The Local Oscillator

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Models

It's been a little over a year since moment method modeling of AM directional antenna systems became a realistic means of proving their performance. I have no idea how many such applications have been filed to date, but it's been quite a few. I have filed three myself.

One of those three was for KCBC, and we filed it the middle of last month. Steve Minshall completed the nighttime phasing and coupling system (which he built himself from a Kintronic Laboratories design) and had it tuned up in just minutes. Following that, he and his helper made the reference field strength measurements and I completed the application. We filed it and are presently awaiting program test authority from the FCC. As soon as we get it, we can crank the night power up to 4.1 kW from the present 1 kW.

Modeling offers so many advantages over a traditional proof. In the case of KCBC, I was able to model the day and night antennas, build circuit models for the base regions and provide Steve with the target base operating parameters. While Steve was putting the phasing and coupling system together and making all the required adjustments and measurements, I was putting the FCC application together, filling in the blanks in the engineering exhibits as information came in from Steve. When he wrapped up the reference field strength measurements, I quickly wrapped up the application and sent it up for filing. There was none of the delay usually associated with documenting a proof and preparing all the maps, graphs and tabulations. Most of the information was known in advance (including operating parameters), so I got the app out the same day that I got the last of the measurements in.

The next modeling project is well underway in Birmingham. Stephen Poole wrote about it in last month's *Local Oscillator*, and he continues his account this month. The WXJC array is a bit unique in that it uses towers that are taller than normal at 109 electrical degrees. This added height results in (relatively) high-impedance tower bases that present all sorts of issues both in modeling and operating the array.

The modeled base driving point impedance for daytime tower 1, for example, is 1,450 ohms. Now we know that in the real world it will not be that high because of the swamping effect of the shunt elements in the base region – the capacitance of the base insulator and the distributed capacitance of the feed tubing among other things. But the current slope at the tower base is very steep, and it would be very difficult to adjust and maintain model parameters on that array. If nothing else, the modeling process has shown us why the array has exhibited apparent stability problems over the years.

So base sampling is out, leaving voltage sampling and loop sampling as our options. Since no one is yet manufacturing a voltage sample device, that leaves loop sampling, and that's what our Birmingham crew has been working on for the past couple of months. A loop sampling retrofit on an existing array is not for the faint of heart. Isocoils and resonating capacitors have to be installed, and for modeling, the loops have to go some distance up the towers (at about the 1/3 point). But at the end of the day, this should present a stable sample and provide for much more stable operation.

I've given Stephen his target parameters and have the FCC application complete except for the reference field strength measurements. Shortly after he gets things tuned up at the site, we should be ready to file.

As if those two models weren't enough for the first few months of the year, I've got another one working as well. KLZ in Denver has since the early 1970s had difficulty with its 275-degree monitor points. I say "points" – plural – because the monitor point location has been changed several times

through the years because of magnetic field disturbances close in to the array along that radial. Other radials have been very stable, and the 275-degree radial itself has been fine, but close in, where the monitor points are, there is trouble.

This cropped up again back in February when Amanda measured the MP field strengths and found the field at the 275 point just over the limit. A peek at the radial (eight points) showed the IDF to be well below the standard pattern value, but with the MP high, she had to raise the tower 2 ratio to bring in the 275-degree null (and all the nulls). That's where things are right now – all the nulls are pulled in considerably more tightly than they should be pending some sort of resolution, either relocation of the monitor point (again), a partial proof with new MP values, or relicensing pursuant to the new modeling rules (and getting rid of the MPs for good). Since we've done the first two several times and gotten only temporary relief, the proper course is clear: model the array.

I have base impedance matrix information already, left over from the 2005 KLVZ-night collocation project, so the model itself is already run. What remains is proofing the sample system, usually the easiest part of the model-licensing process. Not this time, though.

The KLZ sample lines are of an unknown type and impedance. They appear to be a smooth aluminum outer conductor line, and I hope they are 50 ohms. When I did the initial sweep of the tower 1 line, it showed 48 ohms at resonance + 45 degrees and 72 ohms at resonance -45 degrees. When I began investigating this (as well as the fact that the sweep spiral plot was not evenly spaced in the first 90 degrees on the Smith chart), I found that there are RG-59/U pigtails, probably 25 feet or so of the stuff, between the antenna monitor and the point where the lines enter the crawl space under the KLZ transmitter building. Since I can't get the network analyzer to the line terminus, I'm going to attach some 50-ohm 3/8" Heliax pigtails and see what the impedance looks like. Hopefully the lines will both measure out to 50 ohms ±. If not, we may have to replace those sample lines, something I'm not eager to do.

The good news is that once we have the sample lines measured, we're just about done. The model-determined base operating parameters are very close to the licensed parameters, just five degrees off the phase and 6% off the ratio, so it won't take more than a turn on any phasor control. Once that is done and we adjust the ATUs for a match to the transmission lines, all that's left is to make the required reference field strength measurements and file the application.

New Space

The buildout of the new studio leasehold is underway in Denver. Walls are all up and at press time, drywall finishing and electrical work were taking place.

The new equipment racks, four Middle Atlantic WRK-44-32 ganged units with side panels on the outside units, were delivered to the site and are ready to be set in place and bolted to the floor and each other as soon as the drywall folks finish using the engineering room as their drywall cutting area (it's the only large space in the suite with a tile floor). Then we can install the overhead cable ladder system and the electricians can run power circuits to the racks.

Amanda and I now have keys to the new space and as our time permits, we can begin pulling in the inter-studio 25-pair, CAT5e and other cables. We already have all the insulation displacement blocks and can go ahead and lay those out and mount them on the wall in the TOC (Technical Operations Center, what we call the engineering room). We are having Wheatstone provide prewired blocks and connectors for the bridge router. As soon as those arrive, we can mount up those blocks and route the cables into the bridge router rack. Our plan is to have all the rack wiring done and ready to install and plug in the rack equipment on moving day.

The control rooms and production rooms will have to be wired in place after the cabinets, control surfaces and equipment are moved, but because there is so little wiring in the control rooms with the bridge router system, we don't anticipate this taking a lot of time. Production room wiring harnesses will be saved and transported intact to the new space, making those rooms "plug & play." This is much the same as what we did in Portland recently.

Another challenge I have is figuring out the rather complicated HVAC system and controller. The prior radio station tenant installed a dedicated 10-ton HVAC unit and WattMaster Auto-Zone control system. Thankfully we found the installation and operations manual for this system, but the zone manager and control panel are dead. We have been able to force the HVAC unit to run, so we know that part works – it should, because it has very few hours on it and still appears new. But we have not made it run from the control system.

The FCC has granted two of the 18 GHz microwave applications for the new locale. I expect to get grants on the others (four more) in the next month or two. We have already placed the order for

the equipment. I hope to be up to some travel by late May so I can attend a factory school on the system in San Diego. The more I know about it going in, the easier it will be to install and configure it. Of course we will set the units up on the bench and operate them sans reflectors to make certain that they "talk" and pass data before hoisting them up onto the towers.

All this presents a rather daunting challenge, one that will keep Amanda and me very busy over the next few months. With my mobility limitations, this will be even more difficult. But hey, I love a challenge!

Health Update

Many of you have inquired as to my recovery from January's back surgeries, and I very much appreciate your concern and prayers. I am, at long last, doing well and starting to feel almost normal. I still have limitations on movement and weight lifting ability, but I am getting stronger every day. At this point I am still unable to travel, which means that I will miss out on the spring NAB convention, the first miss in almost two decades.

I have an MRI and follow-up doctor visit scheduled for April 5. I'm praying for a clean bill of health.

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

Hello to all from Western New York! Hoarding: Pathological or compulsive hoarding is a specific type of behavior characterized by acquiring and failing to throw out a large number of items that would appear to have little or no value to others. I'm sure most of you have seen the television show "Hoarders" on cable's A&E and Discovery. The show depicts people who gather and retain items most would consider garbage and throw away items.

Most radio engineers are hoarders. We cannot seem to throw away even the smallest nut/bolt/screw/electronic part, etc. I have been saving stuff for years, and occasionally I *will* use some of the things I have hoarded for so long. It's not that I can't stand to throw something away – if it no longer has any use, I'll pitch it, but if there is something I think I can use later, especially in a pinch, I'll hang on to even the smallest part. The trick to all this is organization. You can hoard, but if it is organized, it becomes a "collection."

