# The Local E Oscillator

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#### MDCL

For many years, decades even, shortwave and medium-wave broadcasters in Europe and other parts of the world have been employing various methods of carrier power reduction that are dependent on modulation. The driving force behind this is the cost of power in that part of the world. If power is available at all, it is often \$0.50 per kWH (as opposed to \$0.10 - \$0.15 per kWH here in the States). A lot of stations have to generate their own power at an even greater cost. So anything that can save power is way beyond õgreenö ó it is an economic must-do.

One of the first things I learned as I was studying for my ham license way back when was that the carrier on an amplitude-modulated signal conveys no information. The carrier is, however, necessary to the proper demodulation of an AM signal, just as the 19 kHz pilot is necessary to the proper demodulation of the 38 kHz stereo subcarrier on a multiplex FM signal, so it has to be there. But does it have to be there at full power all the time? Research by the BBC and others says no.

There are two methods of AM carrier reduction in use in Europe. One method reduces the carrier during periods of low modulation. The other does just the opposite, reducing carrier power during periods of high modulation. Both methods have advantages and disadvantages. As I understand it, the method that reduces the carrier during high modulation reduces the peak envelope power of the transmitted signal, which may have some impact on coverage. The other method, if I have it right, maintains the peak envelope power but may result in a lower signal-to-noise ratio at the receiver in fringe areas (because the lower carrier power during õquietö periods will allow the receiverøs AGC to pump up the RF gain, and the noise along with it).

The FCC recently allowed testing of the various MDCL methods on AM stations operating in Alaska (where power is mostly generated on site,

according to the stationsøengineers). The results were encouraging, showing an average 30% power savings while employing around 4 dB of carrier reduction. Those results eventually led to a Public Notice from the FCC outlining a new procedure that will permit any U.S. AM station to employ MDCL control technologies.

When the Public Notice came out in mid-September, I immediately began investigating our options. As it turns out, Nautel employs the MDCL feature in all its current-generation NX-series transmitters, meaning that we already have it in the NX-50 at KCBC. All we have to do is get the FCC authorization and then turn it on. I learned a great deal more about MDCL at a technical session at the NAB Radio Show in Chicago last month. As soon as I got back to Denver from the show, I filed the required paperwork with the FCC and we are now awaiting grant. The FCC told me after the filing that our application was the first such request they had received.

Once we get the FCC go-ahead, KCBC will turn on the MDCL feature in the transmitter. We will initially employ the ACC method with 4 dB of carrier reduction and see what happens. This is an almost ideal test bed for the technology, since our target coverage area is some distance from our site (but still well within the 5 mV/m contour). We will experiment with the different options and amounts of power reduction and see what it does to the signal, both analog and digital, in both the local and distant parts of the service area.

Hopefully we will quickly find a set of parameters that we can live with that will save us a lot of money on our electric bill. If we do, I would plan to purchase the outboard device that provides the MDCL features for the KLTT transmitter (1995 vintage Nautel ND-50).

A 30% savings on the electric bills of these 50 kW AMs amounts to a lot of õgreen.ö Thatøs the

kind of õgreenö operation I want to have. If we save a little  $CO_2$  at the same time, all the better.

# RITOIE

Back in the mid-1990s, I was introduced to a new acronym,  $\delta$ RITOIE $\delta$  (pronounced *ri-tü-ē*). It stands for  $\delta$ Receiver-Induced Third-Order Intermodulation Effects, $\delta$  and the acronym was coined by the late Robert D. Greenberg who was at the time a supervisory engineer with the FCC in Washington.

On that particular occasion, we were moving an FM station to the WCMF-FM tower on the east side of Rochester. WCMF-FM had been on the receiving end of some very serious RITOIE interference created when another station in the market moved its transmitter site to a nearby tower. That station were strong signal would combine with another station s very strong signal in the receiver front-end, producing a third õphantomö signal right on the WCMF-FM frequency. In effect, this punched a õholeö in the WCMF-FM coverage for several miles around the other stationsøtower, in an area that was normally very well served by WCMF-FM. The story of this incident is long and takes a number of twists and turns, but when all was said and done, the outcome was, õtoo bad, so sadö for WCMF-FM; they had to live with the interference. Our stations relocation to the WCMF-FM tower produced no such ill effects and the move went fine (the station, which we no longer own, still operates from that site).

In the years since, I have always been diligent about running a RITOIE study anytime I have considered a new site for one of our FMs. So far it has not been an issue. But last month, I observed a clear case of RITOIE interference involving one of our stations that has likely existed for many years.

The situation is in downtown Chicago, where 26-some-odd stations transmit primarily from two õantenna farmö rooftops, namely the Sears and Hancock towers. Our station which is affected is WPWX with a transmitter site some 17 miles to the south-southeast. I was driving the signal of WPWX with its new transmission line and directional antenna, and I started downtown where I was attending the NAB Radio Show. I noted that WPWX had a strong signal downtown, but in some locations the receiver would be captured by another signal ó signals (plural), actually. What I heard was audio from two or more other stations, one of which was really overdeviated. Iøve heard that before. Itøs the telltale sound signature of RITOIE. It didn¢t take me long to figure out what was happening. The frequency of one downtown signal was doubling and subtracting the frequency of another downtown signal and spitting out a new signal right on 92.3 MHz, the WPWX frequency. Of course this new õreceiver-inducedö signal was extremely strong and WPWX could not overpower it.

I did a little research and found several combinations of downtown stations that would produce third-order products on 92.3 MHz, all 2A-B products (which is what it usually is in the FM band). That should come as little surprise considering all the signals that are down there.

So what does this mean for WPWX? It means that like WCMF-FM, we live with it. There are, in my estimation, very few õfixedö receivers in the downtown area that would qualify for FCCrequired interference protection. Portables and mobile receivers are not protected devices, and letøs face it, thatøs what people are listening on these days.

It does, however, give us a good idea of what we@re dealing with, and however frustrating it may be, we know not to waste further time, money or resources on signal improvement where there can be none.

