Radio Guide

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September-October 2010 – Vol. 18, No. 5

Kintronic Labs – Spanning the History of AM Terrestrial Radio

Inside Radio Guide:

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Rick Hunt, Vice President and Director of Radio Engineering at Entravision Communications Corporation, with one of their Wheatstone G5 consoles.

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The Kintronics Laboratories Inc. family.

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Volume 18 – Issue 5

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Radio Guide, ISSN 1061-7027, is published bi-monthly, six times a year, by Media Magazines Inc., PO Box 20975, Sedona, AZ 86341.

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Radio Waves

by Ernie Belanger – Editor

It's Contest Time

As you know ***Radio Guide*** publishes an *Xtreme Engineering* column in each issue. We know that many of you have been involved in a build, or rebuild, that was out of the "normal" and we want to hear from you about it. So ***Radio Guide*** is running a contest starting with our Jan/Feb-2011 issue. Submit your *Xtreme Engineering* stories to us, and we'll select one for each issue in 2011.

The writers of the six *Xtreme Engineering* storties that we publish in 2011 will be eligible to win an Engineer/Technician Tool Kit, complete with hard carrying case.

Article submission deadline will be Decmber 31st, 2010 – the winner will be selected by random drawing on January 2nd, 2011. Good writing – and good luck.

Remember, I'm here to assist you in fine-tuning your story. So don't worry if it's just a rough draft – by the time it's published it will be a polished final story you will be proud of.

On-Line – Bonus Content

We have exclusive addition items for you in our on-line digital edition. You will find Roger Paskvan's unedited paper on *Transmission Line Properties*, and you will also find photo's of Scott Schmeling's *Studio Re-build.* Visit the on-line version of ***Radio Guide*** at: www.radio-guide.com and you will find this bonus material right after the last page of the regular ***Radio Guide*** content.

If you have story ideas that you want to see us cover email me and we can discuss them: editorial@radio-guide.com

– Ernie Belanger, Editor

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Cover Story

by Tom King

Kintronic Labs – Spanning the History of Terrestrial AM Radio

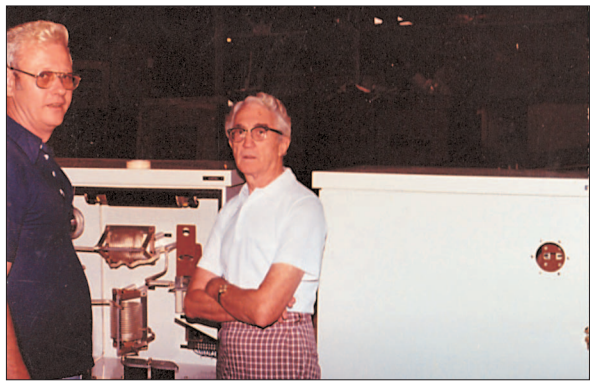
In 1949, Louis King, founder of Kintronic Labs, resigned from his position at RCA as an AM high power transmitter design engineer to return to his birth place of Bristol, Tennessee to pursue his love of radio frequency (RF) antennas and components.

Shortly after he returned to Bristol with his wife, Elizabeth, and two children, he obtained his PE license in Tennessee and Virginia and established a new business as a regional broadcast consulting engineer in office space provided by his father, Arthur King.

Manufacturing Begins

In the early 50's he started designing and manufacturing FM isocouplers and AM antenna tuning units using inductors manufactured by E.F. Johnson and capacitors manufactured by Sangamo. Louis hired two Army veterans that were employees of his father, Boyd Wright and Earl Tolliver, who he trained to oversee manufacturing and field service, respectively. He out-sourced the metal cabinet works and the painting.

In the mid-fifties he manufactured his first directional antenna phasing cabinet and discovered, much to his disgust, upon completion and testing, that the cabinet would not fit through the door of the room in which it was fabricated. Thirty years later I made a similar mistake on one of my early phasor cabinet designs, which resulted in us having to lower the cabinet into the customer's transmitter building prior to the installation of the roof.



Louis King (right) with Bob Seats at the original Kintronic Labs factory in 1981.

Consulting Too

During these early manufacturing years of Dad's business, he was also providing broadcast consulting services and was involved in the preparation of AM license applications and directional antenna Proofs of Performance for many clients in the southeastern U.S.

It was in 1962 that Dad consulted with myself and other family members to arrive at the company name of Kintronic Laboratories.

Many Friends

As a broadcast consultant he enjoyed working with such esteemed Professional Broadcast Engineers as Bob Silliman, Ogden Presthold, Bob duTreil, John Mullaney, Palmer Greer and others.

He would often leave our home around midnight to work on transmitters that were off the air.

I said to myself, at the time, that this was not a profession that I would want to pursue, often times having to work through the night. Well, I, like Dad, have been very thankful for the many friends that have truly served as my mentors and sources of encouragement in the broadcast business, and I have no regrets for having eventually gotten into this business as a result of the persistence of my dad.

Elizabeth King Running Accounting

Business Begins to Blossom

By the early 60's, Louis' business grew to the point that he had to seek a facility with more manufacturing space. It was at this time that he moved to a rented building located in downtown Bristol.

When E.F. Johnson's inductor and RF contactor production was discontinued, Dad built his own.

Undertaking the design of fixed and variable inductors and RF contactors, he worked with Boyd Wright and a new machinist, Bob Seats. He improved the design of the E.F. Johnson inductors by changing the frame bars from a straight design to a bowed design to conform to the inner radius of the inductor winding. This made it easier for field engineers to adjust the inductor without scratching up their knuckles in the process.