Transmitter sites seem to be the best place to find some "hidden treasures," as the sites are usually only visited by the engineering staff and sometimes tend to be the storage facility for unused equipment. There you can find some really neat obsolete gear that usually can be obtained by only asking for it. Not long ago, while visiting a site I hadn't been to in years, I noticed a couple of old Gentner VRC-1000 relay boxes sitting in a junk pile. When asked what plans the engineer had for them, he replied that they were replaced years ago and I could have them if I had a need for them. I don't have any VRC-1000s in service, but I could use the 12 VDC relays out of the units along with the terminal strips, voltage regulator and heat sink. If I were to purchase these items from our local parts supplier, I would have spent around $50.00. A little bit of time invested in removing the eight relays saved about $40, and the regulator transistor and heat sink another $10.00. Will I ever use these items? Who knows, but I have them should the need arise, and they didn't cost a cent.

I suppose there is a fine line between frugality and insanity, the difference being what you expect the outcome to be. I save parts that I think I can use at some point, even some that I know have no value to me at all but maybe someone else can use. Bartering for junk, now that's a new concept! I look at all the nuts, bolts, washers, transistors, connectors, wire etc. I have accumulated and think about how

much money I have saved the company by not having to buy these items. But those savings are only realized *IF* you *DO* use them!

Hoarding can be a good thing, but don't let it get out of control. When you no longer have any space to walk around and cannot possibly put another item on the storage shelves, it's time to weed through all that junk and pitch some of it out. And when you do, give me a call. I'll come help. I can always find some room for some more free stuff!

WDCX-FM – Buffalo

There is not a lot to report on from the Buffalo facilities, as this time of year tends to be rather quiet. As the seasons begin to change, I find myself planning for this year's outdoor projects and any items that I didn't have time to complete from last year. At most, we here in the northeast have only about five months to complete all of our outdoor projects, and if they don't get done within that time frame, well, they just don't get done.

The winter winds were rather harsh this year, and as a result, we have about a dozen Poplar and Black Cherry trees down at the transmitter site. The ground was so wet that when the winds kicked up, the trees were blown over, roots and all. There are a lot of folks around with fireplaces, so getting these trees cut up and hauled away will not be a problem, and the best part is, it will not cost us anything. I'll give the wood away, but they have to agree to clean up after they are done. A little sweat equity and they get free firewood. A little crafty planning, and we get the site cleaned up and I don't have to lift a finger to do it. Now, that's good management!

A project that is slated for sometime this spring is the replacement of our STL tower at the studio location in downtown Buffalo. The old tower is a hand-made contraption crafted out of angle iron and two-by-eights. The wooden cross-pieces that make up the foundation for the tower are rotting away along with the steel structure that the parabolic antennas mount to. Replacing this aging structure will be a 26-foot Glen Martin Aluminum roof tower. This unit will be ideal for our STL antennas, as it is lightweight (about 147 pounds without ballast) and can handle about 90 pounds of antenna loading. The non-penetrating roof mount base covers only about 106 square inches and is made of galvanized steel, so it should last for a very long time. For ballast weight, we will use concrete blocks which fit nicely into "trays" that are made in the roof mount base. In all, this should be a fairly problem-free installation, and I will provide some pictures as the project progresses.

Another project slated for early spring is the replacement of our A/C unit that supplies cooling for the two production studios, rack room and air studio. With the addition of all the automation computers, and the additional heat they generate, our current 20 year old 1-ton unit cannot keep our facility cool enough. Solly Industries will be installing a new 3-ton unit along with re-routing the existing flexible air ducting and diffusers. After balancing out the system, our studios should be substantially cooler and more pleasant to work in, and the A/C unit will not have to work as hard to keep the areas cool, resulting in realized savings in energy costs.

WDCX(AM) / WLGZ-FM – Rochester

The WDCX(AM) transmitter site has seen a lot of activity recently, some of it not good. Tim Greenfield, the adjoining landowner to the east, called me in mid-March and reported several things he had noticed while walking around our property.

First, the access gate to the property was left wide open with the chain and lock lying on the ground. I suspected that the snow plowing service had inadvertently left the gate open after plowing the access road. A call to the manager took care of that problem.

Another item that Tim noticed was that someone had ripped off the gate to the tower enclosure at tower #3. He was able to get the wooden gate reattached to the fence; however some of the gate slats will have to be replaced due to splitting. I checked the area around the tower and found no evidence of any tampering with the ground system or tower by the intruders. I suspect that it was just kids, and curiosity of what was behind that fence got the best of them.

Most notably, and the most severe of the things Tim reported, was the fact that one of the guy wires on tower #1 had snapped. Upon inspection, Don Boye of Western Tower Service and I determined that the anchor point had been hit at some time by the brush-hog and had finally snapped at the clevis plate of the anchor. Once the threaded eye-bolt rod broke, it put extended pressure on the fiberglass rod insulator, which snapped also. The safety loop was found several feet away from the anchor point, stretched and frayed. Don replaced the clevis plate eye-bolt, turnbuckle and the fiberglass insulating rod along with the safety loop and re-tensioned the guy wire. After completing this repair, I checked all of the remaining tower anchor points for damage and found the rest of them to be okay. This particular anchor point's clevis plate is very close to the ground. I suspect that the mower operator was unaware that he

had bumped alongside the anchor point, causing the damage. After the spring thaw, I will install some 4x4 posts around this anchor point to alleviate this happening again.

Another item I would like to share with you is a problem we noticed recently with the Nautel ND-5 transmitter. Since installing the new IBOC exciter, we have not been able to produce 100% modulation without the transmitter faulting out on high RF alarms. The best we could do was about 80% positive and negative peaks, according to the Day Sequerra M-2 monitor. If the audio output level was turned up to a normal level out of the processor, the transmitter would almost instantly start faulting out on audio peaks.

The auxiliary transmitter was put on the air while I performed some tests with the main transmitter into the dummy load. With the ND-5 into the load, I was able to achieve and maintain 100% modulation without any faults, which indicates that the problem is network related, not transmitter. One other item to note is that I can turn the digital carrier off and am able to achieve 100% modulation into the antenna network without any faults occurring, but once I turn the digital carrier on, the faults return.

In the near future, Earl Schillinger will assist me at midnight to see if there is any arcing at any of the day towers on peak modulation. While I am at the tower doghouses watching and listening to the networks for any indication of arcs, Earl will be manning the transmitter's fault reset button to reset the transmitter after the faults occur. After a small number of faults, the transmitter will fold back power to about 4 kilowatts, so nominal output power cannot be achieved and maintained until the faults are reset. Also, I will again check the digital sidebands for proper level using the LPT-3000 spectrum analyzer. I do not suspect that anything has changed digitally since that last time the new exciter was set up, but to be sure, I will again check our signal to insure compliance. More on this in the near future.

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
Joseph M. Huk, Jr.,
P.E., CPBE, CBNT
Chief Engineer, CBC–Detroit

This month we have had many diverse projects. The Federal Communications Commission (FCC) granted WMUZ a Special Temporary Authority (STA) to increase our digital carrier power level by 6 dB. This fourfold power increase involved performing a hardware modification to the power amplifier modules within our Nautel NV-40 transmitter.

Our second major project was finding the issue with the STL for the WRDT day site near Monroe, Michigan, some 35 miles away.

Finally, we installed a new RPU antenna on our WMUZ facility tower.

NV-40 Power Increase

Our Nautel transmitter has the capability of providing -14 dBc at our 26.7 kW TPO, but in order for the transmitter to achieve the higher digital carrier levels and still maintain FCC spectral limits, 144 ferrite beads had to be removed from the amplifier modules. After that, a number of parameters had to be adjusted in the transmitter's operating software. The complete modification took me about 15 hours to complete.

Prior to the power increase, HD coverage, subjectively determined with my Insignia Big Red portable receiver, extended to approximately 4.1 miles. After the 6 dB increase, our coverage extended to a radius of approximately 22 miles. This yielded an improvement of 18 miles. This improvement will certainly benefit our listeners with HD capability.