The good news, though, is that WPWX has a killer signal everywhere else. I have never heard it sound so good, both in terms of signal strength and sound. The new antenna and transmission line made a big improvement in coverage, and the new transmitter and audio processor make for a formidable combination. People listening anywhere outside the immediate downtown area can¢t help but notice the difference.

One more thingí while I was at the WPWX transmitter site, I looked at the ends of the 20-foot sticks of 3-1/8ö rigid transmission line that we took down to install the new Andrew 3-inch Heliax. What I saw was unsettling. On what had been the top Teflon disk on just about every stick of line was an accumulation of carbon, and several of these had arced. All those years of chafing at each bullet had resulted in a deposit of tiny metal shavings or dust on the top Teflons. From the looks of some of those, we were about one ice storm away from a catastrophic failure of that transmission line. Further, discoloration at virtually every end Teflon revealed how much power was being lost in the line due to heating in those no longer solid connections. It was a sobering observation and provided a lesson to be learned.

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

Hello to all from Western New York! Last month, out of the clear blue, I received a visit from

Roy Sampson, the Broadcast Marketing Manager of iBiquity Digital Corporation. Roy had stopped by the station to discuss what iBiquity has been doing as of late to promote what type of receivers are currently available for consumers purchase and to talk with stations about HD-R in general. Wellí we had a hearty discussion! Itøs been almost six years since we went on the air in Buffalo



Unless it a freebie commercial (or infomercial, however you want to look at it) that our

listener heard on WDCX-FM, I seriously doubt that any of them have heard or seen any print advertising for HD Radio. I am a frequent reader of several õHot Rodö magazines, and never have I seen an advertisement for HD Radio. The same holds true for many of the finer home improvement companies that also feature electronics for the home. The information simply is not getting to the

with HD, and NOW we see an iBiquity rep? Where were these guys for the past five years while we were advertising, promoting and more importantly, maintaining our HD-R equipment? You can kind of see where our conversation was going. I expressed my total dissatisfaction and disappointment in the manner in which HD-R has been promoted up to now. I could feel the hairs on the back of my neck starting to bristle, so I thought I should tone it down a few notches and give Roy a chance to plead iBiquityøs case.

#### Here We Go

Roy began by showing me a catalogue (Canadian spelling) with a number of HD receivers in it, expressing how many manufacturers have come on board and are manufacturing receivers with built-in HD tuners. I looked at the list, mostly in-dash units, but a few desktop and even some nice portable hand held units, and handed the brochure back to him. Now it was my time. Of all the tuners I just looked at, name just ONE store in Buffalo that has even one of these radios in stock. He began by mentioning Best Buy, but I quickly nailed that one ó Buffalo-area BestBuy stores do not display HD radios and the sales goons dongt even have a clue what HD Radio is. I explained to Roy this simple fact: until the discount retail department stores, i.e. Wal-Mart, Target, Costco etcí start offering these radios for sale, the public aingt buying!

consumer! Roy began to understand my frustration, and decided he had better move along to another topic where he felt sure he was going to win me over, new cars equipped with HD-R technology.

As soon as I heard this, those nasty little hairs on the back of my neck began doing the twist. Roy began by stating that there were over 100 models of 2011 automobiles and trucks offering factory installed HD-R technology as an option in their vehicles. Now, I am really holding back the urge to jump up and down in place, shake my head violently from side-to-side, and spew random vulgarities at this guy!

õPlease,ö I said, õtell me what brands of vehicles ARE offering the HD receivers?ö He began the list with Mercedes Benz, BMW, Audi, Jaguarí HOLD IT! Are there any 2011 new vehicles that the average Joe could afford that have HD Radio as a factory option? Did you have a good look at the traffic as you drove in here? A lot of Toyotas, Dodges, Chevrolets and Hondas here, doc. Weøre a working-class town, with working-class salaries. The majority of the people in Western New York couldnøt even spell Volvo, much less purchase one.

The second fact I brought out to Roy is that until the auto manufacturers put these receivers in cars that people can AFFORD, they@re wasting their time. I saw a Land Rover on the thruway once of I think it was from Vermont of but you can bet your bippy they are as rare around here as Buffalo Bills Super Bowl rings! There is probably only about five percent of the population in Buffalo that can afford a Mercedes Benz, Rolls Royce or even a Tesla (what the heck is a Tesla?). Roy is really starting to even FEEL my frustration now, and the conversation moves onwardí

Unsure about what to talk about next, Roy opened the discussion by asking me what should be the next step in HD-R reception. Never unsure for ideas or advise, I explained to Roy that the biggest push iBiquity should be doing right now is getting together with the portable/cellular phone companies and developing a way to get HD reception in these contraptions! It seems everybodyøs got one (except me, I still use just a cell phone, no additives) and especially the younger generation, I believe would pounce on this FREE media instantaneously! Imagine, local radio offering nothing but music on an HD-2 channel, how cool is that? And I can get it free, and also tag the ones I want to download and purchase.

This is where the industry should be applying the most concentration right now, in cellular reception. It is hot on the consumer ind, and they have money to spend. Once they get hooked with their portable devices, then they will begin looking for ways to extend that into their autos and homes. Face it, iBiguity, and I dongt mean to offend anyone here, but you guys failed in marketing HD Radio. But, I dongt think itgs too late. Get aggressive and flood the market with advertising, receivers and stores where they can be purchased. Want to even get housewives interested? Offer a 20 percent off coupon in Sundayøs newspaper. If others are anything like my wife, if it has a money-off coupon, it go got to be good and sheøs gotta buy it! And Roy, please send me the receipt for the bottle of aspirin you bought after you left. In all fairness, it is the least I could do to reimburse you for your headache!

# WDCX - Buffalo, WDCX (AM) - Rochester

We will soon be installing a new Nautel NV-40 transmitter here at WDCX-FM. The transmitter arrived at the movers on Monday, September 26<sup>th</sup>, and plans are to begin the installation the first week in October. Once the transmitter is up and running with complete satisfaction, we will begin to dismantle our old 10-bay antenna and replace it with a new ERI 10-bay SPHX-series antenna.