More Innovation

Dad also changed the round contact pins on the E.F. Johnson contactors to a rectangular design, to facilitate a more robust, larger surface area contact between the contact bar and the finger stock in the contact holder.

He also developed a superior roller contact design for 20 Amp variable inductors, resulting in increased surface contact between the roller assembly and inductor winding. This served to eliminate arcing and pitting under power. The ultimate impact of these design improvements was a more reliable and user-friendly AM antenna system.

Big Contract – Positive Results

In 1977 Dad signed a contract with Gates Radio to provide a 3 x 100 kW AM triplexer for installation in Rio de Janeiro, Brazil. This was the largest project that he and Kintronic Labs had endeavored to produce up to that time. Before taking on that project, the company had been relying on bank loans to keep their operation running.

Upon completion of this high power AM project Kintronic Labs was out of debt and has maintained a positive cash flow ever since.

Growth and Innovation Continue

It was around this time that Dad discontinued his broadcast consulting business to devote his full time attention to the manufacturing of broadcast transmission equipment.

In the late 70's he worked with a manufacturer of non-inductive wire-wound resistors to design and develop a series of convection cooled and forced-air cooled transmitter test loads for carrier powers from 1-50 kilowatts plus 125% modulation. He later developed 100 kW and 200 kW load designs based on the successful launch of the lower power loads.

Moving Into the Computer Age

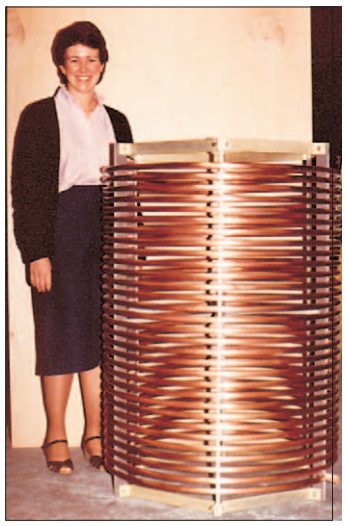
Up until 1982, Dad completed all of his antenna system designs using a slide rule and tabulated data, until the advent of the handheld calculator.

In 1982 Ron Rackley, PE, left the firm of Jules Cohen Broadcast Consultants in Washington, DC and became the first full time engineer employed by Kintronic Labs. Ron arrived about the same time as the Radio Shack TRS80 personal computer and the BASIC programming language.

Ron was instrumental in getting Dad into the computer age and the design productivity of the company increased many fold.

Can Do – We'll Figure It Out

One thing that I learned from Ron during his time with Dad, was that Dad was always ready to accept any challenge presented by a customer agreeing to provide a solution without knowing what that solution would be at the time.



Gwen With One Huge Coil

Dad would get off the phone, and they would look at each other and say, "How are we going to do that?" Dad would say, "Well, I got my tail in a trap again." But the amazing fact about Dad was that he would find a solution to many challenging problems, and he grew his business as a result of this "can do" attitude - the same attitude that continues at Kintronics today.

Tom Joins the Family Business

Ron decided to return to the broadcast consulting business after one year in manufacturing, and I left a career in military aircraft defensive systems development, test and evaluation, and returned to work with Dad in early 1983.

Upon my arrival at the company, I found my sister, Gwen, was in charge of drafting, my mother was in charge of accounting, and Boyd Wright and Bob Seats were in charge of our manufacturing. *(Continued on Page 8)*

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With more than 200 years of combined engineering and technical experience, Kintronic is a global leader of world-class radio broadcast antenna systems. Kintronic engineers can custom-craft your radio broadcast antenna system or component need for any location, at any fixed site, or to meet any mobile requirement.

Cover Story

Kintronic Labs – Spanning the History of Terrestrial AM Radio

– Continued From Page 6 –

VSU-1 Voltage Sampling Units Under Test

Success Has It's Toll

When I returned the business was booming, and Dad was working every day except Sunday morning when he attended the worship services at First Presbyterian Church where he ultimately became an Elder Emeritus.

As a result of the stress brought on by his heavy work schedule, including long hours and late nights, Dad had a stroke eight months after I arrived, resulting in a discontinuation of his regular involvement in the company for about two years.

Tom Keeps Things Running

I had thankfully learned enough about the business by that time and was supported by many very knowledgeable mentors in the broadcast community to enable me to keep the family business running.

During this time we incorporated in the state of Tennessee as Kintronic Laboratories, Incorporated.

In early 1985 we moved to our present location in Sullivan County outside of Bristol where we consolidated our administrative and manufacturing facilities.

Our new location allowed us to grow without the fear of outgrowing the facility

Innovation Continues

Our company continues to grow, developing new products and refining our designs to meet more challenging needs.

More recent developments include designs of RF inductors and RF switches and related accessories, to facilitate the manufacture of RF feeder systems designed for transmitter power levels up to 2 megawatts.

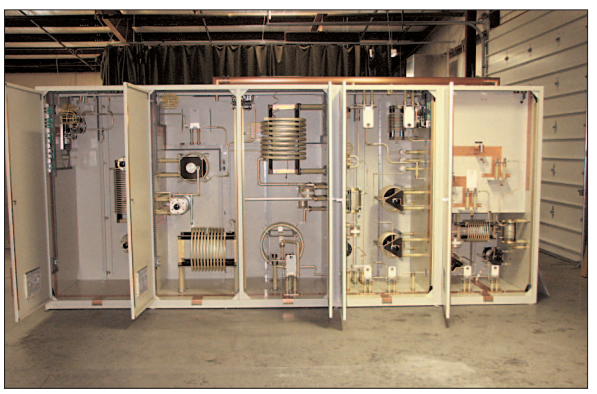
Another significant development was our joint introduction with Star-H Corporation of the KinStar low profile antenna. This is the first AM low profile antenna to be type accepted by the FCC for the U.S. market.