WRDT-AM STL Project

Since I have become the steward of the CBC-Detroit facility, the STL between our. Detroit studio facility and the WRDT day transmitter facility has worked well. That is, until about a month ago.

Normally, I would read approximately 1,500

uV of AGC voltage received at the WRDT-AM Monroe receiver. Gradually, the AGC voltage decreased to approximately 930 uV. At that point our Mosley Digital Decoder was at a point of failure (POF) and the audio was highly pertabated.

We called in our tower riggers to examine the antenna and transmission line on the tower at the studio. With the use of a network analyzer and time domain reflectomenter, it was determined that the transmission line had a fault about 400 feet up the tower. After close examination of the line, it was found that the sheath of the cable was compromised and water had wicked up the line.

The riggers cut the line at the point where the line was not damaged. The bad section of cable was replaced and the system was sweep tested and found to be in specification. The received AGC signal, after the repair, measured near 1,800 uV. Our STL and LANLink transceiver is now operational again. In fact, the LANLink is extremely stable. I used to experience drop outs from time to time. Now the link is very robust.

VHF RPU Antenna

Our Marti unit or RPU receiver has not been operational since I started last June. With the weather improving, it was an ideal time to have the tower riggers install a new antenna. We originally had a vertical at the 430 foot level on the tower. When the tower riggers visually inspected the antenna, it looked like the top element was broken off.

The new antenna is a 4-bay array which has 6dBd of gain. After the installation, the antenna was sweep tested and met the manufacturer's specifications. Subjectively, after connecting the antenna to the Marti receiver, we picked up an RPU transmitter down in Toledo, Ohio, some 70 miles south of Detroit. Now we ready to cover any remote or news breaking event.

Until next time, be safe, and if all goes well, we will be reporting to you from the pages of *The Local Oscillator* next month.

News From The South

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

March has been an fascinating, exciting, frustrating ... and lately, painful, month in Birmingham.

I'll explain the last one first. I've been in pain for the past two weeks with a crowned tooth that's driving me crazy. I've made two emergency trips to the dentist as I write this, and I'm still eating ibuprofen and acetaminophen like they were candy. It will seem to get better for a while, then start hurting again, especially when I'm out in the field with a breeze blowing over my face. In the coming days, I'm going to find the time to tell the dentist to either (a) do a root canal ASAP, or (b), just pull the bloomin' thing so that I can go on with my life.

A Tip of the Hat to TWR Lighting

Last month, I touched on the tower lighting woes at WYDE-FM in Cullman. TWR Lighting, the vendor who sold us the system, went above and beyond the call of duty: after several attempts to repair station #47 on the tower failed, they sent us a complete replacement flash head, with instructions to send the original back to them for analysis. The replacement worked like a champ, and, aside from the fact that the job was *way* over budget (primarily the result of having to pay for repeated tower climbing), I could finally breathe a sigh of relief.

We had replaced the flash tube in #47 three times; each time, it would last for less than a day before it failed again. All of the other stations worked fine after relamping, but this one just wouldn't cooperate. I have to say that I was impressed with what TWR did next. Many companies would have simply trashed the returned flash head, written it off as "one of those things" and

moved on. But TWR's technicians dug into the thing, put it on the bench and finally found the problem: there was some kind of glitch in the triggering and high voltage circuits that would cause occasional voltage spikes. These were killing the tubes.

TWR's technicians, Paul and Raudel, worked patiently with me through this long, frustrating repair. Many companies would have said, "You obviously suffered lightning damage, you'll need to buy a completely new flash head," and would have washed their hands of it as soon as possible. But because of their willingness to go the extra mile, I'll put in a plug for them: whether you work for our company or not, if you have an obstruction lighting project on your schedule, give them a call. Visit them at www.twrlighting.com for more info.

The Tarrant Modeling Project Continues...

Now for the fascination and frustration. It has been fascinating ... and yeah, I'll admit it, even *fun*... to do the modeling project at WXJC(AM) in Tarrant. I thought I knew how AM directional worked (I do have the "AMD" in my SBE certification, after all), but I have learned a lot of new things in the past several months. Those of you who haven't taken the SBE's online AM Modeling course should do so. It's a fascinating subject and the course is very well-written by our own Cris Alexander. It's also exciting because I can see the light at the end of the tunnel, and after many, many months under an STA, we're almost done.

We got the sample loops finished and tested all of them in a known reference spot on tower #2. All of them produced exactly the same output with no measurable difference, which was absolutely beautiful. Next, we had to extend the existing sample lines to reach the loops, which would be mounted

Figure 1 – Testing the completed sample loops

122 feet above the tower bases. The Agilent network analyzer that Cris sent us was ideal for this; in fact, if you ever have to trim sample lines, you should rent, beg, or borrow one of these. Back in the old days, we had to just cut-and-try painstakingly, using a bridge and a generator. But the network analyzer not only let us very quickly trim all sample lines to precisely the same electrical length, but confirming the characteristic impedance was ridiculously simple. The AM Modeling course that I mentioned above (and which I have read now several times!) goes through this procedure step by step. It's easy.

It has also been frustrating because truthfully, we should have been done by now. Cris needs the analyzer to troubleshoot some problems that he and Amanda are having in Denver, but I haven't been able to release it just yet.

There have been the usual Murphy's Law episodes: for example, one of the connectors on the isocoil at tower #5 had a broken collet and pulled apart when we were testing the lines, so we had to wait for a replacement. But the biggest reason, simply put, has been one storm after another. You can't tell it from Figure 1 because I tweaked it with the GNU Image Manipulation Program, but in fact, it was cloudy and overcast when we tested the loops.

Figure 2 – Hanging the loop at tower 3

What should have taken about 30 minutes took all morning; Todd and Jimmy had to carry everything by hand out to that tower – it took more than one trip – and swap each loop into place while fighting a gusty, cold breeze. When that field is soaked, I can't drive my truck to the tower bases without getting stuck. It's about a 1/3 mile round trip to all five towers. Finally, the tower crews were running behind because of the rain as well, so we had to wait for them to become available. But we were finally able to get the loops on the towers.

The first day, we were rained out; we had call off the job entirely. Figure 2 is from the second day, when we got two of the loops done. The third day started out beautiful, but the NWS was calling for more rain, so we rushed to finish the remaining three towers.

When you're in a hurry, you're likely to make stupid mistakes like the one shown in Figure 3. This one broke my heart; we'll have to repair this

Figure 3 – Sample line pushed into the base by a severe storm

sample line (and then re-confirm the electrical length and impedance) before we proceed. The base insulators on those ancient square-framed towers at Tarrant are very short (less than 8 inches) and this sample line drooped a little too far toward the grounded base of the tower. When the storm blew up later that evening, the high straight-line winds pushed the coax into the metal ring at the base of the insulator, burning out a small section of the sample line. We'll be able to repair it, but that's still aggravating.

(By the way, the ugliness of the grounding around the base is a reminder of the copper theft that we suffered in 2008. We originally had copper plates capping each entire base; the thieves cut as much of that as they could get. We repaired it as best we could, but every time I look at it, my stomach turns.)

Cris has been constantly tweaking the model

Figure 4 – Mounts for the resonating capacitors

and providing numbers to us here in the field, and he agreed that the isocoils would have to be resonated. Those 109-degree towers have very high operating impedances at the bases. Even though the coils tested out to over +j700 ohms at 850 kHz, we would get unacceptable loading. Fortunately, we had already anticipated this, and Kintronic had given us bare coax for the coil, as well as a strap and clip, for that purpose. We then installed mounts for two 150 pF capacitors in each isocoil cabinet. See Figure 4.

Lord willing, I'll have more pictures of the finished job next month, including the little rig that I've built to resonate each isocoil. The math shows that we'll have no significant loading to at least +/- 20Khz either side of the carrier frequency, which is especially important for AM HD-R... provided, of course, that we're careful to resonate them precisely to 850 KHz. The vacuum capacitors that we're using are stable to within 50 ppm over a wide temperature range, so if we can just get it nailed to start with during springtime, we should be fine year-round.

That's it for this time; lots of pictures, not a lot of prose. Until then!