We had ERI measure and plot the antenna relative field patterns for various mounting orientations in both the horizontal and vertical planes, to determine which orientation on the tower would provide the best signal into and around the Toronto area. In recent years, the Canadian government has allowed several new FM stations to go on at 99.5, which has greatly reduced our coverage towards Toronto and Hamilton. By optimizing the orientation of the antenna, we can õtargetö the area(s) which would produce the greater number of listeners and potential advertising clients. I ask your prayers that the money spent on this project has been put to good use and that the Lord would bless us with a bountiful harvest of new advertisers and most importantly, listeners.

# WLGZ – FM - Rochester

I will include a full report next month on the happenings in Rochester over the past several weeks. I have simply run out of time, but I would like to fill you in on the events occurring over the past month or so. The Rochester market is growing rapidly, and WLGZ-FM has improved by leaps and bounds. Stay tuned next month for all the detailsí . (Hey, that¢s an old-time radio teaser!)

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 Local Oscillator October 2011

# The Motown Update By Joseph M. Huk, Jr., P.E., CPBE, CBNT Chief Engineer, CBC–Detroit

Last month, I mentioned we were examining our current lightning protection at the studio and WMUZ transmitter facility. This month we have been planning the replacement of the Stati-Cat static

dissipators and the ground system around the 500-foot free-standing tower. In addition, we had some issues with our Nautel NV40 transmitter.

After evaluation of the anti-static arrays, we determined that it would be wise to replace them since there were enough pins that were dulled, deformed our outright missing to significantly weaken the effectiveness of the suppression system. The parts have just arrived and we have

our tower rigger scheduled to install the arrestors.

In addition to replacement of the arrestors we also decided to replace the ground system under the WMUZ tower. Even though we were getting relatively good conductivity measurements, we felt that there still could be deterioration to the copper



# Clamped ground straps to the 3-1/8" lines are not good lightning grounds

wire, welds, and ground rods below ground.

The static-suppression and ground system was installed about ten years ago and has historically

worked very well. Therefore, it has become time to restore the system. Cris indicated I should also look over the grounding throughout the facility and make sure I have ferrite suppressors on audio, data, and

power cables.

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When I took a second look at our towerøs transmission lines, I remembered that the tower riggers mentioned I had arcing where a copper ground strap was tied to each transmission line and clamped. They cleaned up the connections and re-clamped the copper strap. This may serve us well in short, but I believe that in the long run the corrosion between the strap and the outer part of the transmission lines will return. So, I am also going to have the riggers install a ground kit for each of my 3 1/8ö transmission lines. Then I

will have them run a large-diameter, low resistance wire from each ground kit to the towerøs ground system, connected by a CAD weld. That should provide a direct low resistance path for the current to go. In addition, I am going to make sure that anywhere the connections are clamped, we implement a CAD weld.

#### **NV-40 Transmitter Issues**

Initially, after our lighting strike, the transmitter had a few damaged RF amplifier modules. Three of the modules were replaced while one module only required a single PA module replacement. When replacing the PA amplifier board, you must subsequently program the calibration constants for that module into transmitterøs main board controller. This is done with a laptop computer with a serial port and terminal program.

After the work was completed, we were returned to full power (27.6 kW) with one remaining issue. There was still an indication that one of the RF modules had another defective PA amplifier board. To confirm this, I needed to swap the suspect module with a known good one. Since I had some other tasks to complete during the week, I figured that Friday was a good time to make this last check. Unfortunately, after the routine swap of modules I realized that I had issues with modules reseating properly within the transmitterøs frame. Since modules had been swapped on other occasions, locater pins on the backplane of the transmitterøs cabinet started to loosen up and bend. This caused misalignment of the modules over time. I think I reached a point where the pins and edge connectors were wearing out. Nautel is sending me parts to rework a cube where four of my RF modules mate with the transmitterøs connections. Hopefully, in short time we can get our dependable Nautel NV40 rig back to normal again. I will report back next month on how things work out. Until next time, be safe, and if all goes well, we will be reporting to you from the pages of L.O. next month. Best regards.

# News From The South By Stephen Poole, CBRE, CBNT, AMD Chief Engineer, CBC–Alabama

Wow, it is already October; we is 3/4ths of the way through another year. Time flies when you is having fun. And the fact is, there is nothing more fun

than putting up with the high heat and humidity that has been afflicting the southeastern United States for months now. You folks Up Nawth think you know what õhotö is, but come to Alabama and Iøl educate you real good. Itøs not just the heat, itøs the humidity. Our air conditioners donøt drip, thereøs a *stream* of water coming out of them while they run.

As I write this, it has finally cooled off a bit, but the first part of September, I had to keep checking the calendar to make sure it wasn¢t July.

# A New AC for Tarrant

Weøve all ranted about how todayøs air conditioner units just donøt seem to last as long as the older ones. I realize that there are reasons for that: for one thing, the new, higher SEER units run at much greater pressures and include a number of õsmartö control circuits, all of which require more frequent service.

But to be fair, we got over ten years out of the Trane unit at the 850 AM site in Tarrant, and it was time for a new one. We had already replaced the compressor in this unit once, and it was still only working about half the time. (You can see the carcass of the old compressor to the left in figure 1.) When it did work, it would bang, growl and complain. I knew it wasnøt long for this world. After some discussion with Cris, we included it in this yearøs budget.



One thing that we did when we rebuilt the transmitter site in 1999 was to put the outdoor unit behind a cinderblock fence to discourage thieves. The

problem was, that fence was blocking airflow to the unit, reducing efficiency and resulting in more frequent service calls. As part of this project, we opted to demolish that old block wall and put a chain link fence of some type around it.