Kintronic continues to find areas to expand their market including their new fast deployment transmission systems.

Remaining Vibrant and Moving Forward

We remain a vibrant company and Dad's "Can Do" attitude continues to lead our efforts every day.

From the time that I became integrated into the Kintronic family, our mission has been to provide the highest quality broadcast products, in a cost-effective and timely manner, while serving our customers with honesty and integrity.



A 50kW Four Tower Phasor

A Faith Based Company

We know without a doubt that our company is what it is because of the grace and mercy of our Lord Jesus Christ.

One thing that Dad knew to be true, and that we as a company know to be true, is that – "Anything is possible with God." – He is the one that makes all things possible.

Tom F. King, is the President of Kintronic Labs, Inc. a family owned business located in Bristol, TN. He holds an MSEE degree.

For more information about Kintronics visit their web site www.kintronic.com or call 424-878-3141

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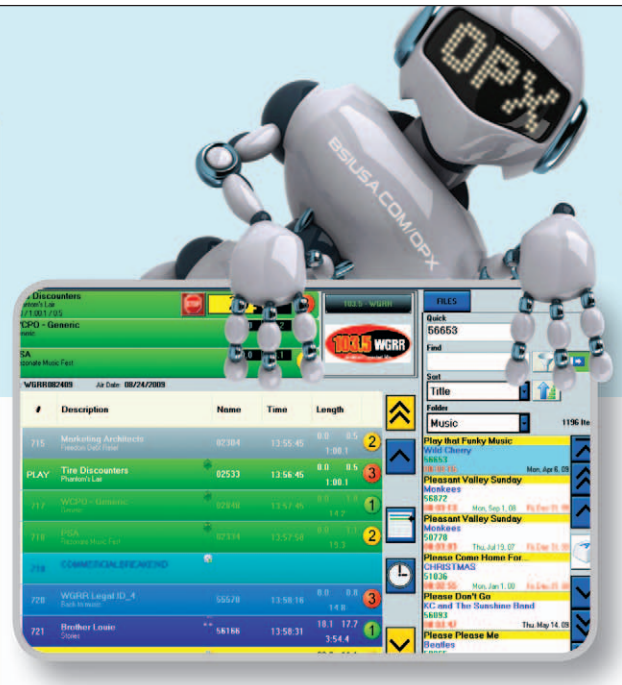

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Xtreme Engineering

By Steve Callahan

Tilted Tower

Does Your Radio Station Need Some T.L.C?

Sometimes Xtreme Engineering takes place hundreds of feet above the ground and it's done by a tower crew to save a tower that's in potential jeopardy – Editor

It amazes me that so many radio stations are bought and sold without the new owner even visiting the transmitter site to do their due diligence. Many AM stations were built just after World War 2 and their physical plants, especially their towers, are getting along in age.

Inspections Needed

When was the last time you inspected your tower? I mean, *really* inspected it by walking to each of the anchors?

I was in Florida recently and stopped by a small 1 kW AM, single tower radio station. The tower and guy wires were heavily rusted and there were the remains of an old RPU "trombone" antenna near the top.

The tower had a homemade, six-wire, folded unipole, made out of once galvanized guy strand and old power company insulators. The ground system was one ground rod driven into the earth outside of the tower fence. The tower was circa 1950 and it was miraculous that it was still standing. I now know why I couldn't pick up the station more than four miles out of town.

Your Most Valuable Asset

A radio station's tower is a very valuable asset. It needs to be maintained and repaired so it can perform as it should. I had the chance to chat with my local tower contract, Chris Loycano of Broadcast Tower Service Inc. in Bridgewater, Massachusetts.

He told me of a tower that he had recently worked on that was initially a mystery. Chris had been called to an AM station to do some regular maintenance. While in town, the station owner asked him and his crew to visit his FM tower across town to re–lamp.

Flange with Only Two Bolts and Shims

Tower Near Jeopardy

When Chris got to the 300 foot FM tower, he quickly found a situation that could easily put the tower in jeopardy. Two of the three flanges on one of the top tower sections were shimmed while only one of the legs was bolted flange-to-flange as they should be.

There were one-half-inch gaps between the flanges which had small pieces of metal stock in them to bridge the gap. To compound the problem, the two pair of shimmed flanges only had two bolts each because the shims were placed where the third bolt should have gone.

Chris and his crew replaced all of the flange bolts on the tower and made up some proper one-half-inch galvanized spacers to properly bridge the gaps. It's speculated that there was a manufacturing defect and that section of tower came out of the factory with two defective legs – and the tower crew at the time wanted to finish the job and used what hardware they had to complete the job.

The Second Flange with Shims

More Complications

One complicating issue with this particular tower is that the bottom half is owned by one entity and the top half is owned by another. Both owners were amazed when they saw the pictures, and knew nothing about the shims.

Before Chris and his Broadcast Tower crew left the site, they also stripped off some old pager antennas and coax, rewelded some grounding, and re-guyed the tower.