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

A good bit of March was spent watching tower crews on the KSTL tower. In last month's column, I had discussed the problem we had with bad Ethernet cables on the Canopy system on the KSTL tower and how we were waiting for the weather to break to get a tower crew up on the tower to replace the cables. Fortunately the weather turned in our favor rather quickly and we had a tower crew up there early in the month. This seemed to go as plan. They climbed the tower and did fairly quick work of replacing the cables. We tested them out when they were up on the tower and we found that the entire Canopy System was working solidly again.

We were also experiencing some problems with the T1 that joins the Canopy system at the KSTL transmitter site, so I got hold of AT&T and I had them run tests on the T1 that afternoon following the repair of the Canopy because my satellite backhaul was having dropouts even after the Canopy was completely stable, so I was pretty sure it was due to a T1 problem. It also meant we would remain on the backup system for the remainder of the afternoon while they diagnosed and corrected the problem.

Once AT&T had their act together, it was already into the evening and it looked like we had all the STL issues resolved. However, at 7:15 the next morning, I started receiving off air alerts from KJSL. I logged in and found that the Canopy was once again causing the problem. This was disconcerting since we just had a crew up there fixing it the day before. I was also a bit perplexed at what was going on. We tested everything while they were up on the tower and it all worked fine. Finally, I put two and two together and figured it out.

The problem showed up immediately after KSTL went to full power. We had tested the system when the tower crew was up on the tower, and of course to keep the crew safe, we had run KSTL at half power. Then in the evening, when AT&T was finished fixing the T1 and we went back on the Canopy, it was already past the time we had changed power levels on KSTL and we were at the much lower nighttime power. So in reality we hadn't relied on the Canopy yet with KSTL at full power until the next day at 7:15 AM. This meant one thing: RF from KSTL was getting into the Canopy system and causing the digital data to be corrupted.

I immediately decided to test this theory by taking KSTL to half power. Once we had the station at half power, the errors completely disappeared. I then remembered that the tower crew had used shielded CAT5 cabling. This was obviously the problem. I called them up and thankfully, they were able to get out to the site later that afternoon and replace the cables again, this time without the shield. This did the trick. We haven't had issues with the system since.

A week later we had a tower light alarm on the KSTL tower. This was a bit of surprise since in January we had a tower crew replace the marker lights with LED fixtures and at the same time they relamped the beacons with new incandescent bulbs. It was the beacons that were out. These were new bulbs and we had not a lick of lightning from the time the lamps were replaced, just lots of cold weather. It appeared it had to be wiring. My immediate guess was that the tower crew had disturbed the beacon wiring while replacing the marker light fixture with LEDs. At each level they had to remove a conduit in order to get the old incandescent fixture off. I was guessing that they might have accidentally loosened the beacon wires while doing this and it took a month or so to show up. This played a large part into the actual repair taking longer than it should.

I had the tower crew start working the measurement of voltage on the wires on the bottom marker level first and then work their way up the tower. Unfortunately, the problem ended up being at the top, but by the time they had it figured out and they didn't have the proper wiring to replace what was needed. They ended up coming out the next day. They replaced the SO electrical cable that runs from the junction box at the top of the tower to the beacon fixture because it looked questionable.

This didn't fix the problem, so they had to replace the wiring harness that run from the SO cable terminal to the actual sockets. When this was replaced, the problem was fixed. Not that I mind working with these guys, but it will be nice to not have play ground crew for awhile.

Valley Notes

By
Steve Minshall
Chief Engineer, KCBC

I love it when a plan comes together! The new phasing and coupling system for the KCBC night pattern is finished. It was considerably more work than I first thought it would be, but in the end I am very happy to report that it all came together exceptionally well. So many projects end with the statement that "everything that could have gone wrong did," but that is not the case here.

The Tunwall controller, which controls RF contactor operation and sequencing for day/night and main/aux switching, worked perfectly and was very easy to hook up. This is the fifth Tunwall controller I have purchased and I continue to be very pleased.

After many weeks of phasor construction and ATU modifications, I wondered what the parameters would look like when RF was applied to the input. The phasor has seven tee networks and the ATUs each have a tee network. I pre-adjusted each network for correct impedance and phase shift. I had already pre-adjusted each inductor in the system, but when the various components are connected together in networks, there are always effects of stray capacitance and lead lengths that need to be adjusted out.

The new night phasor was built "Canadian Style" on laser-cut open panels

At the ATUs, adjustments were made by terminating the inputs of the networks with a 50-ohm load and looking at the antenna side with the analyzer. Each network was then fine tuned for the predicted antenna impedance at the output side of the network. When looking at the network "backwards," the R value will be the same as the predicted driving resistance of the antenna but the reactance will be the opposite sign.

In theory, with all the networks pre-adjusted, the parameters at initial turn-on should be very close to design. When I finally hit the ON button, I was very pleased. The common point read 48 ohms with just a couple ohms of reactance – not bad! The antenna monitor displayed parameters that were almost within licensed tolerances! A big thank-you goes to Kintronic Labs for a great design!

One area of concern has been the possibility of accidental application of high power to the night array. The night system is designed for operation at 4.1 kilowatts. Since the antenna system is connected to a 50 kilowatt transmitter, there has to be a foolproof and failsafe way to protect the night system.

When the pattern is changed, there is a pulse sent to the transmitter's low power remote input. The Nautel NX-50 incorporates a "high power lockout"

input that limits the power to a predetermined level under any and all conditions, so there is a pulse applied to this at pattern change as well. The backup transmitter is a Nautel ND-50. The ND-50 does not have a high power lockout, but there is an easy solution. Through some experimentation, I found that I can apply a pulse to the low power remote input and apply a constant closure across the front panel low power button. This way low power operation is assured whether the transmitter is in local or remote control and locks out the power buttons preventing someone (me) from pressing the wrong button.

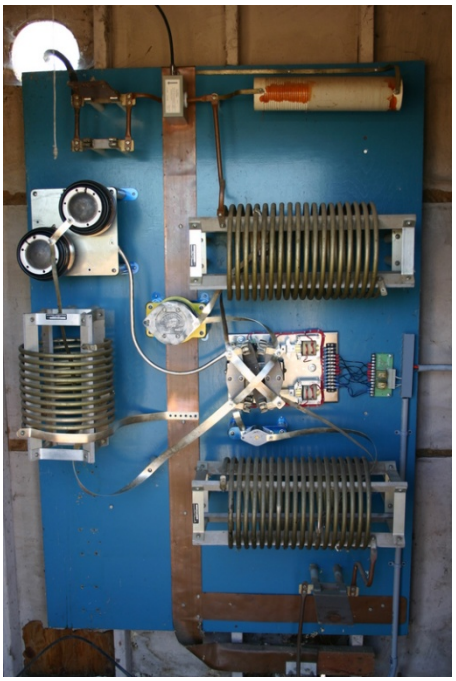
If the above measures were to fail and high power was applied to the night array, there are a couple of brute force protections built in to the phasor. At the input to the phasor I have installed a ball gap set to .028". This gap will allow operation at licensed power but should arc over and cause a shutdown of the transmitter should excessive power be applied. After the arc gap is a big fuse. That's just in case the arc gap does not fire. I found some nice big 600 volt fuses and a holder on eBay. By "big," I mean long. I want a fuse long enough that it's not likely to arc over from end to end if it blows.

There is one more method of high power protection that I might employ. I am considering taking a sample voltage from the common point, rectifying and filtering, and driving a latching relay. The circuit would be adjusted to trip at a predetermined RF power level and open the night interlock circuit. The relay would be reset by the day command. At this point it does not seem necessary to go this far, but I might sleep better.

A round of field intensity measurements followed the morning after the tuning. We were a little bit ill-prepared for the measurements. We were using an inexpensive GPS and nothing else for navigation. At each point, we recorded the measured field and the coordinates. Later, this data was entered on a spreadsheet where distance, bearing, and distance-times-field (DF) were calculated. We found that a few points were off the bearing and the DF revealed one point that was very suspect.

The DF is a good double check to see if field intensity readings look like they fall into line. DF values should drop steadily with distance. There are anomalies, of course, so some ups and downs in DF values are expected. We had one DF value that was triple what was expected, and some investigation revealed an error. A handful of other points were re-checked and at that point we were satisfied with the data.