The HVAC contractor demolished the old wall as part of the job, but Todd, Jimmy and I opted to erect the fence ourselves to save the company a little money. We

didnøt need anything elaborate, and this was such a small fenced area (about 10øby 10ø) that it wasnøt worth bringing in a fencing contractor. Our solution was to purchase a dog kennel from Loweøs, bolt it to the concrete pad and then lace it with an electric fence wire. (Heh.)

(By the way... Iøve mentioned this before here, but it really bears repeating: nothing, and I repeat, *nothing* that weøve tried has been as effective against thieves as electric fence wire. I never would have believed it, but itøs true. These idiots will cut a fence and then try to steal copper from a power company substation, or climb a cell tower to get at the coax, but they *will not* cross a simple õpetö fence, which doesnøt even have enough current to be harmful. Weøve watched them in our security videos: as soon as they see the yellow warning signs, they slink off into the sunset. Who wouldøve thought?)

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Figure 1 - Demolishing The Block Wall And Removing The Old Unit



#### Figure 2 - Todd Dixon Builds the New Fence

With the new unit in place, we simply walked the prebuilt fence frame up around the outdoor unit, anchored it to the concrete pad, and installed the fabric. Finally, we added that allimportant strand of electric fence wire and tied warning signs on each face. (Heh again.)

We only ran into one snag, turning this into a two day project: the contractor has mistakenly ordered a 240 volt outdoor unit, and we have a 480 volt main. He asked if we couldnøt just tie into our 240 volt supply (which is provided by a transformer inside the building), but I didnøt want to do it. That transformer would probably have handled the additional load, but I figured, why not do it right when we have the chance? The contractor had to remove the 240 volt unit, take it back to the warehouse and pick up a 480 volt assembly to be



Figure 3 - The Fence Frame in Place, Ready to be Anchored

installed the next day.

Once it was in place, the building cooled right down. The new unit is much quieter, too. I think wedl get many years of good (and cost-effective) service out of it.

Incidentally, we had to install a new unit at our house a couple of weeks later. Our own AC started freezing up and nothing the repairman could do would stop it, so we bit the bullet and financed a new 13 SEER unit through Alabama Power. All I can say is, I should have done it years ago; the new one will make ice on the kitchen floor!

#### A Trip to New Bern

My family went to the NC coast the first part of September ó right after Irene went through Wilmington, in fact; it almost made them cancel the trip! Sandy and I considered going down there to meet them and to get a little NC seafood, but we just couldnot work it out. Sandy was unable to get any leave around Labor Day, which is when my family would be there.

But as proof that we can be impulsive, we kept saying to one another, õHmm... NC seafood, and NC barbeque... that sounds good!ö We hadn¢t taken a decent vacation since last November, so she and I both decided to take some time off the last part of September. We flew to Wilmington, NC (through storms on the trip out and on the trip back, by the way), and to make it a õworkingö vacation, I scheduled a trip to tour the Wheatstone facility in New Bern, NC.

Youøve heard me say before that most broadcasting equipment is made by the equivalent of high-tech cottage industries. Think about it: Nautel doesnøt sell ten transmitters a day, do they? These are high-priced, special order, built-to-spec items that are rarely mass produced. Well, there are cottage industries, and then there are *high tech* õcottageö industries. (Tongue is firmly in cheek, here.) Wheatstone definitely fits the latter category.

You might have an image of a couple of guys assembling Wheatstone, Audioarts and Vorsis products in a garage somewhere, but in fact, the Wheatstone factory in New Bern is state of the art. While they dongt have a Ford-style assembly line, they do have computer-controlled laser cutting and metal õbrakeö bending machines, with dozens of people working at any moment on their various products. They can make up custom orders almost as fast as they can build their standard products.

Watching them put together an Audioarts D-75 console was kind of interesting. They first bend up and fabricate the case, then put a õbirth certificateö in it -- a checklist that is followed rigidly as the case is slowly loaded with components. At each point, they check everything thoroughly, and the employee will actually initial each assembly with a felt tip pen (look inside your own Wheatstone stuff; you¢ll see these initials all over the place).

Wheatstone combines a lot of old-fashioned hand-built TLC with the latest computerized processes. For example, they have a new automated gadget that will examine each PC card for flaws, highlighting possible trouble points immediately after assembly. A technician can then take closer look under a stereo microscope for each possible flaw. While I was there, we watched a young lady remove a little surface mount resistor and replace it with a new component as smoothly as you could ask for. Took her about ten seconds. I wish I was that good at working with surface mount stuff!

Sandy and I were also allowed into the topsecret processing laboratory, where Jeff Keith and Mike Erickson develop the Vorsis line. The racks inside that room contain all of the popular processors from the last several years for comparison, and they actually have a small FM transmitter with a modulation monitor so that they can listen to a true air signal when making adjustments. Jeff Keith, with whom Iøve corresponded in the past (primarily while writing the SBEøs processing course), gave me the tour.

Jeff and Mike have explained to me some of the differences between the Vorsis and other processors. For example, their top of the line units allow you to choose whether to do the final clip before or after preemphasis, resulting in slightly different sounds ó what some would call õOptimod vs. Omniaö timbres. It was cool to see that they actually listen with Mark-1 Human Ears on excellent studio monitors; itøs not all theoretical work or test equipment (though they certainly had that). Even more exciting to me was the fact that theyøre developing a new õstreaming applianceö processor, which combines the processing and codecs in a single-space rack unit. Iøm very interested in that for the future. Weøre using the older Vorsis HD-P8 processors on our streams at present and are tickled pink with them; I want to demo one of these õappliancesö next year.

All in all, Sandy and I thoroughly enjoyed our tour. The fact that Wheatstone provided lunch in the form of honest-to-goodness Eastern NC barbeque from Mooreøs Restaurant didnøt hurt, either!



# Stephen and Jeff Keith In the Vorsis Lab

#### Trango

We are in the final stages of putting a Trango 18 GHz microwave system onto the link from the WDJC site on Red Mountain to 1260 AM (WYDE). The price keeps going up on our T1 line, so we budgeted to do just that for this year. We only ran into a couple of snags while setting up our Trangos, but after Cris dialed in and noted that the ports had never been enabled, and after I discovered that the Loopback was still turned on(!), they started passing data like a hose.

