerous to the planet, they ignore it – in spite of the fact that there's now evidence of global warming on Mars, too. The last time I checked, there were a total of zero (0) soccer moms driving SUVs on the Red Planet.

On the other hand, there's some irony here. These liberals have rejected God and Christianity – using science as their reason – at the very time that many scientists are coming to the opposite conclusion. There are many who believe in a Creator now, primarily due to the design in nature. We know more now than we did when Time magazine proclaimed "God Is Dead" back in the 60s. A lot more, and the evidence, rather than nailing our Lord's coffin, is leading many to the opposite conclusion: there's no way that life on earth could have just happened by accident.

I strongly recommend the books *Fingerprint of God* and *Creator and the Cosmos* by Dr. Hugh Ross to anyone who wants to see the cosmological angle.

Rant Two: We Need Some Rain

It's amazing the difference that a few months can make. Last summer and fall, it was so wet here that I had mold growing on the side of my house. Lately, it has been so dry that everyone's lawn is turning brown and many cities have implemented water rationing.

While we certainly haven't had it as bad as the folks in California, Georgia and Florida, we have had more than a few fires of our own. Even worse, with the current winds, the smoke from the Georgia wildfires has been blanketing the area. Birmingham has never smelled like a rose at the best of times, but now we have a thick, irritating pine tar smoke to add to the usual exhaust and coal odors. I cleaned my air

conditioner a few days ago after noticing that it just wasn't cooling like it should; the fins were covered with soot and dust. I had to take a hose and blast them clean.

(And of course, it hasn't taken long for the Global Warming experts to chime in on these wildfires.)

Whatever the cause, I'd ask that everyone pray for rain for those areas that need it, and for less rain in those that don't (like central Texas, which has had flash flooding while we've been bone dry).

Rant Three: I Need A Watchdog!

One Saturday a few weeks ago, the board operator at the station called and said that his remote broadcast had died. The Comrex Matrix that we were using had locked up and he couldn't reset it. I know that quite a few equipment vendors and manufacturers have been reading this newsletter, so I'd like to (humbly) reiterate a rant from a few months back. Every single piece of digital equipment in a broadcast environment should have, in order of preference:

1. A watchdog timeout that will automatically restart the unit if it stops responding; or ...
2. A way for me to easily reboot back to normal operation via remote control, or ...
3. A front panel power switch.

I've come up with a watchdog idea for small, single-processor units that I'd like to share with you manufacturers. Someone else may have already thought of this and it may even be patented. It's up to you to check on that. If not, though, feel free to use this as you see fit and save this newsletter as proof of prior art in case someone does try to patent it later.

Background: most digital equipment with a keypad doesn't have each button connected to a separate pin on the microprocessor. That would be wasteful and expensive. Instead, most use a technique called "key scanning." The processor outputs a pulse to each row of buttons and then checks the columns for a connection. For example, if you look at a telephone keypad and assume that we start at the top left, when you press row 2, column 3, the microprocessor would read that as the "6" button.

There's no need to get into the gory details on how this works; the key point here is that *the microprocessor is putting out a repeated series of pulses* as it enables each row and looks for key smishes. If it's a single-processor, single-threaded system, it *must* do this. So... here's my watchdog idea. When the processor stops checking the keys, *it's no longer outputting those keyscan signals*. Why not put a pulse detector on the keyscan circuit? If it doesn't see a pulse for several seconds, it does a hard reboot. Make this part of the switching power supply and there you go.

Rant Four: Security Revisited (Again)

Back in November, while we were frantically finishing up the new building, my laptop was stolen. A real concern was that some of my personal information, including credit card numbers and passwords for websites, might have been on that computer. While I think this one was stolen by someone looking for beer money at a local pawn shop, it made me think. In the future, you're going to have criminals breaking into houses not to steal the jewelry and entertainment system but to grab the personal info off of the computer. This will happen once they realize that they can make a LOT more money that way (you read it here first).

Aside from outright burglary, how do crooks get your information? The methods vary from ultra low-tech (digging through your garbage) to sophisticated ("sniffing" your wireless connection in an Internet cafe while you check your bank balance). You can't become paranoid, and don't take this to silly extremes, but just use common sense. For example, I noticed a while back that many vendors put our account information on the packing slips that accompany a delivery. (Digikey does this, for example.) As a result, I don't just leave those slips lying around when I go eat lunch now. I either shred them or lock them away in a file drawer.

Another rule that I follow is also due to hard experience. *I never, ever trust any personal or critical information to an unsecured medium.* This includes wireless phones, normal (unencrypted) email and public networks (such as wireless browsing at an "Internet cafe").

If this sounds too paranoid for you, consider what we experienced a couple of years ago when we were involved in some sensitive negotiations via email. All of sudden, this information began to appear in a forum online! I was asked to investigate and eventually determined that someone (probably an employee) was tapping into email at the station. Either they'd guessed or stolen a password or were "sniffing" the wireless network.

One final suggestion: when you make purchases for the company, the vendor is supposed to ask for ID and/or a POR number. All of our accounts are supposed to be set up this way. If the sales clerk

at Lowe's or Home Depot doesn't do that, I complain to the manager to protect our company.

Rant Five: Prophet, Oh My Prophet!

We upgraded to the latest version of NexGen a few weeks ago and have been having a ball ever since. The latest bug was really baffling: voice tracks were somehow making it into the rotation for liners. When a liner was supposed to fire, the system would play a voice track instead.

We called RCS/Prophet support; they recommended that we delete the local database with a special key combination. This is just one bug of many; Rick Sewell started a thread about another good one in our forum a few weeks ago.

I love NexGen, and it has been a very reliable system in general, but the bugs that we've encountered in this latest upgrade are surprising. They've got another upgrade coming out in a few weeks, and I hope they get all of this straightened out by then.

Not A Rant; An Upgrade (For Comrex Codecs) ...

Speaking of Comrex's POTS Codecs – we have the Matrix, Vector and Blue Box here – they're generally quite reliable and sound surprisingly good, especially at higher bitrates. On FM, I like to use EQ to roll off the highs to get rid of the "swishy" digital sound, but aside from that, they're amazing.

However, I have noticed in the past that if you have a marginal phone line that causes the unit to drop or to renegotiate the connection speed, they'll sometimes hang, as mentioned above. And in fact, when I got to the station and questioned the board op in this specific case, sure enough, he told me that it had only been connecting at 9600-19200 baud and was repeatedly renegotiating just before it locked up.

We've told our board ops that if the Matrix won't connect at a speed of at least 19.2K baud and/or constantly retrains, it's a bad phone line. The remote talent can try redialing a few times – on a long distance call, in particular, you might get a better connection that way – but if several retries never give the baud rate we want, we preemptively declare the remote a potential disaster and make other plans.

Comrex has some upgrades for these codecs and Todd has already installed them in all of our machines here. I'll be very interested to see if this helps with the "bad phone line = lock up" problem just mentioned. If you use these Comrex POTS units, go to their website and download these upgrades. You can install them with a serial cable and Hyperterm under Windows.

Until next time!!!

Gateway Adventures
By
Rick Sewell, CBRE
Chief Engineer, CBC–St. Louis

When I first started as chief engineer for the St. Louis stations, one of my most common problems was with the T1 lines that connected the studios to the transmitter sites. Hardly a month went by that I didn't have some issue with one of the two T1 lines that were part of our facilities. We would either have a full blown outage or at the least some sort of digital artifact show up in the station audio going to the transmitter site or coming back from the transmitter site during a satellite feed. And yeah, this always seemed to happen on a weekend or holiday.