The application for license has been filed and now we await "Program Test Authority." There are still a few details to wrap up. I want to replace a few straps in the phasor with tubing just to make it look as good a possible. The ATUs need a little tweaking to bring the SWR down on the transmission lines, and the common point could use a little bit of adjustment for proper orientation of the load impedance on the Smith chart. None of these are significant enough to effect normal operation.



ATUs were also built on open panels

Catalina Tales

By
Bill Agresta
Chief Engineer, KBRT

Greetings from Santa Catalina Island! This has been a good,0 productive month here at the KBRT transmitter plant. Working with studio contract engineer Mike Duffy, I installed an APT Oslo digital T1 STL that has so far proven to be a very nice upgrade to the original QEI CAT-Link that we have been using since 2000 or so. The Oslo's APT-X compression protocol seems to be very stable and sounds great, allowing more audio plus data channels over a single T1 than the linear CAT-Link did. If only my T1 was reliable, I would use this unit full-time for everything, but as it is, we use it for remote control, data and return audio since we have our C-Band satellite receiver located here at the transmitter plant. With the unreliable T1 we also make use of our DTMF dial-up connection for remote quite often.

We also installed a new Nautel Exporter Plus and AM-IBOC and they have proven to be a very nice upgrade as well. Our old NE-IBOC exciter needed to be rebooted more and more often and always seemed to have issues just after I left the plant. The new units have their issues, but none of them affect their reliability once they are set up and calibrated. I was not happy to find that most of the setup units are not the same as those used in the NE-IBOC, but with a nice spectrum analyzer, an HD Radio receiver and some patience, we got it all set and calibrated very nicely. Thanks to Joel Saxburg for coming over with his Anritsu analyzer to make this job doable. The new Exporter Plus and AM-IBOC have run non-stop without the slightest of operational issues for over two months now, something the NE-IBOC was never able to accomplish. It is nice to know that I can leave the plant and remain on the air in HD without having to worry.

As many of you may know, California got its share of rain this year and it looks like we may still have more to come. In most cases, Catalina Island does not see as much rainfall as the mainland. This has been the case since I have been here. This year, however, we saw the eye of the storm, getting quite a bit more rainfall than most of the mainland. We certainly did need it since our water reservoir was becoming dangerously low, but now we've got the aftermath – weeds-weeds-weeds! Seems like the past few years have yielded an increasing growth of weeds, more than an army can keep up with. I thank God for our DR power mower we purchased a few years back because without it, I would be in big trouble, even with an army of weed pullers. This is the time of year, I have to make sure all my maintenance inside the plant is done and I am caught up on all my projects because the weeds begin to take over my life, at least a few days per week of it. Last year I had two helpers, and by the time we got the job done, we had to start again back where we began because the weeds grew that fast! This year, only time will tell but, they seem to be taking over very quickly.

You are probably wondering about how the Conservancy "road" did through all the rain. Well, lets just say it could have been worse. No one sank in the mud, but the treatment did not hold up through the storms. Basically we got a dusty and eroded dirt road now, much worse even than the poorly maintained asphalt road that they tore out. The road creates so much dust that if I open any windows here or even leave a door open, you can see the results within very little time. I have to replace our air filters much more often now and I am having sinus issues that have made things pretty miserable at times. It has created maintenance issues for our truck including a frequently clogged air filter and stress damage caused by the bumpy wash-board roads. I guess I am missing where the advantages in this road treatment lie because all I have to go on so far tells me this road treatment is the biggest failure I have ever seen!

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

The Chicago Chronicles

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

Project Sheherazade

The question last month was: "Of all the microphone types ever made, which type is one of the most faithful in reproducing the human voice, but in its heyday was also the most fragile, so much so that the mere act of blowing into it could destroy it?" This again is a question for the old-timers, who I'm sure remember this one most fondly: The Ribbon Mic. This type used a corrugated metal ribbon suspended between two magnets to produce the sound. As the ribbon moved in response to the changing air pressure around it, a current to match the audio signal was created. As mentioned above, the early ribbon mikes, such as the venerable RCA 44 and 77 series, were as treasured for their purity of sound reproduction as they were feared for their fragility. They even, to quote Wikipedia, surpassed most condenser mikes for the clarity of their sound, and without the potentially lethal high voltage which was a necessary part of the condenser mike design. But ribbon mics were expensive to buy and especially to repair, which happened often since they could not endure any sort of rough treatment at all. Since the last turn of the century, Chinese- and Russian-made ribbon mics have made their entrance onto the scene, and they are more rugged than their oh-so-tender predecessors. One of the things I found out in the Wikipedia article is that it is now possible to build such a mic from a kit, since it has no active parts, and with newer, more rugged, higher output materials, can more than hold its own against its condenser and dynamic competitors. Now *that* would be a project I'd love to take on!

Next month's question: How is the unknown output impedance of a circuit determined?

AM Ibiquity--The Latest Updates

It's all about HD Radio this month, How'd that happen?

I've always wanted to own an AM station , if only to learn how to deal with the practical issues surrounding the implementation of HD Radio. I love HD on AM, when it works, which is not as often as it should. But when it works well, the audio coming out of the radio is flat out incredible.

But as sure as the knowledge that HD on AM can work wonders is that HD on AM can be incredibly problematic. As anyone who works this mode is aware, it's all about the load. But that's not all. This was highlighted to me on a recent "working vacation" trip to Detroit.

I like to run AM directional antenna proofs in my spare time. It's not a bad paying gig at all, it's occasional enough to not be a drag on the rest of my life, and the scenery is great! But sometimes, weird things happen. So it was on my most recent trip to Motown. From here on, only the places shall be named, and a few call signs. Names are being redacted.

The station I was measuring is a DA-2 with 12 towers, with six each used for day and night patterns. The arrays are located right next to each other, both with the max signal beamed toward Detroit. The engineering quality of the operation is first rate. The station I was measuring has 20 radials in its partial proof. Several of them extend to the south toward such towns as Flat Rock, New Boston, Gibraltar, Riverview and Monroe.

Let's digress for a moment. Believe it or not, there are only *six* AM stations licensed to Detroit itself. One of them is a Class C on 1400 kHz and the only one which is licensed to Detroit not running 50 kW. All the other stations are 50 kW, most are directional to the north, and all of them have their transmitters south of town, including that biggest of the big boys in the area, non-directional WJR. And 'JR was there first.

Including the four Canadian stations across the Detroit River in Windsor, the transmitters for which are also south of Detroit, there are *fourteen* stations there. That's a lot of AM RF floating around in a relatively small space. And, any one of those transmitters can develop an intermodulation mix in it from the RF of another transmitter. That is a problem I may have run into that weekend.

I was taking signal readings on my subject station in that area when I hit a point which was all white noise on the Field Intensity Meter (FIM). Making a note of it on my data sheet, I moved on to the next point, and found the same problem, only stronger. I went to the next one. This one was disastrous. I looked around and saw.... a massive eight-tower DA. Running up and down the dial on the FIM revealed it to be the site for the new kid in town – literally – Radio Disney. Fifty kilowatts into eight three-eighths wave towers. Thing is, the station was over a half MHz away from the frequency I was monitoring, and about a half mile away from where I was. Then it hit me: I'd heard this interference the first time I ran this radial, though not the second. What was going on here?

I contacted both Joe Huk from our own WMUZ, and then the engineer of the station I was monitoring and told both what I had found. Did either of them know the name of the station engineer? Yes, both did, and quite well. Turns out that this fellow is also the CE at one of the other 50 kW blow-torches in the immediate area. To make a long story short, we got together on the phone and started talking about this. The CE of the measured station has a spectrum analyzer, and he was anxious to find out what the spectral output of the Radio Disney transmitter was like. The CE of the Radio Disney station agreed; they set up an appointment to get it done. The big question was, with all these high powered transmitters so close together, was the problem with the HD generator or with intermodulation products? Who's running intermod filtering between their transmitters and antenna systems? One local engineer I talked to strongly suggested that there is one station in the area, not running 50 kW, by the way, which was the source of a lot of the intermod problem, but the owner won't talk to anyone about dealing with it. I'm not surprised. I know the guy.