Weare going to have Southern Broadcast Services fabricate a bracket to go onto that old selfsupporting tower at 1260. It as built of galvanized angle stock, so thereas no feasible way to use the Trango-supplied clamp; plus, we have to watch for the unipole lines running up the tower itself.

Todd and I have been tickled at the thought, though ó the fact that liløold 1260 AM, all 5,000 watts of it (a whopping 41 watts at night) will have a 44 megabit link when we/re done is a hoot. We may have to put something down there in the transmitter building to eat some of that bandwidth just so we can say we did!

Until next time!

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

#### **Re-Thinking the Over-the-Air STL**

You know you@re in love with what you do when not only do you learn more about your field, but you really enjoy learning itô indeed, you revel in it, and even sometimes make knowledge. For instance, HD Radio has not only been for me a real learning experience, it@s been a fun one, and with the advent of multi-casting, another

aspect of the learning experience has presented itself. Simply put, the days of the 950 MHz band STL, at least for FM stations, are numbered.

This isnot rocket science. The 950 band was allocated for broadcast STL back in the forties (or was it the fifties) to provide for exactly one station, one audio channel or a pair of stereo channels, from studio to transmitter site. Period. Every engineer knows that. The band used to be bigger, but for decades it has been all of ten MHz wide, with twenty 500 kHz channels. First mono, then in the sixties, FM stereo, then in the eighties AM stereoóall these could be accommodated nicely, since a only one stereo or two mono channels was all that was needed to be transmitted. Analog audio, even with FM baseband as the modulation mode, didnøt even take up a whole channel. The telling truth was that, up until the 1990øs STL FM receivers designed for reception of the entire half MHz channel width didnøt even exist. Moselev broke that mold with their 6000 series STL rigs, which, when coupled with their digital encoders and decoders, could both take up the entire channel, and in their later models, could transmit up to two stereo channels in an APT-X companding format utilizing MP2 algorithms. By comparison, while Marti STL transmitters could do that much bandwidth, their STL receivers could not, and were never designed to. Here in Chicago we still use 6000s as the primary STL link on one of our stations, and as backup rigs on two others. We even have a Marti STL-15 in service, transmitting digital audio.

But then along came HD Radio in 2003,



followed by multicasting in 2004, and then it was

õKaty, bar the door!ö Making HD Radio sound as good as its potential required that the entire audio path, including the STL, be õlinearö; that is, just like a CD, with no digital compression, avoiding conversions between analog and digital. At that point, although few beyond the design lab knew this, it became necessary to abandon FM as the

modulation mode of choice in favor of AM, or more precisely, Quadrature AM (õQAMö). This allowed for a high rate of data throughput in the half MHz of bandwidth in a channel, which was a good idea as far as it went, but it wasn¢t long before the real world found a fly in the ointment ó QAM is *really* susceptible to interference, especially from FM signals occupying the same channel. Add to that a crowded STL band in a major metropolitan area, add a fun little tropo band openings in spring and fall, or whenever, for good measure, which can be found in any market, and you have an instant reliability problem,.

And, what if a station must utilize more than two stereo program streams in its STL? On the 950 MHz band, forget it; it won¢t happen. Four audio channels, comprising two program streams, just stuffs it.

This is why alternative frequency bands are beginning to look more and more attractive. In particular, STL operation in the 11, 18 and 23 GHz bands is beginning to find advocates throughout the broadcast engineering world. The CBC stations in Denver have been utilizing GHz band STLs for quite some time now and, as this is being written, CBC-Chicago is poised to inaugurate STL service on a multi-GHz band for one of its stations, with a second station likely to do the same in less than a year. Please note, these are coordinated, licensed channels, and they cost to get, but oh the benefits!

What are they? For one thing, IP connectivity. At the present state of the art, connect

your Ethernet-based audio system (or make a conversion of your analog audio chain to digital, IPbased) and go; maintain or adjust the system from off-site, using your web browser; 44 mbps channel throughput, which means no digital compression need apply; and up to eight stereo (or sixteen mono) audio channels accommodated in one fell swoop. Got multiple FM stations at one site, all with HD multicasting? Well, there you go. Want more control functions for your sites? The Wheatstone IP-88 Blade unit will interface nicely, and give you both audio and control closures available on a web browser. World Cast has its Horizon box, which provides one audio channel pair per box, and you can install up to eight on an STL. We have three on our current STL project. Weøl use the IP-88 Blade next time around.

A big impediment to STL use in these GHz bands was recently removed by the FCC. Cris Alexander talked about it in these pages last month. The õfinal RF linkö prohibition no longer applies, allowing licensing of a GHz-spectrum STL, although employing an 802.11 link as the final RF link is *still* the best way to go to get your audio data across the base insulator of an AM stick.

As an aside, Iøm told that Kintronics is out with a device which would actually isocouple your CAT-5e across your AM towerøs base insulator. How well would that work for, say, 50 kW of RF into a half-wave tower, if I may be so bold as to ask? For my money, the little RF hop with a 5.8 GHz NanoBridge is still the most elegant and least expensive way to get digital STLs past the base insulator.

The point is, if yours is a station doing HD multicasting, or multiple radio stations at the same site, and youøre casting about for ways to get all those program channels from here to there, and the thought of the cost of a T1, which is high and goes forever, brings a tear to your eye, you can do worse than to check out a link via the 11, 18, or 23 GHz bands. Iøl keep you posted as to how our setup is working.

#### Antenna Follow-up, and then some

As this is being written, it has been just over a month since the new WPWX antenna was installed. It took more time than usual for the FCC to get its act together to license the pattern and allow the stationøs ERP to go back up to 50 kW from the obligatory half-power level due to a snafu with their database in Washington, but even while operating at that reduced power, the difference in coverage was already apparent. Remember that the previous main antenna was not a circularly-polarized array, but rather an H&V type; that is, there were separate elements for horizontal and vertical polarizations.