How to Avoid Xtreme Tower Situations

Here are a few handy tips to help you avoid issues like this one. If you own or operate a radio station, you should get to know your local tower crew. If you don't know of one, call around to the local SBE or other stations for some recommendations.

Resist the temptation to use one of those tower crews that are based far from your area, because there may be a cold and rainy night when you need them, and they will be eight states away.

Be sure to schedule regular tower inspections and maintenance visits. Chris Loycano suggests that guyed towers be inspected every other year, and self-supported towers be inspected every four years.

Take some time to visit your tower array and walk the entire site – even to that far guy anchor that's hard to get to. Take a digital camera and take pictures of what you see

Fencing

Keep the area within the base fence clear of trees and brush. Check that the fence is in good repair.

You do have a secure tower base fence don't you? I read about an AM station that didn't maintain a fence around their tower, and the FCC visited the site and issued a Notice of Violation. The station countered that the tower was in an alligator-infested swamp and that a tower base fence was unnecessary. The FCC didn't buy that argument and the fine was upheld.

Keep Brush Cut Down

If you have a large site that needs the plant growth managed, find a local landscaping crew that can cut it once or twice per growing season. Chances are good that your tower crew knows someone that they have worked with and can recommend them.

From personal experience, it's much easier to get to a tower base to make some repairs in the middle of the night if you won't have to push your way through brush that's thick and over your head.

I have seen pictures of a station that allowed some willow trees to grow up under their guy wires over the years and those trees deflected the guy wires sideways. That negligence put unplanned stress on the tower and it eventually had to be replaced because it was so badly bent. An expensive tower replacement job like that could have been prevented by some scheduled site visits.

Tower Painting

When it comes to tower painting, we've all seen some very bad tower paint jobs. If you use a reputable and dependable tower crew, you'll know the job will be done right so your tower is protected.

One thing that hollow tube towers have, that many people neglect, are the weep holes in the base section. They are ignored because they are frequently painted over and if you don't know they are there, you won't go looking for them.

They should be kept open so the tubes can drain and not build up standing water that can rust the base section from the inside out.

The Proper Spacer Bolted in Place

Tower Renters

If you have ever rented space on your tower, keep an eye on what your tenants have put on your tower. When tenants leave, they frequently just take their equipment out of the building and drive away.

Your local tower crew can strip off old hardware which is only contributing to your tower's wind load and not to your bottom line.

Invest some time and money in your towers and tower site to avoid Xtreme – above ground – Engineering.

Steve Callahan is the Director of Engineering for Rhode Island Public Radio. Chris Loycano of Broadcast Tower Service, Inc. can be reached at 508-326-9485.

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Transmitter Site

Properties of Open and Shorted Feedlines

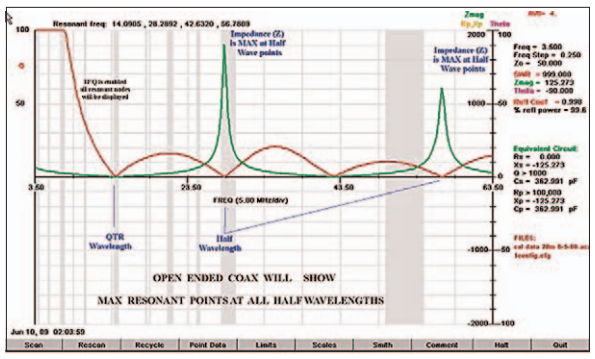
– by Roger Paskvan –

The author was able to look into transmission lines using a network analyzer to provide a visual display of waveforms. For these measurements, the new ***Array Solutions*** *AIM 4170 provided an economical means of accomplishing the task.*

The AIM 4170

The AIM 4170 provides your laptop with a large display in several colors that actually shows what is really going on inside the transmission line. The author has compared the readings of the AIM4170 to that taken with an HP 8714 network analyzer and both agree within 1% under 150 MHz. It's a well made, beautiful instrument priced within most engineer's budgets.

So let's take a minute to look into the properties of open and shorted end lines. Connect the analyzer to a piece of open ended (not shorted) coax to the port, run the calibration routine, and here is what you will see.



Screen Shot Showing Open Coax

How to determine a quarter wavelength of coax using a network analyzer.

Taking advantage of the known factors of open and shorted coax, they can be used to determine the exact length of any cable.

A length of coax with the end open will have minimum impedance (Z) at all even quarter wavelengths measured at the input end. This same coax has very high Z at all half wave multiples, measured from the input end.

If this same line is shorted on the end, it will have maximum Z at quarter wavelength multiples and minimum Z at the half wave points.

A quarter wave line that is shorted at the end will have a very high Z at the source point. A half wavelength of coax shorted on the end will have a very low Z at the feed point.

This information can be used to measure a length of coax for quarter or half wave pieces. The nice thing about a network analyzer versus other methods is that you can actually see this theory in real time.

Methodology

A network analyzer, such as a HP8714 or AIM4170, will show these impedance maximums and minimums on fractional wavelengths of coax that are open ended. You can use this information to find a quarter or half wavelength.

Set up the network analyzer to measure impedance and enable "Q" if you have that function available. Decide on a frequency.

First, calculate an approximate quarter wave length as follows: 11803/Freq = 1 wavelength (y) in inches; divide this number by 4, then multiply that number by the velocity factor of the coax. (i.e. 0.66)

Now, add a few extra inches and this is your starting point. Cut a piece of coax to this length, then multiply the frequency you want by two (2).