That's when the games would begin. I would call the phone company and they would run tests and tell me that there is nothing wrong with their equipment the problem must be with our equipment. That was hardly ever the case and more than 50 percent of the time the loopback test they conducted would somehow correct the problem.

Another issue that would complicate the problem was that we were dealing with two different phone companies, since our studio is in Missouri and both transmitter sites are in Illinois. This has changed to a certain extent since both companies are now part of AT&T again.

It was rare when I actually found that our equipment actually was causing the problem. When I

did, it was usually due to a bad crimp connection or a power outage.

In 2004 we moved our studios about four miles and thus had to have the T1 lines reworked. Shortly thereafter, we switched our multiplexing equipment to the Harris Intraplex and the phone company also restrung some of the stretches running from their local central office to each transmitter site. Once those changes were made and all of the bugs were worked out, the issues we had with the T1 lines really quieted down. In fact we had no trouble at all.

I was really beginning to think I was leading a charmed life this spring when I realized we had not had a problem with either T1 line for more than two years. I knew that I was well overdue and that we were really pushing it. That's why I would test our ISDN backup for station audio each week, making sure we could dial up both sites. In fact, I installed a connection at the studio between the Intraplex and the ISDN unit that would cause an automatic dial up of the transmitter sites with ISDN should an alarm occur on either stations Intraplex. I was fairly sure that I was prepared for what I knew would inevitably happen soon. Murphy had to be very unhappy with our T1 lines running so well for so long.

I don't know if the guy's name was Murphy, but someone decided last month that they needed some extra cash and the best way to do that was to find some copper. It just so happens that they chose the stretch of phone trunk line that runs to the KJSL transmitter site as their target. This stretch of line is an isolated stretch that runs next to a lake and is not well patrolled, so it was a convenient target for such an operation. In one fell swoop, they took down the multi-pair cable that contained the T1, ISDN and POTS circuits to our transmitter sites.

By looking at the events record of the AutoPilot computer, I determined that this occurred about two in the morning. I didn't find out about it until much later because the computer no longer had a line to call out an alarm. We don't have any operators on duty overnights, so it wasn't until the first operator came on duty that the problem was discovered. The event actually took both stations off air because our remote control units are all daisy-chained together. When one goes off line, the fail safe will take any connected transmitter off air.

We were able to get KSTL back on the air rather quickly by defeating the fail safe. They could still take readings and control their transmitter site because the link between their studio and transmitter site was still good. With KJSL, I was dead in the water. My back up to the T1 audio was to use the ISDN from the studio to the transmitter site. Since that was gone, there was no way to get back on the air. I couldn't even use the Comrex POTS line since the phone line was gone as well.

I called Cris Alexander to give him an update on the situation. He devised a plan to get us back on the air quickly using the Crawford Broadcasting satellite network. We would use our studio ISDN unit to dial up the ISDN at the KLZ transmitter site in Denver and from there, Ed Dulaney would patch in our audio to the uplink located at that site. Since our CBC satellite receiver is located at the transmitter site, we just needed to connect the audio to from the receiver to the audio processor.

Thanks to the efforts of Ed Dulaney and Amanda Alexander in Denver, we were back on the air at around 10:30 AM. The phone company had the T1 and ISDN lines temporarily connected with a line that ran on the ground later that evening. The next day we had to scramble again to use the Denver connection because the phone company cable crew knocked off temporary connection as they were stretching new cable for the permanent fix.

In all, we were on the satellite feed for parts of three days until the phone company got the stretches that were stolen replaced. According to the phone company linemen, it is not uncommon for a stretch of cable to be targeted numerous times once the thieves find it a convenient target. If that turns out to be the case, we may need to consider an alternative backup method for our audio to get from the studio to the transmitter site. Having all our eggs in this one basket may not be the best idea any longer.

Valley Notes

By
Steve Minshall
Chief Engineer, KCBC

There was a time when I thought that all there was to setting up an STL system was to get an STL transmitter/receiver pair and connect them to a couple of antennas. That was before I actually had an STL system. Later I would discover that there was so much more to STL systems. A good working STL is a wonderful thing, but when it goes wrong it is not a happy time for the engineer.

Until recent years, STLs came in two basic flavors: discreet or composite. Times have changed, and now we have all sorts of STL systems, including digital systems. With the new systems come new problems. I have had more than my share

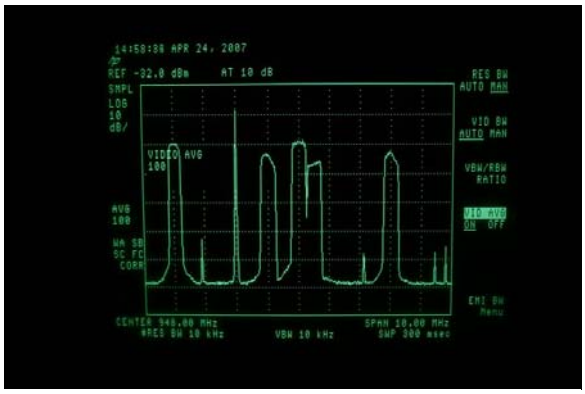


Figure 1 - Rooftop Sample Antenna

of STL problems, but working through problems builds experience that would not otherwise be gained. I hope to pass along some of my experiences here.

One of the primary attributes of a digital STL system is that it needs a specific signal-to-noise ratio to work. It is not how much signal reaches the receiver but rather how far the signal is above the noise. There are two forms of noise that we are concerned with. The first is the internal noise generated in the receiver. The second is noise being picked up by the antenna.

The first stages of the RF amplifiers in the receiver are responsible for the receiver's noise floor. Typically, receiver noise floors tend to be around -120dBm. One of the nice features of digital receivers is a well-calibrated signal strength meter that reads in dBm. To check the noise floor of a receiver, it is necessary to connect a well-shielded 50-ohm load to the input connector and read the noise signal strength from the front panel.

Noise coming in from the antenna is generally interference from other STL systems. Since

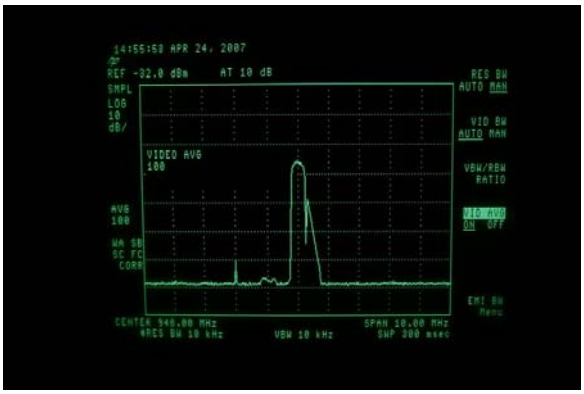


Figure 2 - Filter Slope

the digital STL receivers are frequency agile and have a good signal strength meter, they make a great test instrument. One of the coolest things you can do with the receiver is to check each STL frequency for noise level. It is often surprising to find dead quiet channels where you expected to find signals. Quite often, I have found that the channel that should be clean has interference on it.

There are many factors that determine the lowest signal-to-noise ratio that will operate the digital receiver. The specific modem settings of the

system affect the minimum signal-to-noise ratio as well as the specific type of noise that is encountered. In round numbers, we need about a 30dB signal-to-noise ratio, in theory.