We then started discussing HD on AM itself, and things got even more interesting. As some of you may know, many of the stations of Citadel Media have dropped AM on HD. It isn't just the issue of adjacent channel interference anymore, either. In Detroit, AM station audio is a real point of pride and has been forever , particularly with the two 50 kW "next door neighbors," WJR and CKLW, on 760 and 800. Both have had award-winning audio for years, thanks mainly to the work of the late, great Ed Buterbaugh, who worked at both places to make them sound like FM without the stereo. And WJR ran Motorola C-Quam, which Ed made sound wonderful. But when HD radio came in, constricting analog audio fidelity compared to what Ed had done with it, he retired immediately. Not long after that, he lost his battle with cancer.

Well, WJR (and now WLS here in Chicago) have dropped HD on their AMs and replaced it with (would you believe?) Motorola C-Quam. I suspect, but don't know, that the other Citadel AMs which were ABC/Disney properties have done the same thing. Now, does anyone know where one can find a C-Quam radio to listen to it? Yeah, it's retrogressive, but the AM station engineers have gotten tired of their analog audio being squished when HD is on.

That's not all. At least one engineer I've talked to lately tells me that for HD on AM to be more successful, it is imperative that the HD software be able, on its own, to adapt to changing load conditions in the antenna from moment to moment, rather than the other way around. I asked Cris Alexander about this, and he says that, while making the generated HD signal adaptable to the load might well be possible (this is software, after all, and I've always believed that one can do anything with software), being able to bring it off *properly* will be incredibly difficult to do. It will work whatever DSP chip that runs it, to the max.

Tom Walker at Ibiquity agrees. In a recent conversation with me, he says that, "while the concept of load-adaptive HD software has been developed, it still needs to be commercialized." I believe it's actually already being done on FM, but FM's available bandwidth, and the similarity of antenna designs from station to station, as a load, makes writing the software for that a piece of cake, compared to doing it with any given AM antenna system load. Consider that no two directional antenna systems are alike. The same can be said for single towers of different sizes, and the condition of the ground system is also a huge factor. Normally, this is done as a form of pre-correction in the IBOC system, anyway.

There are also issues of peak-to-average ratio for the digital carriers; solving that issue will solve a whole host of others, on both AM and FM. For instance, with the peak-to-average ratio reduced, digital-only transmitters may be able to operate at higher powers than now allowed since the danger of peak clipping will be reduced. The limiting factor then will be the ability of the HD-only transmitter to operate at the power level which will still allow it handle the heat. That right there will help in the station's ability to raise its HD power level by the 6 db which the FCC now allows**.** Quoting Tom Walker again, **"**iBiquity is presently working on a solution using a new PAR algorithm and should be completed

sometime in the future."

New IBOC software is coming on AM. A new software load has been released to the broadcast equipment manufacturers and hopefully it will be in the hands of end-users (stations) by NAB time or at least, later this spring. In this release, according to Tom, there is the option to turn off the secondary and tertiary carriers. Stations can still opt to keep the "in-analog passband" secondary and tertiary carriers. I doubt that many will. This is the big news. **See Figure 1**. This one option will enable AM stations to again operate their analog signals out to a full 10 kHz

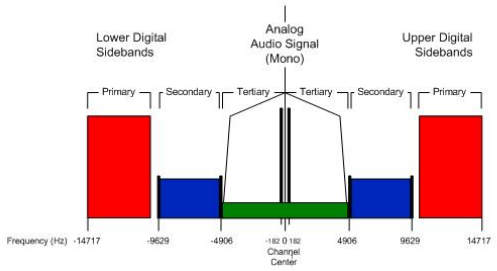


Figure 1 – iBiquity MA-1 mode

frequency response, *and* to modulate their positive peaks at higher levels, all while retaining IBOC capability. Further, with the tertiary carriers now gone, this new software version will bring down the host noise underneath the analog to an imperceptible level. The audio throughput will be reduced from 36 kB/sec. to 20 kB/sec. A new feature will be introduced, called "parametric stereo." For the first time, AM stations can choose to switch their digital audio modes between mono and stereo, making the resulting digital audio sound better in the mono mode.

All of this will be backward-adaptable to existing IBOC receivers. The system has been tested in the field, and so far it has worked well. The one thing the new software does not do is to reduce the total bandwidth of the signal; all of the digital information will still, of necessity, be between ten and 30 kHz out from the center carrier.

Ibiquity is thinking ahead to the future of AM (way ahead, in my estimation, but exciting). Check out **Figure 2.** The next generation, or further beyond, of IBOC technology will eliminate analog entirely, and create two complete sets of sidebands with a total bandwidth of 20 kHz, thus reducing adjacent channel interference. Lovely to look at. Just don't count on it anytime soon. Other sources have informed me that this will be the way to multicast on AM, with the close-in sidebands being used for mono audio, and the tertiary outer sidebands being used for a stereo split-cast.

Changes in IBOC multi-casting software is also coming. I recently got that news from the folks at BE. Currently, the MP3 mode changes the IBOC throughput from 96 kbps to 120 kpbs. The HD-3 channel then operates on the 24 kbps channel leaving 96 kbps for your HD1 and HD2 channels. In my experience here in Chicago, the stations using HD-3 are all operating with mono audio.

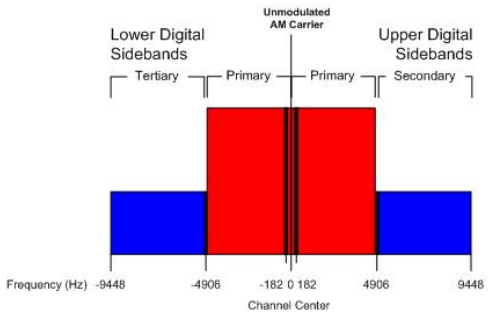


Figure 2 – iBiquity MA-3 mode

This upcoming new importer software release allows a station to broadcast up to four programs on multicasting, by adding an HD-4 channel. The exciter/exporter will need to switch from the MP-1, normal hybrid mode to the MP-3, extended hybrid mode. Now HD1, HD2 and HD3 will fit in the 96 kbps bandpass with the HD4 in the 24 kbps extended partition. Note that again, all of this is backward compatible to existing receivers.

Thanks go out to Tom Walker at iBiquity for helping out on this month's column.

Notes on FSi-10/ASi-10 Maintenance

My experience is with the Broadcast Electronics FSi-10 since I don't have any AMs in my stable yet, but I'm told that what I'm going to tell you about the FSi-10 applies to the ASi-10 as well, so here goes.

One of the things they don't make a big deal about with the first generation of HD exciters is that, somewhere in every box, there's a hard drive. Now, our units are first-generation boxes, some six-plus years old would you believe, and they go and go, 24/7, hard drives and all. I don't ever remember reading about this in the manuals, but at that rate, the expected life on a drive is about four years. I'd say we've gotten our value out of them, but before they took it upon themselves to crash and burn at the end of the runway, we figured that it was time to replace them. So we did. Easy, right? Heh-heh...

First thing we learned is that the motherboard we used, which was in the short-lived first generation of motherboards, likes Western

Digital drives. It doesn't like Seagate. Said nothin' 'bout that in the manual. Maybe it's all coincidental, but when we put the Seagate in, not only didn't it work, but the motherboard, after a couple of tries with the drive, just up and quit. We called the factory to order the motherboard, and their response was gentle but firm: "You really don't want to replace that yourself in the field. You're going to create more problems for yourself than you can possibly know. Send the box back here and let us do it. It's the only way in which we can guarantee that it will work when the job is done. By the way, we haven't a clue as to why your 'FSi' won't accept Seagate, except for whatever it is with the motherboard." Oh.

Now, what other problems could there be in those things? We're likely to find out, when the next big update for the FSi's come in sometime this spring. This is the one which will allow us to increase our HD power. Can't wait. I love challenges.

FCC Website's New Toy....

So you have a superpower FM station, and you're wondering how much more HD power the FCC's going to let you run than the 1% you're allowed now. Maybe more? Maybe *less*? Well, now you can find out. Paste this one into your browser: http://www.fcc.gov/mb/audio/digitalFMpower.html.