Set the network analyzer to sweep 10 MHz or more above and below the times-two frequency. While measuring impedance (Z), cut the open end off in little chunks until the first peak in impedance occurs at the desired (times-two) frequency. This will be the point of a quarter wavelength at the desired frequency, since we are at two times this frequency. (We are actually measuring half wavelengths at the times-two frequency.)

Testing the Frequency

To test the original frequency, solder a short across the open end of this coax. The entire pattern now shifts to the left. Re-adjust the network analyzer for the original frequency you want, and sweep 10 MHz above and below this frequency. The impedance peak should be centered at the desired frequency for a quarter wavelength.

If "Q" is enabled, there will be a red line that will dip at this node.

Why Double the Frequency?

The reason we double the frequency is to allow cutting an open-ended coax. If we used the original frequency to find a quarter wavelength, we would have to short the end before each measurement.

The author has noticed that above 1,000 MHz, this (X2) method is not reliable due to stray capacitance problems. Above 1,000 MHz, you will have to cut a quarter wavelength direct and short the end for each measurement. For stubs at these frequencies, Heliax works better since it is not affected by heat, bending and stray hand capacitance of coaxial cable.

Showing Resonant Points

If you are using an AIM4170 Network Analyzer, Impedance is called Zmag.

The instrument has a "Q" function that can be turned on. This red line will actually show the minimum resonant points along the scan line, taking all the guess work out of interpreting the display. It is an actual physical display of the wavelength theory.

Quarter Wave Stub

Under the function menu is a tab called "1/4 wave stub." If you enable this function, the program will tell you how much needs to be cut off to meet the resonant quarter wave point. (Details are in applications under the help menu.)

From the above diagram, you will see the relationships between impedance, for open sections of various lengths of feed line. The impedance "seen" looking into various lengths of feed line is maximum at all half wave points along the line.

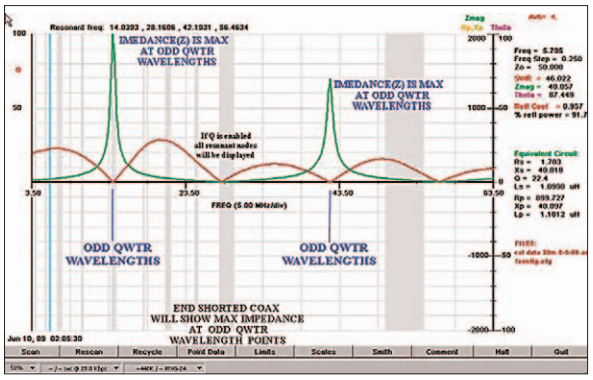
Impedance is minimum at all odd quarter-wavelength points (1/4, 3/4 and so on) as measured from the input end along an open line. A 1/4 wavelength feed line that is open at one end presents very low impedance to a signal generator.

At all even quarter-wavelength points (1/2, 1, 3/2 and so on), the impedance is maximum and voltage is maximum.

A 1/2-wavelength feed line that is open at one end presents very high impedance to a signal generator. You should also notice that the impedance is resistive at multiples of quarter wavelengths.

At points in between quarter-wavelength marks, the impedance is capacitive or inductive.

If we look at a shorted end piece of transmission line, we will see that the impedance shifts from maximum at half wave points for open line to maximum at quarter wave points along the line with a short at the end of the feed line.



Screen Shot Showing Shorted Coax

Shorted Lines

Shorted lines can he considered in a similar manner. For example, a 1/8-wavelength line that is shorted at one end presents an inductive reactance to a signal generator.

A 1/4-wavelength feed line that is shorted at one end presents very high impedance to a signal generator. A 1/2-wavelength feed line that is shorted at one end presents very low impedance to a signal generator. Also notice that the impedance is resistive at multiples of a quarter wavelengths. With "Q" enabled, a node is shown at each resonate point along the transmission line.

With this information, you can determine the velocity factor of any transmission line.

Finding the Velocity Factor of Coax

First connect a piece of open-ended coax on the network analyzer and sweep it with a wide enough bandwidth so you will see at least two peaks on the screen. The length of the coax doesn't matter

Now measure the frequency of one peak and then the frequency of the second peak. (Let's say it is 14 MHz for the first one and 42 MHz for the second peak) Subtracting these two frequencies = 28 MHz (call this F).

Next, measure the actual physical length of the coax piece in inches. (Let's say it is 140 inches (call this L).

The velocity = (2) (L) (Change in Freq in MHz or F) or (2) (140) (28) = 7,840.

The velocity factor = Velocity/C *(speed of light in same units as L)* = 7,840/11,817 = 0.663 or 66%

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His original unedited manuscript which includes additional valuable information that was cut due to space limitations, is available in the Digital Edition of ***Radio Guide*** *at www.radio-guide.com*

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Studio Site

Lacing Up More Studio Improvements on a Shoestring

by George Zahn

Before we get to more ideas about good studio maintenance and upgrades on a tight budget, I first want to thank the many ***Radio Guide*** contributors and readers who have shared kind comments and ideas on this and other topics. When you share ideas here, it helps us all, whether managers, engineers, producers, or talent. Keep the comments and ideas coming!

Stretching Your Budget May Save Your Job

In this day of downsizing and cutbacks, we need to stretch every dollar, and an employee's resourcefulness might make the difference between a paycheck and a pink slip.

A smart engineer can pay for him or herself in savings to the company, and some of the best in the business have shared ideas and stories on these pages. Sometimes, a studio needs some subtle tweaking to make things better, and then there's what contributing engineer Jay Crawford encountered.