This new ERI antenna has two distinct differences from the previous one. First, the new antennage circularly polarity reduces multipath a great deal. This is especially apparent downtown in the middle of what the late Paul Harvey used to call õThe Alabaster Asparagus,ö where the multipath has plagued the Power 92 signal since forever. And second, the half-wave spacing of the six levels of the antenna (I hesitate to call them õelementsö since there are actually *thirty-six* elements in the antenna, with one driven element and *five* reflectors at each level) means far better control of the vertical pattern, resulting in less signal going toward the nearby ground (and also, by logical extension, up toward the sky) and a lot more signal going out toward those listeners in the range of 15 to 25 miles. That can¢t have helped but make a big difference in our coverage.

There have been drive-arounds of our target listening areas by most of the Chicago management team, including myself. Results have been gratifying, particularly in the downtown area. And, get this, it is all being done on an antenna which has allowed us to *lower* the transmitterøs output power, from 24.3 to 20.7 kW, a difference of 15%.

Weøve discovered something else as well. Remember that the transmission line was replaced as well, from rigid copper, installed in twenty foot segments, to a single run of Heliax, with new hardware at both ends. In examining the old line after its removal from the tower, we discovered that a number of the Teflon insulators had been damaged by heat. Some had even started to turn black. Translation: we had dodged one scary bullet (no pun intended). There is no doubt about it: that hard line was headed for failure at some point in the not-toodistant future, which would be a catastrophe, and, we believe, it was costing us some power to the antenna, resulting in loss of coverage and listeners. Now that that a corrected, the future here at Power 92 can only be looking up.

And that is not all. As this is being written, another of our Chicago cluster stations has also had an antenna alteration. Buoyed by our success with WPWX, engineering went to ERI to see if any kind of improvement could be done in the WYCA signal into Chicago as well. In the last number of years our signal from the Beecher site has had challenges from a couple of sources, the entry of a new LP station near Michigan City some 40 miles to the northeast of the WYCA site and the addition of HD service at our second adjacent neighbors in Chicago. We wanted ERI to find out if a change in antenna configuration, any change, would result in a meaningful improvement in the coverage of the station toward Chicago. Anything was fair game: a different antenna was not ruled out; nor was a change in our existing two-bay antenna full-wave spaced antenna. ERI did its job nicely, and the result was a sizable stack of pattern studies for Cris Alexander to look at in his spare time.

And, surprise of surprises, the best looking result we found, did not require the replacement of the existing antenna, but rather moving it around its pole mount a mere 30 degrees! Which we commissioned our friends at Rhodes Tower to do, gladly, in a two-hour period on a pretty morning in September. That project, from study delivery to completion, took all of *four days*!

Did it make a difference? Surprisingly so!

The peak lobe of the pattern, produced by the antennaøs relative position on the pole, was moved around from the general direction of Lake Michigan near the Michigan/Indiana state line, to straight at Chicago. The signal is full-quieting in Hammond now, and the real null in the pattern, which had been pointed at the corn fields to the southeast of the Beecher site, is instead pointed more toward the cornfields in the direction of South Bend, Indiana, where, wouldnot you know, there is another station on 102.3 MHz. Idl bet the folks at that station would be just thrilled to hear about that, if ever they were told. But our loyal 102.3 Chicago audience should be even more pleased when they tune in to Rejoice 102.3 FM. Time to burn more gas on another signal drive.

Until next month, Blessings to you all!

# The Portland Report By John White, CBRE Chief Engineer, CBC–Portland

The disassembly instructions began with the words õPry the cover.ö Words that hardly inspired confidence. With some reservations, I decided to proceed, illustrating both the power and limitations of the Internet.

Some six weeks ago I was rebooting the streaming computer which is on a KVM switch with the NexGen server and DRR. I switched video to the streaming computer and waited for the computer to start up. And waited. Nothing. So I at first suspected I had switched to the unused channel on the KVM. Hmmmí . No video for any of the computersí just a green blinking light on the monitor.

Ultimately, it turned out the monitor was dead and I replaced the monitor. I didnøt think much more about it until a little over a week ago when I got a call that the control room NexGen monitor was downí for the same reason. The computer had been rebooted with no video and a green blinking light on the monitor.

With that, the game was afoot with a new mystery to puzzle out. Yet the control room was still

down and the obvious solution was to temporarily borrow the monitor from the production room. The result: the control room NexGen computer rebooted with no video and a green blinking light on the borrowed production room monitor. So yet another

> monitor was borrowed and the control room was back in business and now I had a mystery on my hands.

Why did *three* NexGen monitors fail in the space of some six weeks? I had four common factors to work with: the monitors were all connected to the same computer system, they were all the same make of monitor, they were the same

age, and two of the failure scenarios were identical with the third similar to the other two. All of which raised the question: what exactly is going on here?

My next thought was to do a search to determine if there was an actual pattern to the failures. For that I chose an Internet Bing search for õDell monitor green blink.ö That search produced 784,000 results, suggesting a systemic problem.

Winnowing through the results produced some interesting additional information. Many of the



failures occurred on boot-up or after the monitor had been idle. The monitor had been fine but did not work when turned back on or on wake up (the failure mode for all three monitors at KKPZ). Others were more specific, reporting failures of capacitors in the monitor power supply õdue to heat.ö That report is also consistent, as a switching supply can continue to run with weak capacitors but not be able to start up on wake-up or power-up conditions.

With that information in hand, I decided to investigate furtherí hence the disassembly instructions to õpry the coverö of the monitor to take it apart. Many parts of the monitor assembly are press fit, with minimal use of screws. Subassemblies are attached and connectors are provided allow assembly to integrate the sub assemblies into the finished monitor.