That is the page on the FCC's web site for finding out the answers to all your superpower HD power questions. The FCC has already done all the figuring for you. Just like a government these days. Merely key in your station's call sign and facility ID number (found within the FCC FM query section) and click "Submit." Then watch the answer(s) crank out on the screen. Game over. Try it for all of your superpower FM stations, just for fun.

You're welcome.

I have to tell you: when Cris mentioned in these pages recently that WDCX wasn't going to be allowed to increase its HD power, I got into a real snit about it, and actually started to write a rant about it for this column, one that would have made Mark Levin proud. Then I got curious and checked the FCC website just to see if anything had changed on the subject. It had. And, as a matter of fact, WDCX *will* be allowed an increase digital power, all the way up to 2.95 kW of HD ERP. But not right away. Not in the budget yet. We don't have the transmitter horsepower in Buffalo to do the upgrade.

Moral: Check before you rant. You may be pleasantly surprised. Which brings to mind: I am just that, pleasantly surprised, with the FCC's website. The way it's put together, it's one of the finest on the web.

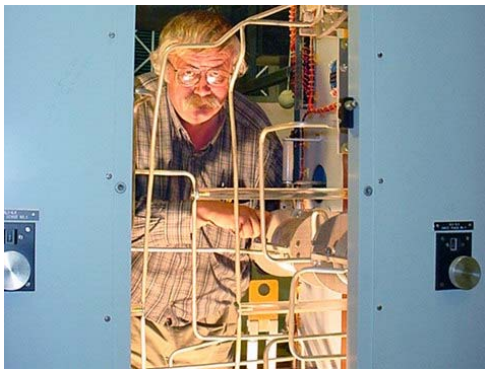
Until next time, blessings!

The Portland Report

By
John White, CBRE
Chief Engineer, CBC–Portland

This month, I want to give a detailed rundown on the UPS bypass boxes I talked about last month.

The best place to start is with what I wanted to accomplish and why. In this case, I have equipment that is powered 24/7 with UPS backup. However, what happens when it's necessary to repair the UPS? I need a bypass. From there I developed a set of requirements for the boxes.



- Plug and disconnect.
- Default to raw AC on UPS failure.
- Switch between power sources without disrupting the load.

Most UPS devices use a relay to switch power, so I felt comfortable that a relay would be fast enough to satisfy the third requirement. Plug and disconnect was easily satisfied using plugs and power cords. I solved the third requirement using the closed state of the relay for the UPS power. If the UPS fails power off, then the default is raw AC. I added switches to force a bypass state for that.

The second project was "ultra simple" and extremely complicated. Nearly every station has one

or more Rolls 79 receivers, typically for EAS. I had never seen a Rolls receiver with a readable display until recently. The problem is the back-lighting lamp is burned out. So the task was to find a replacement lamp.

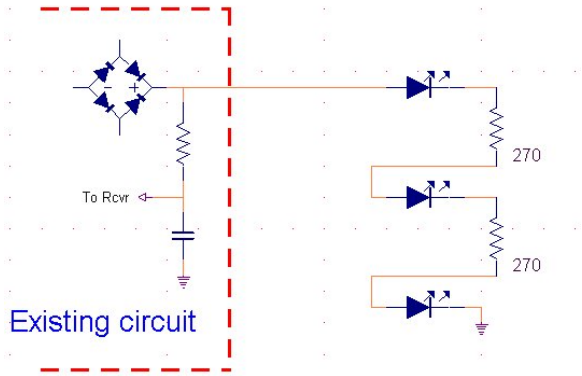


Figure 1 – Rolls receiver modification schematic

A bit of looking soon told me why the lamps are normally burned out. The lamps have a life time to 3000 hours, just a few months. So the first idea was to look for a 10,000 to 15,000 hour lamp and drop the operating voltage. So off I went to Mouser. Every long-life lamp was out of stock as well as most short-life lamps.

Second idea: use a high-intensity LED. That didn't go much better. Again out of stock. Finally I visited the only remaining electronic parts stores in the area. They also were out of stock. But they did have a suggestion. Amongst the parts they stock is a series of kits for model makers. Modelec makes parts kits for lights for models. Miniature cross-arm gates, signs, headlights, etc. One kit, the MDLC-L3CW, contains 10 high intensity white LEDs and resistors.

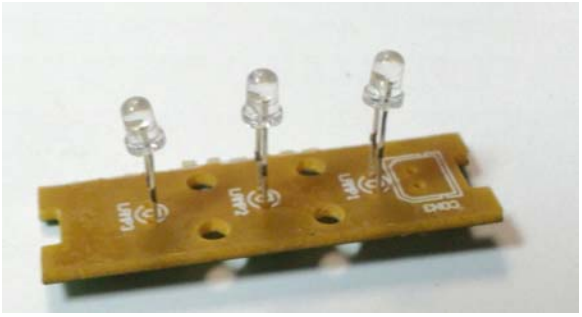


Figure 2 – LED lamp board

The display on both the 79 A and B is simple to work with as shown in pictures. Both use a lamp mounted on an EC which snaps into the back of the display. Although the A and B use different power arrangements, I used the same power solution for both. By operating three LEDs in series with two 270-ohm resistors, the current is 14 mA.

I used trace cut to mount the three LEDs and resistors. I also angled the end LEDs to slightly to provide more coverage. The pictures and schematic are self explanatory.

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

As always, the months just keep flying by. Is March really over? It has been a month of wires, wires, oh, and more wires, with some snow here and there! I spent the majority of last month attempting to continue tracing down wires in the engineering room and in the studios for the big move. The idea is to get a good handle on what is there now so we can replicate it in the new facility. Now it's on to putting what I have found into a spreadsheet.

I had the privilege during the tracing down of wires in the studios to have my mom come in and help me. This is a two-person job because of where the wires may go. She originally helped when we renovated the studios in 1999, punching down a lot of the 25-pair cables. It was several years ago when we got the new Wheatstone G-6 control surfaces that we ended up tearing out what she did and replacing it with what was needed for the new bridge router and control surfaces. After several bumps and bruises, very dirty clothes, lots of coughing and sneezing from all the dust and

the distractions of small problems around the studio, we were able to get three of the four rooms documented. The fourth room, KLVZ, will have to be done on a Sunday afternoon as it is usually jam packed with clients and live shows Monday through Saturday.

It seems that every time I plan on taking time out of my schedule to type up where the wires go, something happens. Whether it is a station going off the air, a snow storm, or both, it never fails. I will have someone come to me just as I sit down and prepare to type and tell me about some problem. I will most likely be spending my nights at home and weekends working on getting everything documented in the next couple of weeks so we can figure out what we can eliminate.

The new place is beginning to take shape. The drywall is being done and the rooms are beginning to look like real rooms. We got the new server racks in, the cable ladder in and all the cables and wires we will need. As the date of moving in gets closer, I get more anxious. I have no idea how this will all go. I am grateful I will have a team of engineers who have dealt with big studio/office moves like this. I know this will be a learning experience and I look forward to what I will learn from these men and the experience.

We have had an ongoing issue with the ISDN line at the KLVZ day site not staying connected. One day it will work and the next the line never picks up. It's occasionally used for backup to the STL, but it also provides telephone service to the site. Without it we can't dial into the Burk remote control and the alarm system cannot call out if there is a break-in or fire. I finally decided to call the telco, Qwest, on this issue. After working on it for several hours, they found the underground cable from the splice box near the road to our building was bad. To fix it, they ran a temporary line over the ground to our building. We are supposed to be on the schedule to get this buried. I am sure I will be talking to them very soon to get this done as we will have horses on the land as well as the possibility of a tractor working the site. The last thing we need is for a horse to get hung up in the cable or for a tractor to get caught in it and tear it up.

We had a nice blizzard on the 23rd. of March. We left early to get home before the worst of it hit. We had no intentions of going out at all during this blizzard, as we knew conditions would be bad. At 5:37 PM I got a text alarm from AutoPilot that the KLZ generator was running. Keith had checked it not too long before and said the 140-gallon diesel tank was just over half full. So I called Xcel Energy and they estimated it to be fixed around 9:00 PM. 9 came and went and the power was still out. I called again and they said it was a power transformer that was out. It would take until the next morning to fix. I was in panic mode at this point. We had estimated a half tank of fuel, 70 gallons, burning an estimated 6 gallons an hour. This would have meant the generator wouldn't last past 7:00 AM, so I reduced the transmitter power to 2 kW to conserve fuel. I woke up nearly every half hour to check to see if the power was back on.