"I have a nineteen year-old daughter, and after a summer of having her home from college, I think I may explode if I see another make-up or fashion make-over program emitting from what was my big screen TV." Yet that's almost exactly what a radio station asked Crawford to do in the production studio in the past months: a complete studio "make over."

No Decorating Needed

No, Jay didn't have to worry about color coordinating the equipment, painting accents, or dressing the place up – most of us, including me, have a hard time matching up Eeyore and Winnie the Pooh on a good day! But they needed a production studio that could do solid, basic commercial production on a daily basis.

The small station had not really produced spots in years, instead they out sourced the work, paying someone else to produce them. Commercials were then sent to the station on cassette, for transfer to cart. We're talking about a noise and flutter nightmare!

Antique Console

Jay had to start with – well, everything – but he looked at the console which was an RCA, likely from the late 1960's. I know engineers who have made miracles happen, but when it's a "40-something" age console with limited or no replacement parts, there are times to cry "Uncle," proving it's all relative.

While the station did not have the budget for a brand new console, Jay went to digging, and discovered that a sister station had a 1990's vintage console in storage that was more than salvageable.

Not only was the newer console with "parts available," it was also a simple console, and the small station had a lot of part-timers who weren't blessed with tremendous experience. So, Jay's solution saved money and headaches and brought the station forward 25 years.

Portable Media?

In recent articles, we discussed portable media such as flash memory cards, thumb drives, and CDs. According to Jay Crawford, "Their 'portable media' was carts."

They had a cheap, semi-pro reel-to-reel machine from the 1970's which didn't work due to lack of rubber parts and usable tape. Beyond that, they had a home-use, dual cassette deck and a home-use CD player.

– First, let me say that we're not relating this to embarrass the station involved. –

There are likely many small stations that are in the proverbial boat, and we're here to keep that ship from capsizing (or downsizing for that matter). Right now, replacing those old tape decks with new technology can actually be a more cost-effective fix, than fifteen years ago trying to replace a reel to reel deck. Here's what Crawford did to salvage the studio.

Modernization Equals Savings

"I chose an inexpensive computer with Adobe Audition. No real personal preference for the program, but everything I have heard from others say it's easy to learn and does what is needed in a radio production studio," says Crawford. "We are keeping the home-use equipment – CD and cassette aren't heavy use items at this station, at least in the production studio."

Think about that. Instead of a $5,000 commercial grade reel deck, the station now has a computer that would cost no more than $1,500 new, with tons of storage, and about $350 to license Audition. You've improved quality and cut replacement cost. The computer also allows you to record CDs and other media.

Still Using One of These?

Undergoing a "Cart" Transplant

The only remaining dilemma for Crawford was the dying and dead carts decks that were flat-lining on a regular basis. "Everybody loves and hates the carts," Jay explains, "They are so easy to use, if you forget to have something ready, or a program fails you can just grab a cart, shove it in a machine and hit 'play.'"

But the negatives are there, even if you don't consider the machines have needed rubber parts for at least 10 years and will soon need heads.

The carts themselves are more or less unavailable; the old ones have needed new pressure pads for years and years. And they just sound bad – really bad when you have operators talking about it on an AM station."

For the sake of audio quality, let the old dinosaurs go out a museum or get recycled into something more useful.

Flash Drives

As I'm writing this, the jury is still out on the cart replacement, in Crawford's opinion. He examined options including flash drive recording and playback, and recordable and re-recordable CDs. After close examination, the station did invest in two Marantz flash drive recorders for air and two for production.

He admits that he may be moving one of the decks from production to air, to more closely match the three cart decks in air – leaving one in production.

While adding four decks can be expensive, any of the new portable media has a longer projected life span than the old carts at this point. Plus, Jay's resourcefulness in saving money on the console and recording and production gear made the price tag of the decks far more palatable.

Echoing Sentiments

Not to ignore the aesthetics of a make-over, another topic that comes up from time to time is how to improve the overall sound isolation of a studio, or even between studios. From an economical standpoint, soundproofing of the studio may be one of the lowest priorities unless you're building brand new facilities.

I asked a group of engineers jokingly about reverting to the old days of gluing egg cartons on the walls to deaden and diffuse sound. The most common feedback included making sure that whatever sound proofing is used for the studio is indeed fireproof – and for the record, that would not include egg cartons.

The Cost of Sound Deadening

The important message is that before choosing some carpet or fabric remnants over Sonex, Soundtex, or another professional product, keep safety in mind.

If you are considering upgrading your soundproofing, better wall insulation or a second layer of 5/8-inch drywall obviously can help, and may be cheaper than coating every inch of your studio walls with sound absorbing material.

A completely covered room can create something akin to an anechoic chamber, a room in which there is virtually zero reverberation, which is far worse than have some reflected sound in the room.

You might consider a few strategically placed sheets of sound deadening material on various walls to help a reverberation problem. Don't forget that square corners in a room help sound echo. Trapping it there could solve your echo problem.

If you're not sure where you want the sound material on each wall, try temporarily mounting it via Velcro or mounting the material on a board which could be hung like a picture frame in various spots. It's not unlike recording studios using portable baffles between instruments for isolation. You might be surprised that a little soundproofing and diffusion of sound could make a nice difference without redoing an entire studio.

Not all stations are using computer audio delivery and editing. Next time, and we'll discuss maintenance issues and problem prevention.

Do you have any ideas or comments on the studio make over we've been discussing. What changes have you made that might help other engineers and management? I hope you'll share them with us as Jay did.