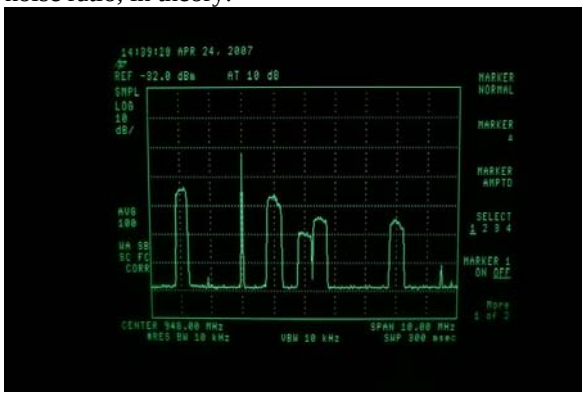


Figure 3 - Quarter-wave Antenna

It would appear that a signal that is 30dB above the receiver noise, a -90dBm signal, would cause the receiver to lock. I have found that generally these systems don't work much below -80dBm. I have seen a system that works well with a signal at -78dBm, but that is less than desirable. I would generally not want to see a signal of less than -68dBm at the receiver, and even that does not allow much fade margin.

Fade margin is a generic term here. A signal can fade and therefore reduce the signal-to-noise ratio but there is one more insidious thing that can happen. Interference from a distant STL transmitter can be propagated to your receiver and reduce the signal-to-noise ratio. This is often a much larger problem than a simple fade of the desired signal. This is harder to diagnose since the event is often short lived and it is impossible to "see" the interference when your STL transmitter is operating.

The use of a receiver preamplifier is generally not desired. A preamplifier will amplify any noise along with the desired signal by the same amount so it does nothing to increase the signal-to-noise ratio from noise entering the antenna. The preamplifier can also be a source of inter-modulation distortion unless it has a filter preceding it. A high gain antenna at the receive end will help reduce offending signals that are appearing off axis while increasing the desired signal level. This is a better way to go.

The key to a high signal-to-noise ratio at the receiver is to use plenty of transmit power. The use of a linear amplifier is an inexpensive way to add 10dB to the signal. A big transmitting dish and good, low-loss, transmission line are important as well.

Antenna heights play an important role in achieving a good signal-to-noise ratio. If the receive antenna is placed high on the tower, it's exposed to interfering signals from great distances. If the receive antenna is placed low on the tower it will be less likely to receive interference from distant stations. My experience has shown that a high transmit antenna combined with a low receive antenna produces the best and most consistent signal-to-noise ratio.

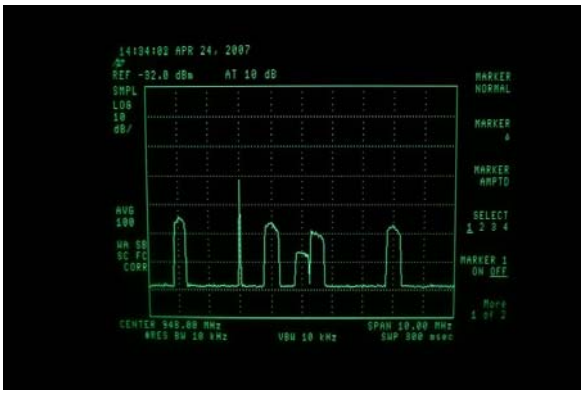


Figure 4 - RG-58 Jumper

A particularly bad situation is a long path over flat land (or even worse, water) with high antennas at each end. The direct signal between the transmit antenna and the receive antenna can be interfered with by a reflection from the ground. The signal may be fine during normal conditions but under certain conditions, such as dew forming on the ground, the reflected signal can reach an intensity that can cause cancellation of the direct signal. Using a low antenna at one end of the circuit can reduce the amount of ground illuminated by the transmitter or reduce the amount of ground seen by the receive antenna.

Thermal layers in the atmosphere can cause another problem. In this case, the signal may be blocked or reflected where two distinct air masses of different temperatures meet. This phenomenon may also be responsible for some ducting effects. I once experienced a complete loss of signal at a receiver 26 miles distant while at the same time creating severe interference to a station at 70 miles distant due to some sort of ducting effect.

Long paths over flat areas are prone to these propagation effects. One effective way to overcome these problems is to incorporate space diversity reception. This involves placing two receive antennas at different heights on the tower. The two antennas can feed separate receivers or feed a single receiver through a relay.

With composite STL systems, two receivers can be switched back and forth for diversity reception

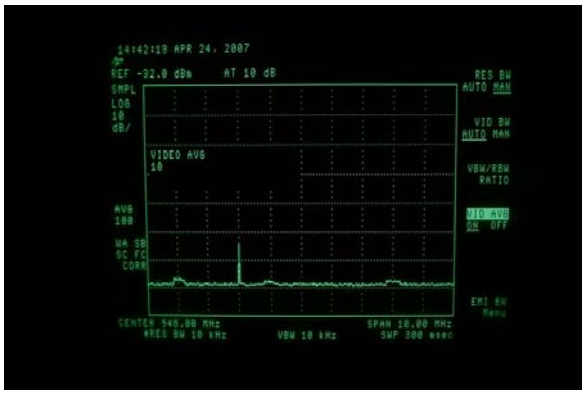


Figure 5 - RG-8 Jumper

using the squelch circuitry. With digital systems, the switching is not quite as easy and requires some creativity. In the past I had a system that switched between receivers by counting bit-errors with a decade counter. Several "hits" were required to switch the receivers. This system worked well for years and only on very rare occasions did both antennas fade at the same time.

My diversity antennas were spaced apart by about 200 feet; however, an STL manufacturer has recommended 20 foot spacing. The switches were logged on the station remote control system and it was interesting to note that the lower antenna was in use much more often than the high antenna.

My need for the diversity reception came to an end when the STL path was later changed. If someone had the time and resources, it would make interesting study to place a number of antennas on a tower, monitor the signal levels over a year or more, and hopefully gather some useful information.

I have also learned that line-of-sight paths are not always needed or even desired. Antennas that are operated slightly below the horizon can receive quite usable signals. What the receive antenna receives is some refraction of the signal. My experience with this is limited to one station operating in this mode, but I have a very stable signal, albeit at considerably lower signal level than line-of-site would provide.

Digital STL systems do not tolerate corruption of the signal. The old analog STLs would perform quite well on a noisy channel, but the digital receivers are not so forgiving. A channel that worked fine with an analog STL may not be usable for a digital system. It is interesting to note that co-channel analog STLs cause a lot of interference to the digital systems where as the analog receivers tolerate co-channel interference from the digital systems quite well.

Since the purity of the received signal is of utmost importance, it only makes sense to put a good filter on the input of the receiver. A band-pass filter can be used to keep signals from outside of the STL

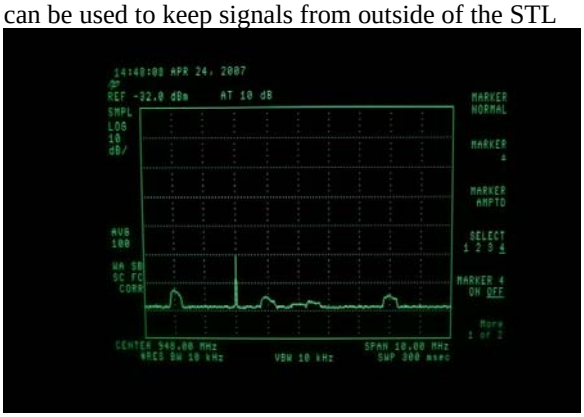


Figure 6 – Heliax Jumper, Hand Tight

band from getting to the receiver. I prefer a *channel* filter such as the filters made by Integrated Microwave. These filters are 500 kHz wide and must be purchased for the specific STL channel. These filters introduce an 8dB loss, but remember that it is not signal strength that we are concerned about, it is

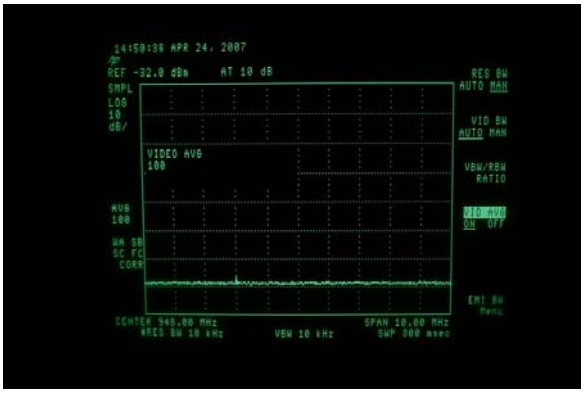


Figure 7 – Heliax Jumper, Wrench Tight

signal-to-noise ratio. As long as we have a reasonable signal level, an additional 8 dB of loss is usually not a concern.