Now, I'm sure you're all wondering why not go out there the night of the storm and fill it up?

The storm started with thunder, lightning and "hail" that was really little snowballs!

Well, the answer to that question is because during my checking of the all the sites we noticed something wrong with KLTT. It would not switch to night mode. It was off the air. My parents and I were watching a movie together since we figured we wouldn't have to get up early for work due to the snow. About a third of the way into the movie, we decided we'd better get out there. We weren't sure if we burned something up trying to get it to switch. We found that two of the three phases of power were out. We had seen some United Power trucks driving the road with their spotlights on the power lines. The drive out there was not that bad. It was a slow drive but not as slow as the drive back.

My dad worked some magic and we moved some of the wires to a phase that was working so we could switch the phasing and coupling system to the night mode. Then we moved the wires back. We left the transmitter off since there was not enough power to keep it on. We began the long drive back home. It must've snowed three or four inches in the short time we were at the transmitter. At around 2:00 AM, during one of my checks on KLZ, I noticed the power was back up at KLTT and turned on the transmitter

so we would not miss any paid shows that morning.

Early that next morning, I woke up and Dad and I headed to KLZ to put some fuel into the generator tank. The snow had stopped and the road crews had a little bit of time to get things plowed. Many of the roads were packed hard with ice. This storm was a very wet one, as they tend to be this time of year. As I shoveled the driveway, the snow on the concrete was already slush. This was the same for all the roads. We were able to get up to the KLZ site with no problems. We checked the tank and found there was still half a tank left. We were slightly baffled as none of us filled it up. Evidently Keith underestimated the fuel level when he checked it last. We added 20 gallons of fuel, transporting it in 5-gallon cans from a nearby gas station.

I called Xcel and they estimated 5:00 PM that day to have the problem fixed. 5:00 came and went. I called yet again and they said there were still a few people without power. They estimated this time that it would be fixed by midnight. We got to work the next morning and KLZ was still on the generator. Now, either the power was back and for some reason the generator didn't transfer over of the power was still out. We called Xcel and got them to start looking at the issue. We headed out to the site to check on the tank again and it was perfect timing. Xcel had just pulled up on the property. It turns out a fuse was blown in the switch cabinet across the street from the KLZ site. That was quickly fixed and we got the transmitter back to full power pretty quick. We had called a fuel jobber to come out and fill the generator tank with fuel as well as the tractor to avoid having to make numerous trips to the gas station to get the cans filled then dump them in the tanks. The fuel truck showed up while Xcel was working on replacing the fuse.

Earlier in March I had noticed the city of Thornton cutting down trees along the canal that runs through the KLZ property. I must say, it looks very nice. You can see very clearly the entire property from the road. But they left all the brush piles on the property. They are supposed to have a guy come with a wood chipper to clean it all up. I sure hope so.

I pray the month of March showed us our last major snow of the season. I am very ready for spring… for thunderstorms to come rolling through, for baseball to start back up and for the trees and grass and flowers to bloom. With this, though, comes the task of maintaining the fields at our sites. With a new string trimmer, a working tractor and push mower and with the John Deere riding mower (which is presently in the shop for maintenance), I am sure we will not have the same problems as last year.

Well, time to get to work on the spreadsheet for the wiring. So until next time, that's all folks…

Digital Diary
by
Larry Foltran
Corporate Website & Information Technology Coordinator

The IT Tool Box

A few weeks ago, my wife went to move my computer backpack (I guess it doesn't belong in front of the closet) and was shocked at how heavy it is. I suppose I never realized it until she mentioned that she felt as if her arm was about to fall off when she lifted it. I opened up the backpack and started pulling out the items I take to and from work each day. The inventory consisted of my laptop, a pair of Ethernet cables, a small toolkit, flashlight, and a variety of other items.

Her next question was whether I really needed all that stuff. Quick and easy answer… yes!

I thought about giving her an example, but I didn't want to make her eyes glaze over as every word went straight over her head. No disrespect to my wife, but she leaves to me the things that I'm blessed with and I am more than willing to do the same for her. So let me instead share an example with you that will hopefully support the need for me to feel like a pack mule each day I leave the house.

One quiet afternoon, there was a knock at my door from one of the folks here at the station telling me that the Internet was down. As you know, that could mean a variety of different scenarios from a general network outage to an issue with that specific computer. Since my Internet connection was still active, I decided to first check the actual LAN connection to the troubled PC. Grabbing the flashlight out of the backpack, I took a look under the desk and reseated the Ethernet cable. Unfortunately, that made no difference. As I climbed back up from under the desk, several more people came out of their rooms with the same message. That instantly eliminated the possibility of an individual computer issue. Time to troubleshoot the network.

The next tool I selected for the job was my laptop. Because there are several different routers in place within our network, each with wireless capabilities, I can quickly connect to each and determine in what segment of the chain the issue could reside within. If I connect to the router and am unable to bring up a web page, the issue is farther behind that router or within that router specifically. On this occasion, I was pleased to see that our link to the outside world was active on our broadcast network and the issue was isolated to our general office network. That instantly cut my work in half and I knew that I could eliminate one entire side of the infrastructure from my thinking.

Now the potential issue was within a group consisting of a switch, a router, and a firewall appliance. The next tool out of my backpack was an Ethernet cable which I used to connect the laptop to the switch. That quickly showed me that I could connect to the switch, but I still have no Internet connection. Next stop was the Ethernet link between the router and the switch. Using the other Ethernet cable, I replaced the jumper between the two pieces of equipment and tried again. Still no prize. Next I used a small RJ connecter that switches a straight Ethernet cable to a cross-over. Although modern switches are typically smart enough to determine the connection type, I still like to try this little piece of equipment just in case. Still nothing.

So by this point, I had used a series of tools and determined that the issue was most likely the switch itself. My next plan of attack was to substitute in a small 4-port switch and connect my laptop to that and see if I could connect to the Internet. As Google appeared on my screen, a broad smile appeared on my face. Knowing where the problem resides is sometimes half the journey to resolving the issue. Having the right tools is essential in finding out where the problem is. It all simply goes hand in hand and justifies the need for me to carry my heavy backpack in to work each day. Now I need to find a way to convince my chiropractor.

The Move Ahead to Windows 7

With the addition of two new Win7 laptops to our sales computer inventory, I can breathe a sigh of relief that we've thankfully bypassed the world of Vista here in Detroit. Although I still run Vista on my laptop (hopefully not for long), I still prefer to have XP on the work computers simply because it's easier to diagnose issues and ensure our computers are happily playing nicely.

The integration of our two new machines was seamless and they were actually easier to get connected to our network and printers than the XP computers. I did encounter two snags, both involving very old software that we are still using. In one circumstance, launching the software in XP compatibility mode solved the issue. The other situation was related to linking up with the office color printer via the network and became more of a thorn in my side.

The setup for the color printer was put in place way before I came onboard. At the time, the printer was connected to a computer which served as the spooler. Unfortunately, users could not print when that computer was shut down, which obviously created an issue. The operations manager at the time and I ended up connecting a printer server access point to solve that issue, but left the rest of the setup in place for another day when we would have some time to calmly devote to it. As I'm sure you know that day rarely comes.

While recently setting up the new Win7 laptop, I realized that the IPP port monitor software that I typically use to connect to the color printer refused to work on this new OS. Granted there are several ways to skin a cat when it comes to IPP printing, but in this case I decided that it may be time to reconfigure the color printing setup and make it work as it should.

In a nutshell, each color print job was sent via one network to the other network, back through the building via an Ethernet cable to a wireless access point, and then through a wireless signal to the wireless printer server. I still don't understand why, but that's how it was. I decided to simplify this setup and simply configured a LAN-based printer server within the main network and connected the printer to it. A simple configuration which made the XP neighborhood happy along with the new Win7 tenants. One big, happy IT family…for now.

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
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, 6 kW/65m 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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