I'm also looking for ideas on studio lighting. Do you prefer fluorescent, incandescent, natural (where available) or other? What's the funkiest light setup you've been around or are there light-affected announcers at your station? Share your stories with others by sending ideas and feedback to email: gzahn@mkcommunities.org

George Zahn is the Station Director/General Manager for WMKV Radio in Cincinnati.

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Disaster Preparedness

Planning For Disaster – Unintentionally

by Judith Gross

There are times when decisions you made along the way may end up serving well beyond their original value – giving that extra edge when pressed into a difficult situation at an unexpected moment of catastrophe.

It was an unusual bit of just such serendipity that allowed Chile's largest independent radio network to deploy reporters rapidly across a wide coverage area and inform an alarmed public in the aftermath of a powerful earthquake, reporting remotely from even the hardest hit locations.

Bio Bio La Radio went on the air in the mid-1960s and today covers 98% of Chile from eight major locations. News, weather, sports, culture, lifestyle and stories of all kinds are the mainstay of the network.

Bio Bio's Maria Carrasco reporting live.

Elections and Soccer

As 2010 got underway, two major events were looming where excellence and diligence in serving an avid radio listener base would be in demand: the Chilean Presidential election and the country's soccer championships.

The network was also set to broadcast play-by-play of a major South American soccer series – the Liberator's Cup from Argentina, Peru, Brazil and Venezuela..

To facilitate coverage of these important events and others, late in 2009, Bio Bio added four Comrex Access portable codecs to its stable of equipment, using them to keep the citizenry informed about what turned out to be an historic election, and satisfying soccer fans with the latest news about Chile's beloved sport.

Disaster Strikes

Then, in late February, came the magnitude 8.8 earthquake just off the coast of Chile's Maule region, destroying buildings, causing numerous injuries and hundreds of fatalities – knocking out power and communications signals and even triggering a tsunami along coastal towns.

It took two or three days before cell service could be restored, but as soon as it was, Bio Bio La Radio sent four reporters out with their portable Access codecs in tow, traveling in station vans and even police cars, to report on the devastation and emergency efforts all across southern Chile and to re-establish vital communications.

Journalists Maria Carrasco, Richard Jimenez, Rodrigo Pino and Jorge Munoz deployed across the region most affected by the quake and were able to send live reports from Concepcion, Santaiago, Talcahuano and Dichato.

A ship tossed on shore in the disaster.

Moving Reporters to The Disaster Sites

Having portable remote equipment available proved to be the key in reporting the disaster, "We were able to go and cover where there was no other form of transmission," says Alejandro Marnich, Manager of Operations for Bio Bio La Radio.

The damage was far-reaching: uprooting houses, collapsing highways and flattening buildings. It caused chemical fires, damaged part of capital city Santiago's International airport, and destroying hospitals. Even the country's Fine Arts Museum was partially ravaged. And dozens of inmates were able to escape from one of the country's prisons.

Buildings were reduced to piles of rubble.

Generators Kept Them "On The Air"

Power outages were widespread and severely hurt communications channels of all types, making the remote coverage of Bio Bio La Radio even more crucial. Marnich notes that the network has generators in all of the country's major cities – another fortunate choice made long before the quake – and was back on the air shortly after the quake hit.

"It (back-up power) allowed us to go on air within 20 minutes of the earthquake, making us the only broadcast medium at the epicenter and in Santiago and Valparaiso and giving us a way to inform people of what was happening," Marnich says.

Generator power also allowed Bio Bio La Radio to transmit critical emergency information to an alarmed populace even as aftershocks were still being felt.

Portability is Key

More devastation to report.

The portability and simplicity of the Comrex Access was a definite advantage for the radio network. It fit into a reporter's hand while they filed their updates using a hand-held mic. Easy transport and rapid set-up are two of the biggest factors during times of emergencies. It was absolutely essential during Bio Bio La Radio's earthquake coverage.

The four reporters traveled from town to town and village to village to provide the most comprehensive coverage. In addition to the portability and easy set-up Marnich also praised "the quality of the audio transmission" of the equipment.

Lessons for U.S. Broadcasters

It's important to learn from disasters such as the Chilean earthquake and have backup equipment, alternative ways to stay on the air, and a well-thought out emergency plan in place. The network already had some contingencies in place, such as multiple generators which allowed them to surmount power outage problems.

Cooperative contingencies with other stations, power generators, lightning strike protection, and even consulting with federal, state and local emergency management offices are all prerequisites for disaster-proofing broadcast stations – to the extent that disaster-proofing is possible – and to becoming an asset in a disaster.

But sometimes the most ideal response in the wake of an unexpected event is to have been the kind of broadcaster that provides maximum service to the community by embracing technical innovation as a part of day-to-day operating procedure all along.

Bio-Bio's Access – Job well done!

Stations that rise to the challenge to become more mobile, more flexible, and to upgrade as the technology grows, are not simply sharpening their competitive edge and providing more interesting programming.

They may also be equipping themselves to weather the next man-made or natural disaster and cement their role as the critical link in the emergency communications chain.

Judith Gross is a writer and radio producer with her own freelance marketing and media company in Binghamton, NY. Contact her at: judithgrossradio@gmail.com

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FCC Focus

Political Ads – Yes or No?

by Peter Gutmann

As we head into the final sprint of this year's political marathon, let's review some of the most persistent questions and concerns.

Perhaps the most widespread issue is access – whether a station with a specific format or audience must run political ads at all. The answer depends upon whether the station is commercial or noncommercial and whether the candidate is Federal or non-Federal.