The effect of a channel filter can be seen in Figures 1 and 2. Figure 1 is the reference from a sample antenna placed on the roof of a studio that has five digital transmitters and one analog transmitter running. Figure 2 shows the effect of a channel filter tuned to the STL signal at 948.0 MHz. The slope of the filter can be clearly seen on the effect on the

948.5 signal.

Another thing I have been concerned with is

Figure 8 – Honk it Down!

jumper cables used to interconnect STL system components. At one site I operate, I have three digital STL receivers, three channel filters, two signal splitters, two digital STL transmitters, two linear amplifiers, and a power combiner. This means that I have 12 jumpers between pieces of equipment. I use solid copper outer conductor cables for all of the interconnections to reduce the possibility of interaction.

The use of braided cables (such as RG-8 types) would be asking for trouble. At 950 MHz the braids leak a lot of signals, in and out. I have included photos here showing the leakage of various cables as displayed on a spectrum analyzer. Figure 3 shows the spectrum received on a ¼ wavelength piece of wire place at the input of the analyzer. Figure 4 shows the effect of connecting a two-foot, good quality, commercially made, RG-58 BNC cable to a dummy load. Note that the shielding of the cable is almost non-existent, being only 6 dB better than the antenna! Figure 5 shows the leakage of an RG-8 jumper. Note that the RG-8 is much better but it is still only providing 32 dB of isolation. Figure 6 shows a three-foot jumper of solid outer conductor coax. This was installed finger tight and, as can be seen, the isolation is worse than the RG-8. Figure 7 shows the effect of tightening that same jumper with a wrench. Now we finally have some real shielding.

Filters and good jumpers are inexpensive compared to a complete system. Put in a good channel filter and connect it to the receiver with a good jumper tightened with a wrench as in Figure 8. These items may not be necessary for successful operation but they are cheap insurance. Why would you want to take a chance?

Some digital STL transmitters have an internal isolator incorporated on the output. It was discovered that the isolators greatly reduce unexplained problems with the systems. The isolators prevent unwanted signals, reflected power or otherwise, from going back into the transmitter and corrupting the signal. For this reason I place an isolator on any amplifier that I use. See Figure 9.

One thing that is my pet peeve is to use pressurized transmission lines whenever possible. Dish antennas can be purchased with pressurized feeds. Some dishes can be retrofitted with a pressurized feed. These styles have a 7/8" EIA flange for connection. The antennas can be directly connected to 7/8" air dielectric line or connected to other sizes with adaptors or pressurized jumpers.

Figure 9 – Use an Isolator

The advantage of the pressurized lines and antennas is that their condition can be monitored constantly. If it takes a bullet or other damage occurs it will be immediately obvious. If there is a leak that would allow water in it will be obvious also. If the connector of a foam line develops a problem, you may not know until the first hard rain, and then it is too late. I sleep a lot better knowing that all of my STL lines and antennas are holding pressure.

The Chicago Chronicles

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

The ink is barely dry on the May issue and already I have a start on this article. My sermon this time is entitled, "Fasten your lap straps, folks, the future is going to be one fast ride."

It's not like we didn't see this coming. One of the formative books of my youth was Alvin Toffler's "Future Shock." Written about 1970, it was a look into the future of society, with every aspect coming under Toffler's scrutiny. Toffler was an incredibly prescient man; many of the things he predicted have indeed come to pass. One of these tenets was that technology was going to accelerate at an exponential pace, exceeding the ability of the average Joe to keep up with it all. So far, society is keeping up, but just barely. I wonder if it will continue to be able to do so for the next ten years.

We've already been seeing this sort of technological speed increase taking place in the area of computer technology. Except for the keyboard, monitor, mouse, microprocessor and hard drive, nothing that existed on the original 1980 IBM/Microsoft PC box exists in the current state of the art PC sold today, and those exceptions have highly evolved, both in power and function. The original 1 MB drives have been supplanted by IDE, EIDE, and SCSI technology. The evolution of both memory and microprocessors is already well known. However, the original 25 pin serial port (and its successor 9-pin model), the 25-pin printer port, the 8" floppy drive, the 5-1/4" floppy and the 3-1/2" hard floppy are all gone now, replaced by the USB port and the flash drive "memory stick." Mice are being replaced by optical trackballs and touch tablets on laptops (that's one area where change is not necessarily progress). Video cards have evolved from mono 600x480 pixel units to the incredibly hot video cards of today. Sound cards didn't even exist in 1981; sonic technology back then was the poster child for "crude technology." Remember that little speaker which produced only "beeps" and "boops"? Today, the sky's the limit in audio. Even the computer's memory system is vastly different from what was extant in 1980.

Frankly, that could be said for all of computer technology. Back in the beginning, your IBM-based PC had a technological life of maybe six years. Today, the state of the art life of your system, laptop or desktop, is measured in months — fourteen, by the present estimate. My laptop's video just went berserk after four years of faithful service. I found out the other day that I have to replace the old girl, but I'm old school. I just hate giving up on it, or any technical thing I have. I'm typing this part of this article on it right now, bad video and all. Yes, a new laptop is on the way, but it may not have the comport I need to do some of the things I need it to do at the radio station, and that new-fangled comm-port-to-PC adapter is not really progress, either. They say it's the same, but it isn't. Some quirks in its works, you know. I'll miss things on the new laptop that I'm use to using on the old one.

For a techno-geek, I am weird among my peers in that I absolutely refuse to be the first nerd on my block to have the latest whiz-bang techno-toy. For instance, Susie and I as yet do not own an HD-TV. Maybe, in a year of so, okay? Also, I'm not interested in having an iPod — yet. Maybe if it worked well with classical music, I don't know. But there is one area where I am ahead of the Joneses: I've had access to HD radio in my car for about two years. The first one I had was bought for me by Mr. Crawford, for which I thank him. I now have my own HD-R in the car, an anniversary gift from my wife. Thank you, Susie! And now, there's one in my office at work. Another one is on the way for use in the house.

Now, where is this leading? Well, just as the radio industry is settling in to the HD-R era, two developments are now appearing on the horizon as possible pretenders to the digital throne. One is

actually part of the plan. The other has the promise to blow the industry wide open — again. If it works. That is, if it isn't just another "crossed-field antenna."