Once I got to the power supply, I did find two failed electrolytic capacitors. Other similar capacitors nearby are just fine, which calls into question the diagnosis of elevated temperature conditions as the cause of the failure. An inspection of the circuit layout revealed that the failed capacitors are at the lowvoltage winding of the switching transformer and likely the input capacitors of the low-voltage DC filter. My bet is the failure of the capacitors is the result of ripple current, either exceeding the ripple current rating of the

component or failure of the capacitor to meet ripple specifications.

This has been a hot button for power supply design as nearly all discussions simply ignore ripple current totally. In a rectified supply, the input capacitor chargers quickly to the peak voltage, then discharges to supply current to the load. For a oneamp power supply, the peak capacitor charge current can be as high as 60 amps, a daunting ripple current requirement!

Now that I have the monitor disassembled I plan to try replacing the capacitors and see what happens. The connectors will be a limitation as they are intended to allow assembling the subassemblies

into a finished product. Designed for one-time use, they do lend themselves to disassembly and reassembly. (Hint, watch for small plastic pieces that disappear on assembly.) More on this project next month.

#### **Regional Test**

On the west coast, this monthøs Required Monthly Test was originated at the tsunami warning

> center and distributed via the Weather Service to Washington, Oregon, and California. That test went well from a logistics point of view, although it did suffer from the deterioration of the daisy chain of repeated playback and recording.

I have to say that state and local emergency management have been doing an outstanding job focusing on warning and local citizen response.

Local emergency services have learned a lot from the Loma Prieta earthquake. After the quake, it was found that 90% of the rescues were done by residents and neighbors. Here in the Portland metro area, emergency management is putting a lot of effort into training ordinary people how to safely make rescues. The teams have a variety of names, SERT, NERT, and NET but the concept is the Neighborhood Emergency Team, or neighbors helping neighbors.

The program has a heavy focus on Ham Radio communications from the field teams to the local fire stations and then to the local Emergency Operations Center. Then from the EOC to other EOCs and the state operations center.

The focus is on the people as part of an emergency response. Always a good bet.

#### Done!

In past months, I talked about the tower base insulator replacement here in Portland. That project is now totally closed with the painting of the insulators this month. An Orange letter day.



The replacement insulator assemblies are now painted. Note that we bagged the lower porcelain insulator before painting!

# Rocky Mountain Ramblings The Denver Report by Amanda Alexander, CBT Chief Engineer, CBC - Denver

#### **Time Flies**

Does anyone else think this year is flying by? I thought it was just last week that I submitted my September column for *The Local Oscillator*. I still can¢t believe it is already October. Halloween is not that far away, candy is out in all the stores. And just the other day, I went to Lowe¢s and they had all

their Christmas stuff out. Yesí CHRISTMAS! Where has the time gone? If you find it let me know.

#### **LED Sidelight Markers**

You might remember that back in August, we had a set of LED sidelights go out on two of the towers at KLTT. We got them warranty replaced and installed. I guess Rick in St. Louis has been having issues

with his LED lights, too. So upon further investigation we found that we somehow got the wrong sidelights. The ones we got from TWR Lighting were not meant for AM towers. The RF I guess is just too much for them. After some work, we have been able to get all twelve of ours and all four of Rickøs warranty replaced. They should be in any day now and installed shortly thereafter.

#### Inventory

Inventory is finally done. This year I didn¢t have nearly as much missing as last year. I still need to keep better track of items. I have somehow lost one of our AEA HF Analyzers. I remember where it was last year, but this year, it has moved. I don¢t remember loaning it out to anyone, so where did it go? The prairie dogs at KLZ must have broken into the building and taken it. Silly dogs. During the year, I normally don¢t think about or realize how much stuff we have. Then I get the list from my dad and I realize we have a lot of stuff! 90% of it doesn¢t move, ever. But that other 10% moves around a lot. My goal for the upcoming year is to keep much better track of everything. When something moves, I¢ll open up the spreadsheet on my computer and mark it.

#### Maintenance

I am busy working on maintenance of the

sites. KLVZ is off the air now and it is the best time to do any ATU work or transmitter work. I have created a list of what needs to be done at each site. The work at KLVZ is just a part of the big maintenance picture. This work includes cleaning the inside of the transmitter, phasor and ATUs along with cleaning up the field outside and just trying to

> get it looking decent. We have not had to mow out there this year, and somehow got away with a ton of thistle.

Last year, Weld County got onto us about the thistle, even though it wasn¢t the noxious Canada thistle that they worry so much about around the crops in the county. Jerry Ford, the guy that grazes horses on the land, was able to get his horses out at the site near the end of growing

season and they were able to eat mostly everything up. I might get the tractor out there one day and do a quick pass through of the site ó it just isnøt that big (15 acres).

KLTT seems to be the site that suffered most this year in the growing department. We normally have horses out there year round to keep the property õmowedö down. This year, they werenøt there and it looks like a forest. The tractor is now out there and ready to be used. We havenøt needed it in awhile because of the horses, so it will be nice to get some good use out of it. I am hoping that by mowing before winter, when spring finally arrives, we will already be ahead of the growth.

Last year we put down some Noxall (preemergent herbicide), but I guess without rain for several days it doesn¢t work. It is much like fertilizer, the water activates it. It did work well at the KLZ towers, but the other sites are bad. If next year is anything like this year, I plan on buying herbicide to kill it all off at least. Hopefully we can get the Noxall on it and just put some water in our sprayer and have some fun.

I am looking forward to fall. The temperatures in the Denver area have already been pleasant. It provides the perfect weather to do outside work. My list is ever growing but, that gives me something outdoors to do every day.

#### **SBE** Certification

I am currently studying for my Certified Broadcast Radio Engineer (CBRE) certification through the Society of Broadcast Engineers (SBE). I am sure some of you have heard me say for several years now that I am studyingí well, the difference this time is I actually turned in my application to test during the November test window. It is a bit stressful, but I have purchased the new version of CertPreview and am using both new and old to study. The new CertPreview, after a test, tells me in the five categories how I did. Then I can go to the old version and select that category and focus on it. The newer version does not offer that yet. I do pray I am able to pass the test. So for the next month I will be studying, studying and studying! And here is my plug: those of you broadcast engineers who read The *Local Oscillator*í if you are not a member of the SBE, you need to join. It is a great professional organization, and they provide an opportunity to continue with education because as you all know, things are always changing. Just go to http://www.sbe.org and join!