The first is HD-3 for the FM band, which uses a second digital carrier system (remember, in HD-R there is no such thing as a digital carrier, for in fact there are all of 191(!) carriers in that HD-R envelope on either side of the FM carrier. What do you bet that piece of trivia never makes it into Trivial Pursuit?). This second set of carriers, dubbed the Extended Hybrid, is located between the FM modulation envelope and the now-ubiquitous HD-R carrier set, and has been known in HD-R circles for quite some time. It has a lower data rate (25 kB/s.) than the original HD-R carrier that we all know and love, but can be considered to be quite useful for a third audio-programming source, especially for talk formats. Public Radio station WUSF in Tampa Bay is experimenting with it, along with NPR Labs, Ibiquity and Harris under an FCC STA. The intent is for a subscription radio service, dubbed "conditional access." The results of the WUSF experiments should be known some time around the beginning of 2008. Consider that also to be an added source of revenue for radio stations, *if properly implemented from a programming and marketing standpoint.*

But there *may* be an even more compelling technology looming on the horizon — Ultra Narrow Band (UNB). I caught my first glimpse of its existence in the same *Radio World* issue (April 25, 2007) in which I saw the WUSF article. It was part of a guest commentary which appeared on page 45. In that commentary, H.R. Walker, responding to a reader's criticism of UNB on the previous page, points out that both HD-R and HD-TV are in their relative technological infancies, but that "newer modulation methods" and technologies, "with higher bandwidth efficiencies" (remember that phrase) "may soon change that." Trials are already under way by several companies and in several places. I'm not going to go into the entire treatise. Read it for yourself and see what you think. Yes, there are issues surrounding the technology, as I mentioned earlier. One issue is funding; another is finding the programming or information throughput to use with it. If you thought that the Information Explosion couldn't get much bigger, you may have to re-think that. It might be that said IE is about to hit hyper-drive, and it just might be that *this* industry is going to be at the center of it — *if* the technology proves out, *and* the powers that be in this industry will not only let it, but push it, hard.

Yet there's another question, or set of questions, to be answered here: Are the HD-R receivers currently being manufactured going to be ready for all this new technology? For that matter, are they going to be ready for even the full implementation of HD-R, which is supposed to supplant FM completely by filling the entire channel with data channels? Are any of the receiver manufacturers making plans to implement the new data services which are inevitably on the horizon and to which broadcasters may depend upon for their continued success and profitability? If not, it's time to get a move on, and do what it takes to make it happen.

Reading both Stephen Poole's and Steve Minshall's articles in last month's *Local Oscillator* reminded me how prescient are the folks we have here in this company. Stephen said that the only way in which we as engineers are going to survive in this business is if we keep learning. Amen, and speaking for myself, I find that learning and staying ahead of my peers is the real fun part of being in this business. As such, I feel sorry for my peers who are planning their retirement already. Frankly, as one small step, I'm gearing up for the next challenge, the new digital radio specialist certification from the SBE. My response to that news is, "Well, It's about time!" and I intend to be the first in the Chicago market to get it. I trust, however, that I won't be the first in the company to do so. After all, it is not considered good form to upstage one's boss.

And as to Steve Minshall's contribution to my thought stream: Steve gave a forward view of how mobile data services would, in the not-too-distant future, affect the lives of all of us. Go back and read his article to see what he had to say. I think that Steve is right on the money in his future assessment, and I hope to be a part of it.

But there's one thing which can throw a monkey wrench into all this future progress, and it's actually the same wrench from two sources: The resistance to the rapidly changing technology from either the public, which will resist spending dollar after dollar to keep up, or from the broadcasters who are unwilling to spend the money on the technology or the promotion needed to make the bigger money and serve their public better. The key to the public is promotion and more promotion. We who are in the business all know the keys to the goal. Win the hearts and minds and the pocketbooks will follow, especially if the price is reasonable. The time to start is now. And, at $59.00 for a radio, HD-R is starting to get there, right now.

****

Darn. I'm in rant mode again. Stephen Poole should be very pleased. Now, understand that

I'm not going to name the manufacturer involved for a couple of reasons, but there's a lesson to be learned in this experience, no matter which manufacturer is involved, which is why I'm passing this along.

I received word from more than one source a few weeks ago that a certain FM exciter series, of which type we have six, needed a modification to its power supply to keep the exciter from locking up during an electrical brownout. While the rig would stay on the air, it wouldn't pass audio, which kind of amounts to the same thing. The manufacturer's list server described it as a "critical update." Uh-oh. Since I'm always on the lookout for ways to increase reliability at our stations, the description certainly got my attention. There were a couple of factory-supplied parts involved in the mod, which were ordered for all five of the exciters involved, and in short order those parts arrived. Looking at the downloaded instruction manual, it became apparent that this mod was going to require a considerable amount of soldering skill – there is a lot of surface mount stuff here, to which a rather large wire and a capacitor had to be soldered – so I made it a point to do the actual soldering myself. Armed with that info, off I went to do the right thing.

I should have learned from the first exciter that I was modifying that this project was, well, jinxed . The first exciter, at WYCA, was modified, turned on and.... nothing. It was comatose. Black screen. A quick call to the factory yielded a customer service person who hadn't seen this problem before and who was wondering what the "critical update" moniker was all about. According to him, this mod was intended for an electrical brownout environment which was much worse than most of what we would ever see in this country. This guy had obviously never had been to our WPWX transmitter site. From that analysis, I figured that there was only one of two things I could do – either undo the modification or leave the rig down and see what it would do, which had actually been suggested. I've never done this sort of "waiting" diagnostic before, but I actually did it for quite a while before the screen actually came up on its own (surprisingly).

But it wasn't perfect yet. The AFC was out of lock. Another call to the factory got the suggestion to just re-start the thing. Well, geez, why hadn't I thought of that? (Fatigue.) That done, the rig came up perfectly and hasn't had a problem since. That isn't really a big comfort to any Engineer because one has to wonder when the rig is going to go comatose again; so far, it hasn't.

But the experience did give me enough hope to try the mod on the next exciter, at our big station, WPWX. This time I had help from transmitter and remote broadcast maven Warren McFerren, and the modification process went without a hitch – in and out in less than an hour, and perfect from the get-go. Well, maybe this modification had some hope after all.

Right. I should have known I was gambling, and that my luck was running out. The third modification was at our WSRB main transmitter, and this one was a disaster, which proves the rule. This time, there was a real clue. Upon opening up the exciter's power supply section, I found that a factory modification had gone bad. Two components which had been kluge-added and which were hanging onto a couple of wires going elsewhere on the power supply board had fallen away from their common solder pad, and I couldn't quite figure out which pad it was. How long had it been that way??

Another call to the factory. This time, I got an educated guess, shall we say, as to the proper location of the connection. The fellow later called back with the really proper location, the change was made to the kluge, the modification completed, and the exciter put back together. It didn't work. This time, being that we were on the air on the backup and it was very late, I left the station on the backup without HD for the night, just to see if the main rig would act like the one at WYCA had. Next morning, I put the main rig back on the air, and it did come up, except that the AFC would go out of lock every few minutes for just a half second or so – just enough to be annoying. Another call to the factory and this time, a new power supply for the exciter was sent post haste. Next day, Warren McFerren came out to the site and put the new power supply PC board in. No change. This time, the factory went deeper into the situation. They asked questions about software versions and serial numbers. Then they wanted the exciter back for some more critical updates to both hardware and software. This was our oldest HD exciter, and the software version we were using was apparently so old that it couldn't even be updated in the field. Yikes! So, that's where we sit as I write this, with the exciter on its way back to the hospital for a total makeover. I checked most of our other exciters. The four newer ones, they're OK. The very first one we put on the air was replaced a long time ago. This was the last of the anomalies, or so I hope.

I only wish that this whole situation could have been handled better, from all sides. From where I sit, the modification called for in this case was a lot less critical than advertised, it caused many more problems for us than it solved, even with the quality

of my work in doing the mod, and problems unrelated to the modification accrued which became serious issues of unscheduled off-air time, especially for our HD. And I'm sure that some of the decisions I made could be second-guessed from here to Sunday.

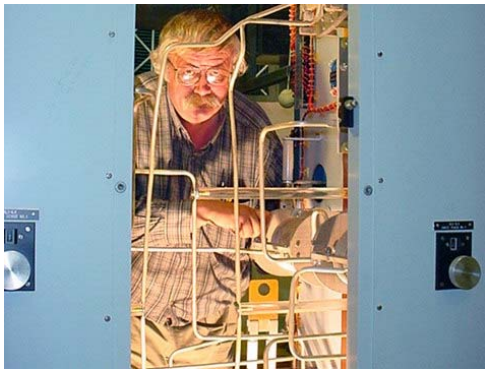
And, oh yes, the last two exciters in our stable for which the modification is indicated aren't going to be done. They're fine as they are. Let sleeping problems lie. Enough.

And, enough for my rant and for this month. Tune in next month, folks.

The Portland Report

By
John White, CBRE
Chief Engineer, CBC–Portland

It's the end of the month and a holiday weekend as I prepare the final edit of my column. As I was considering an introduction this month, I thought back to my early experiences at the KKPZ transmitter site. The top of Mt. Scott is generally very quiet and the sound of firearms off in the distance was quite a surprise. The first time it happened, I had no idea of a location and no real clues to pursue. When it happened again, I began to wonder if there was a firing range nearby. A range didn't work as an explanation because it didn't happen often enough. As I was headed up to Mt. Scott some weeks later, the explanation became clear. The Mt. Scott Blvd. access borders on the Willamette National Cemetery.



In the years since, the sound of gunfire at the site has come to mean the passing of another veteran, so many of them from WWII. I think many of us know some of the names: Audie Murphy, Jimmy Doolittle, Pappy Boyington, the names and the stories of those of America's greatest generation.

The Memorial Day holiday and a recent email from Bill MacCormick prompts me to mention the names of four men: Bruce P. Crandall, Jason L Dunham, Tibor (Ted) Rubin, and Paul R. Smith. Take a few moments, google those names. These are men worth knowing. They have earned more than a few inches in the airplane pages. ("Airplane pages" is an old print media term which refers to the obscure back pages of the news paper. B47, B52, etc.)

Earlier this month Cris asked us all for a report on our contribution to bettering "the listener experience." From an overall point of view, I think of the listener experience as a total package. This total experience includes the technical quality of the signal the listener hears, the content of the signal and the reliability of the content for the listener. In this, KKPZ has concentrated on the local programming content that is relevant to our local audience.

In some respects, improving the listener experience is a state of mind that involves everyone at our station and goes beyond any one aspect of day-to-day operation. With the advent and implementation of HD-R, I find my own thoughts evolving. At KKPZ, our CRC satellite receiver is located at Mt. Scott and the audio is back-fed on the CAT-Link to the studio. Prior to HD Radio, I hadn't worried much about the difference between the 10 kHz and the 15 kHz channels. Now the goal is to get the best sound quality possible from the satellite programs. I have now reconfigured the backhaul to put the daily-use satellite channels on the 15 kHz circuits.

Reception and Engineering are two other examples. Neither have a direct impact on the content of the day-to-day programming that flows from the station to the listener. Reception, however, is one of the primary conduits between the listener and the station. A bright, sunny, "May I help you?" is the voice of KKPZ when a listener calls. That voice *is* the station at that moment. Engineering helps to enhance the reception function by helping the receptionist's tools, such as the telephone system, meet the needs of communications.

Similarly, the layout and implementation of the studio facilities will have the same kind of impact.

As I mentioned in last month's column, this is an area I have been concentrating on. With the reconfiguration of the KKPZ studios, I have been looking to make choices which will allow flexibility for the future production of local programming. One possible example is state government coverage as government is taking more and more actions that directly impact our audience. Since the legislature has decided to schedule a second "emergency" session in 2008, this may or may not impact the capability our station needs. Flexibility is a worthwhile goal.

Last month, I talked a bit about the new studio cabinets at KKPZ. Overall, I was impressed by the layout and workability of the Wheatstone design. One limitation I found is the access to the upper equipment pods. Wire raceway access is via 2-3/4 inch hole in the bottom of the pod and a corresponding hole drilled on the countertop. Feeding cables through both holes is a bit of a trick at best, and doesn't get better as cables fill the raceway and equipment fills the pods. I had searched for some tube or method to improve the raceway. A cardboard mailing tube didn't work, the outside diameter didn't match the hole. Finally I found Kinkos has a plastic map storage tube which has an outside diameter of exactly 3 inches, a match to standard hole saw sizes. Drilling the holes out to 3 inches and a short length of the tube slides nicely through the matching holes and provides a nice controlled cable path. With the tube in place, cable installation and maintenance is a breeze.

Grounding is another of those little details with this installation. As I assembled the cabinets, I took the time to install grounding to all the rack rails and the steel cabinet frame. Grounding is one of those things that isnt a problem until it's a problem, and when it's a problem, then it's a PROBLEM. The extra grounding may not be necessary, but I do like not having to worry about these kinds of problems.

The last few months, I have mentioned work on a new water tower at Mt. Scott. The tank is noteworthy because its height and shape make it a prime candidate to capture and retransmit AM signals, distorting the pattern of AM radio stations. Fortunately, I had the cooperation of the local water district and the Happy Valley planning commission.

As they say, the last 10 percent of the job often takes 90 percent of the work/time. With painting and circuit modification, that was true for this job.

The good news is, the painting and final adjustment are complete. The detuning equipment wasn't damaged or changed during the painting. Painting did take on some planning and safety issues. For those of you who are not familiar with AM detuning networks on towers, the networks create the equivalent of a high impedance parallel L-C network. Significant RF voltages can appear on the commoning ring and at the detuning adjustment network.

The entire property is enclosed with a perimeter fence. At the water tank installation, there is no fence around the tank itself. For safety reasons the commoning ring, lower portions of the drape wires and interconnect wires are enclosed in protective insulation. Warning signs are also posted. RF safety procedures may easily come into play for the painting crew. It's not a huge deal so long as training and safety procedures are followed for the painting crew.

Now the bad news. After years of work and STAs to keep KKPZ legal, I still have one tower owner that refuses to detune. That owner believes that since he is a Part 90 licensee, the FCC rules don't apply to him. Still, I have seen great improvement and cooperation with the other six towers. So far, I am able to keep a sense of humor and view the situation as the glass half full.

There may be relief from another front. Cris recently announced that a coalition comprised of engineering directors, consulting engineers and equipment manufacturers has been at work on a set of proposed new AM performance verification rules. The new rules and procedures will modernize the design, adjustment and maintenance of many AM directional systems. The results should produce better and more stable antenna systems.

In order for this modernization to work, re-radiating towers must be handled in a consistent and uniform minimum manner across all services. At the present time, some services operate under the newcomer policy while others such as the cell industry have additional requirements. At the time of the cell rulemaking, that made sense. The large number of those towers justifies extra attention. For KKPZ, the fact remains that as long as the tower owner refuses to detune, we can't comply with the FCC requirements for our directional system. Hmmm, can you spell permanent Special TEMPORARY Authority (STA)?

Rocky Mountain "Hi"
The Denver Report
by
Ed Dulaney, CBRE
Chief Engineer, CBC - Denver

Lock it Down!

There's been a lot of talk lately about the idea of "GPS Synchronization" of AM broadcast carriers. The argument has been made that the fringe coverage of many AM broadcast stations can be extended by insuring that every AM carrier on the same frequency is locked to a stable GPS standard.