# KLZ D to A Converter

Gosh, I dongt even know how long ago, the digital to analog converter out at KLZ quit working. That is a fairly important piece of equipment as it is needed for us to get our Westwood feed from the Maxx satellite receiver into the Intraplex backhaul to the studio. The Maxx is AES only (no analog outputs), and the Intraplex backhaul is analog only.

Now, the feed we take is just once a day for three minutes (a commentary from Bill OøReilly), but itøs still an important part of 560 KLZ. We found a local place that does service work for Behringer, but after them having it for well over a month, it was found that part needed to fix it would end up making all the repairs cost more than a new unit. So what did we do? We got a new Behringer D/A converter. We have it installed and the OøReilly commentaries are coming down the pipe the way they should.

# **Audio Sciences**

The KLTT audio server has a different soundcard then the other three audio servers in the facility. It has the ASI6114, while the others have the older 4215. We have begun running into a problem of late. We have had KLZ set up so that we are able to run the audio server through the console or put it directly on the air (bypassing the control room altogether), so the board is basically dead and our board ops can do production in the control room without accidentally putting it on the air. For several years, KLZ was the only station we did this to. Well, since moving to the new studio space, we have begun using the control rooms for production even more. So we set up the other three stations to do this very thing.

Well, with the ASI4215s, we have never had a problem with the settings returning to factory defaults after a reboot of the audio servers. With the 6114, we have it set up so that ASI Control Line 1 Out feeds Player 1, Line 2 Out feeds player 2, Line 3 Out feeds player 3 and Line 4 out feeds players 1-4. We use this fourth channel as the ASERV feed (all channels mixed together). If we have to reboot the audio server for any reason, these settings return to the factory defaults, and if we forget to reset them, it can take us off the air around 5:30 pm when our board ops switch the board off (no mix output fed to the air chain).

I have told everyone and made notes to myself that if the audio server for KLTT is rebooted for any reason, we have to check this. I even have instructions on the screen of the computer. Audio Sciences has had me try the settings in ASI Control and ASIMixer. Neither seems to save the settings I put in. My next step is to install a newer version of the driver to see if it fixes the issue. I pray it does. We dongt have any silence sense on the station, so if we are off the air, unless it is a transmitter being off, I dongt know for a while. I always hate working on audio servers. So much can go wrong and really mess things up.

Well, that about wraps up another month in my world. So until next timeí thatøs all folks!!!

# Digital Diary by Larry Foltran Corporate Website & Information Technology Coordinator

I was recently handed a copy of an article or blog post discussing how Facebook, Twitter and other social media offerings are certain to eliminate

the need for traditional media sources including television and radio. In the writerøs view, the news sources weøve looked to for years have been made obsolete in a variety of ways, essentially turning every user into an on-location journalist.

The portion of this piece that stuck with me was a short paragraph or two where the author declared that Twitter and Facebook

have essentially killed news radio and television, relegating both to sources of entertainment solely. In support of this claim the author cited several significant news events, one being the attacks in Mumbai in 2008, in which up to the second information was transmitted via tweets and other posts from those who were there. This is before any news media personnel could even arrive on the scene, many of which were alerted to the incidents by the same information source. A constant stream of information with no biased spiní right? Perhaps, but certainly not completely accurate.

With the recent  $10^{\text{th}}$  anniversary of the 9/11 attacks, reflections of that morning clearly displayed to me how technology played a part in spreading the news of those horrific events. For me, it all started with a cell phone call to a co-worker from his brother who worked at a local newspaper. A second call reporting the fate of United 175 prompted those of us in the office to hit the internet in search of information. As word spread, the frequency of the incoming calls increased. The unprecedented web activity increased and the major news related web sites ó Fox News, CNN, BBC ó crashed one by one. I recall accessing a Brazilian news web site and translating the information to the coworkers huddled around my desk. Reports ranged from missile attacks to explosives planted around New York and Washington DC, with more targets to come scattered across the United States.

In retrospect, we now know that the vast majority of that information we were bombarded with that morning was inaccurate or pure speculation, but the accuracy of the reports increased rather quickly. Now take a moment to consider how different the



flow of information would have been if Twitter were around at that time. Consider the number of tweets that would have originated that morning from the

New York area alone. A constant stream of information with accuracy spanning across a broad spectrum causing a wide range of reactions.

Without the structure of radio and television news and the teams of experienced journalists, inaccuracies and misconceptions could perhaps persist for much longer. Would

the average tweeter rush into the center of the storm to dig for the facts? Can the information streaming to your computer or smartphone be verified for accuracy? For some, that is insignificant. The constant stream of information is the key and the facts can be sorted out afterwards. To those people I say, try turning on a dozen radios ó each tuned to a different radio station ó and then try to make sense of the information you hear.

Iøm certainly not going to throw out the baby with the bath water. Social media most certainly has a strong position in reporting the news, but I certainly donøt agree that it can remain alone. What it does, it does well. Some strong examples are the events surrounding the earthquake and resulting tsunami that struck Japan earlier this year. Itøs difficult to forget the various cell phone video and photos taken as the buildings shook or the water rushed ashore. Perhaps it generally comes down to the audienceøs expectations. Those who desire an instant perspective of what is happening can stick with twitter. But if you prefer increased accuracy, simply wait a bit and turn to the radio or television news outlets.

Perhaps the same was said of radio and television when they came on the scene. In each case, the new media source didnøt replace its processor. It simply divided each segment into smaller pieces of the whole, each segment with its dedicated audience. At this point, I think the same can be said about social media. All co-existing, contributing in their own individual ways. If only that could be said about society in general.

í until next month!

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KBRT • Avalon - Los Angeles, CA 740 kHz, 10 kW-D, DA KCBC • Manteca - 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 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 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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