I admit that the idea has a lot of merit. Here in Denver, I have the two KLDC sites synchronized. One of them is the daytime site, and it already had GPS synchronization through the NE-IBOC HD exciter. The night site is not broadcasting an HD signal, but the exciter in the unit is capable of accepting an external reference. So I took one of the 10 MHz signals out of the KLZ EASU (KLZ shares the site with the KLDC night transmitter) and used that for the reference source.

With the synchronization in place, there is no noticeable phasing or flanging of the signal, even with both sites fully powered up. Before they were synchronized, the carriers were about 0.15 Hz "off frequency" from each other. This caused the signal to fade in and out, making the signal difficult to listen to.

Having said all that, however, I'm rather skeptical that GPS synchronization would actually accomplish all that much in the real world. Even if two signals are synchronized together, the resulting mish-mash of audio would still be objectionable to most listeners. The carriers may not fade out, but hearing Rush Limbaugh on one station and Al Franken on another could cause problems much greater than periodic fading every would!

Considering that the cost to convert the average station would be anywhere from a few hundred dollars to a few thousand, and considering that every station causing interference on the same frequency would have to do the conversion, it's easy to see that this is probably not an option for most broadcasters.

It's Not Easy Being Green

This year has to be the "weediest" year ever in Colorado! We had a lot of moisture during the winter months, and a fairly wet spring. Therefore the weeds are growing like... well, weeds!

Amanda and I have been spraying them regularly, but there's just no way to stay ahead of the growth. Almost every day brings at least a light rain, and that nullifies the efforts of spraying. And it's virtually impossible to mow, as the ground is saturated with moisture (at least at KLZ) and the tractor will go for a few feet before getting bogged down in mud and ruining the ground system in the process!

Hopefully summer will bring some sun, and with it some drier ground! Yes, we can use the moisture, but until someone can come up with a weed spray that works during monsoons, I'll just continue to go out to the sites and scream at the weeds to "go away." It hasn't worked yet, but I'll keep trying.

KLZ Hiccups

When we first started the CCM format on KLZ last month, the station sounded great. The digital audio was crisp and clean and easily held its own with all the FM stations in the city.

But a few weeks ago, we started noticing some "burps" on the air. This was about the same time we were going to swap out the MPEG audio cards for linear cards in the Intraplex cages. So we made the swap. Well, that didn't solve the problems, and it created a few new problems as well.

So we switched back to the MPEG cards. The audio hiccups remained. Now we were more than just a little perplexed, as everything was so perfect a mere week earlier. After giving it some thought, I

began to think that the problem wasn't with the audio path, but in the HD signal – specifically in the digital carriers somewhere.

There was no noticeable degradation of the analog signal, but the digital was sounding worse and

Amanda tries to get a handle on the KLZ weeds

worse. Finally, Cris had called me saying that the station was almost unlistenable. But when I tuned in, it sounded perfect. As a matter of fact, it was as good, or better, than it was when we first started the CCM format! Cris, on the other hand, was adamant about the problem being there (most likely wondering about my sanity for saying that it was sounding marvelous!).

This finally convinced me that the problem wasn't the AES audio nor the NE-IBOC, but that it was a problem with the load. HD Radio 101 states that the digital carriers like to reside at their "happy place" where the SWR is at 1.4:1 or better. With the wide-spaced two-tower broadside array at KLZ the SWR is over 2.0:1 on the sidebands.

What makes matters worse is that the upper sideband is at nearly 2.4:1. When the array was tuned up initially I had that sitting at a skosh over 2.0:1. Not optimum, but acceptable. Something has to have changed at the site, and I'm betting that it has something to do with what I mentioned above – the massive amount of rainfall that we've received.

However, getting to the towers has been impossible for the past few weeks. Even my tower crew with its big Dodge Ram 4X4 and off-road tires got stuck in the mud out there! Hopefully things will dry out soon and I can do some measurements of the ATU and tower bases and see what's going on.

A Few New Problems

I mentioned that the swap of the audio cards created some problems, didn't I? Well, apparently the linear PT/PR-353 cards need to receive their timing from the internal clock in the Intraplex. The MPEG PT/PR-250 cards also need to receive their timing from the internal clock. This poses a bit of a problem!

At the studio, I have one PT-353 card and one PTR-255 card (a bi-directional MPEG card). At the transmitter, I have a bank of four PT-250 cards. Now I cannot put both ends of the chain on internal timing as the clocks will "slip" over a period of time. That causes timing errors. Nor can I put one end on internal and the other on adaptive (also known as "recovered" timing, as it derives the local clock signal from that which arrives on the MPEG stream). By doing so I cause one end or the other to get out of sync!

So as soon as things slow down a bit, I'm going to try and put the linear cards in a separate cage with their own CM-20 interface and see if that will work. I thought that digital was supposed to be much easier than analog to work with!

LED Tower Lights

We are in the process of installing the first set of LED side lamps on some of our towers here in Denver. If these things work as advertised, they will save us beau coup money over the long term. The lifespan of these lamps is supposed to be at least 10 years. And considering that they use about 1/10th the amount of electricity than their incandescent counterparts, the savings should start adding up right away.

My biggest concern is lightning. Solid state devices and high voltage don't mix very well! And we get a ton of lightning every year. Dialight, the manufacturer of the devices, says that lightning won't be a problem. Time, as always, will tell.

Summer Projects

There are still a few weeks of spring left, but I'm already thinking about some of the summer projects that are heading our way. We are looking at upgrading the Canopy STL to the KLZ transmitter, as the current link is starting to get swamped with interference.

Then there's the NE-IBOC upgrades on all the exciters. If you've not contacted Nautel to get the latest version of the software (currently they're on v1.2) then you should do so. One thing to be aware of is that the new version seems to have different scaling values for the Magnitude/Phase Delay parameters. I had to adjust ours by over 10% to get the HD signal

to work. There are also some new "features" to watch out for. I cannot speak to the FM guys, but if you decide to upgrade an AM NE-IBOC, plan on at least an hour to get things tweaked back in again – and have the spectrum analyzer handy!

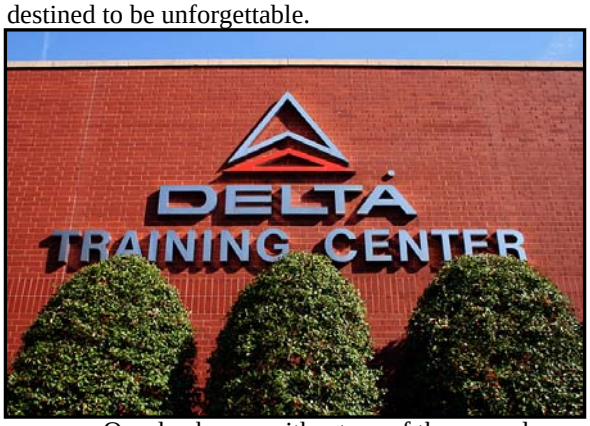
One other project that's in the works is the painting of the KLTT transmitter building. Maybe other places don't have this issue, but I just cannot find people that want to work! I've solicited bids from six different companies, and only one of them has bid the project. Two others have looked at the building, but they won't return my calls. Of course I am making mental notes of all those that won't respond, and you can bet your socks that I won't be calling on them for anything in the future!

Duty calls, so it's time to get back to the grind. Until next month... press on!

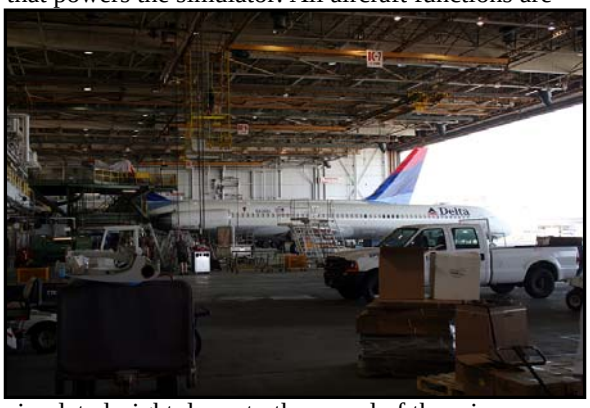
Digital Diary
by
Larry Foltran
Corporate Website & Information Technology Coordinator

This month, I decided to stray slightly from the path I've tried to follow during the last several months and write about a recent trip my dad and I took to Atlanta, Georgia. Nonetheless, there will be a tie-in to something computer related. So follow along and enjoy the ride.

Several months back, I was invited down to Atlanta by an acquaintance who is a Flight Procedures Instructor for Delta Air Lines. Many of you are probably not aware of the fact that I am a huge commercial aviation geek, among my other geeky interests. Needless to say, this type of trip was destined to be unforgettable.



Our day began with a tour of the procedures training simulators at the main training facility. These are exact flight deck replicas used to train pilots in basic procedures such as preflight checks, flight computer programming, auto flight set up and other areas. Delta basically uses these simulators for training in instances when the use of a full motion simulator is unnecessary. Despite the fact that you won't get bounced around when sitting in these simulators, they are still very complex and high-tech pieces of equipment. Each room contains a computer terminal where the instructor can program a variety of different situations and a very large computer cabinet that powers the simulator. All aircraft functions are



simulated, right down to the sound of the wipers.

Next, we made our way to Delta's TOC (Technical Operations Center) located to the south of Atlanta-Hartsfield International's runways 26L and 26R. We had the opportunity to walk around one of their enormous maintenance hangars and had an all-access pass to the several aircraft in for work that day. The first was one of Delta's Boeing 767s. We spent about 15 minutes sitting and chatting in its spacious flight deck and then walked the entire aircraft. What an eerie feeling it was to walk around a completely empty airliner. I also had an opportunity to do something that a lot of travelers don't get to do. I sat in first class for free!

We poked around several other aircraft including a 777 that had recently arrived from overseas and was in for some computer work. I naturally had to peek in and see what kind of computer power we were talking about. The

computer area on a 777 (or T7) is accessible through the forward luggage compartment. The computer room of sorts is located beneath and slightly aft of the flight deck. Although this area is normally not accessed during the course of a flight, there is a removable panel beneath the carpet outside the flight deck door that would allow the crew to climb down into the computer area. The navigation, flight control and assorted other computers area arranged in a rack-type configuration which allows for quick component replacement if necessary. Aside from the flight system computers, this aircraft is equipped with computerized checklists that are displayed on the flight deck information display, eliminating the need for hard copy checklists on the flight deck. The entertainment system powering the seat-back screens on the T7 is also computerized and runs on Linux. Yes, our well-dressed penguin friend is alive and well in today's commercial aircraft.

After a quick lunch, we made our way to Delta's full-motion simulator building. This had been

the moment I had been waiting for since we scheduled this trip. We boarded Delta's MD-90 simulator, an enormous metal box sitting on hydraulics. Well, that's the way I had to explain it each time I was met with a blank look after saying that I would be in a simulator. In reality, this high tech piece of machinery was designed to mimic the actual aircraft's movement and flight equipment. Outside of the simulator bay are two large computer cabinets. One controls all of the activities related to motion and the other handles the operation of the flight controls and visuals. I later read that each system is further divided into small sub-systems, relaying information via Ethernet packets at a rate of 50Hz.

Once we crossed the small draw bridge and entered the simulator, the "foyer" of the sim looked more like something I would imagine on a submarine. To the right was a large control panel with several monitors and two tall chairs on rails. Directly beyond was the simulated flight deck.

I was invited to take the left seat as the instructor prepped the simulator for "flight." The sim momentarily bobbed as if floating on water and a simulated Atlanta airport appeared outside the windows. The visuals on this sim are projected down onto a curved screen from a group of projectors visible from outside of the simulator. A Fresnel lens directly outside the flight deck magnifies the image and provides a sense of 3-D.

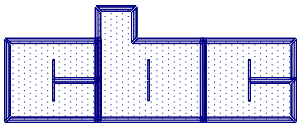
I won't go into every last detail of the four hours we spent in the sim, but I will say it was amazing. The first flight was a day trip from Atlanta to Jacksonville, Florida. I flew the aircraft manually for most of the flight and finally let our German friend take the controls ("Otto Pilot"). The return was a night flight with my dad in the First Officer's seat, helping me out with the gear, flaps and other controls out of my reach. The computer did an amazing job of not only simulating motion and flight, but also different weather situations, passing aircraft and turbulence.

Although the visuals seemed a little sparse compared to the flight simulator I run on my home PC, this specific simulator is probably close to 20 years old. I can only imagine what a newer simulators look like and what kind of processors they have "under the hood." I was told that many of these simulators run day and night, either used by Delta pilots or leased to other airlines. What's also impressive is that they only occasionally need to be re-booted, a process that normally take between 15 and 30 minutes to complete. A computer than can run for days without requiring a re-boot? It's obviously not running Windows.

Until next month…

KBRT • Avalon - Los Angeles, CA
740 kHz, 10 kW-D, DA
KCBC • Riverbank - San Francisco, CA
770 kHz, 50 kW-D/1 kW-N, DA-1
KJSL • St. Louis, MO
630 kHz, 5 kW-U, 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
810 kHz, 2.2 kW-D/0.43 kW-N, DA-2
KLTT • Commerce City - Denver, CO
670 kHz, 50 kW-D/1.4 kW-N, DA-2
KLVZ • Denver, CO
1220 kHz, 660 W-D/11.5 W-N, ND
KSTL • St. Louis, MO
690 kHz, 1 kW-D/18 W-N, ND
WDCX • Buffalo, NY
99.5 MHz, 110 kW/195m AAT
WDJC-FM • Birmingham, AL
93.7 MHz, 100 kW/307m AAT
WEXL • Royal Oak - Detroit, MI
1340 kHz, 1 kW-U, DA-D
WLGD • Birmingham, AL
1260 kHz, 5 kW-D/41W-N, ND
WLGZ • Rochester, NY
990 kHz, 5 kW-D/2.5 kW-N, DA-2
WRDT • Monroe - Detroit, MI
560 kHz, 500 W-D/14 W-N, DA-D
WMUZ • Detroit, MI
103.5 MHz, 50 kW/150m AAT
WDCD • Albany, NY
1540 kHz, 50 kW-U, DA
WPTR • Clifton Park - Albany, NY
96.7 MHz, 4.7 kW/100m AAT
WPWX • Hammond - Chicago, IL
92.3 MHz, 50 kW/150m AAT
WRCI • Webster - Rochester, NY
102.7 MHz, 6 kW/100m AAT
WSRB • Lansing - Chicago, IL
106.3 MHz, 4.1 kW/120m AAT
WYRB • Genoa - Rockford, IL
106.3 MHz, 6 kW/65m AAT
WYCA • Crete - Chicago, IL
102.3 MHz, 1.05 kW/150m AAT
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
WPHC • Cordova-Birmingham, AL
92.5 MHz, 2.2 kW/167m AAT

CRAWFORD
BROADCASTING
COMPANY



Corporate Engineering

2150 W. 29th Ave., Suite 300

Denver, CO 80211

email address: crisa@crawfordbroadcasting.com