Non Comm Restrictions

Noncommercial stations have no obligation to air any political material at all. Indeed, the Communications Act forbids them from supporting or opposing any candidate for political office.

Can they run editorials or make endorsements? No!

However, note that these limits apply only to broadcast activities and do not cover websites, newsletters and the like, although appropriated funds may impose further restrictions.

Commercial Station Obligations

Commercial licensees can decide which, if any, non-federal candidates they wish to allow on their air. If you want to sell ads only to city council candidates and ignore all other local or state elections, that's fine – just don't expect any favors from the mayor whose requests you snub.

And remember – once you allow one legally-qualified candidate on the air, you must afford equal opportunities to all legally-qualified opponents for the same office – but only if they claim that right within seven days of their opponent's prior use.

Federal Candidates

In contrast, Federal candidates (that is, candidates for the U.S. Senate or House of Representatives in the 2010 election) must be given reasonable access to every commercial station.

Whether all-music, religious, time-brokered or foreign-language – none of that matters.

All legally-qualified Federal candidates must be given an opportunity to buy air time essentially whenever they wish, subject to certain reasonable limitations for non-standard lengths or placement.

How about candidates whose views you find repugnant? Sorry, but you can't pick and choose specific candidates to allow on the air. All Federal candidates are entitled to access. Plus, once you allow any candidate on the air, then you must accommodate all of his legally-qualified opponents for the same office.

Often the problem takes care of itself, though, as most candidates tend to steer clear of ideologically-opposed media, and don't want to spend campaign dollars on hostile listeners. But that's a candidate's choice.

Remember, too, that write-in candidates are not automatically entitled to status as legally-qualified unless they meet criteria established by the FCC and applicable state election authorities.

The Discalimer Option

To distance yourself, can you precede a political spot with a neutral disclaimer that it doesn't represent your views?

Yes, but only if you preface all other political spots for the same office with the same disclaimer.

Why? Because the Communications Act forbids broadcaster discrimination among candidates.

No Censorship

Can you censor a spot you find offensive?

Not if it qualifies as a "use" – that is, a spot in which the candidate's voice is heard.

In exchange, you are immune from libel and slander for airing it.

Non-uses, though, may be edited or refused on the basis of defamatory or offensive content, which you could be held liable for broadcasting.

What if I Get a Complaint?

If an opponent claims that an ad is defamatory and demands that you cease airing it, do you have a duty to investigate?

Not if it's a "use," (since you can't censor it). Otherwise, if it is a non "use" – yes.

But, only to the extent of asking the sponsor to justify the claims in the ad, and being satisfied that its response seems reasonable.

Political Rate Disclosure

When a candidate or representative inquires about your political rates and policies, how do you disclose them?

There is no standard approach or format, so long as all station selling practices are divulged in a way that enables a political advertiser to make an informed decision among the myriad possibilities.

– Continued on Page 20 –

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FCC Focus

by Peter Gutmann

– Continued from Page 18 –

However, it's always best to make disclosures in writing and to include a copy in response to all political inquiries.

Issue Ads

Must you air issue ads from political organizations or other entities? No – only Federal candidates are entitled to access.

If you do air issue ads, do you have to allow opposing viewpoints as well?

No – you can be as selective as you wish, although most broadcasters tend to foster an image of fairness to all elements of their audience and advertisers, even though not legally required to do so.

Must a Station Remain Neutral in an Election?

Only if you are a non-commercial station. Otherwise, not at all.

You're free to editorialize and even endorse specific candidates. Unless the fairness doctrine were to be revived (and there seems little chance of that), neither opponents nor their advocates have a right of response.

Do you have to balance your news coverage of election issues or offer time for responses?

No – genuine newscasts, news interviews, documentaries and on-the-spot coverage of genuine news events are all exempt from equal opportunities.

But there are specific qualifying rules for each type of exemption. Generally, each must reflect independent journalistic judgment of its newsworthiness, and cannot be used as a subterfuge for advancing a particular candidacy.

Giving Away Time

What if you don't want to sell time – can you give it away?

Yes, but remember equal opportunities – whatever you give to one candidate must also be made available to all legally-qualified opponents.

And bear in mind that all such gifts are subject to the Federal Election Commission's political donation rules.

If a candidate refuses a station's offer of free time when a gift of free time has been made to her opponent, does she waive her equal opportunity rights?

No – you must accommodate her reasonable requests for equal opportunities or cancel the initial gift.

Once you air a spot or give away time, must you advise opposing candidates of their equal opportunity rights?

No – that's what your Political File is for. It's the burden of opponents (or their committees) to find out what they may be entitled to.

But be sure to update your Political File at least daily, so as to ensure it is relatively current when inquiries are made.

The Political File

Do you have to answer telephone calls concerning the contents of the political file, such as a candidate or representative asking for information concerning equal opportunity rights?

No – but if you do accommodate even a single telephone request, then you must extend similar treatment to all, so as to avoid any display of favoritism.

Debates

How about a debate – can you extend selective invitations and ignore minor-party candidates in that way?

Yes, so long as the choice of participants is based on a reasonable determination of their newsworthiness and so long as it's a genuine adversarial debate, with no candidate able to dominate or control the content, format or production.

Specific Candidate Situations

How do you accommodate a program host who runs for office? Unless legally-qualified opponents agree to waive their equal-opportunity rights or accept a station proposal in lieu of their rights, you must offer them comparable time. For that reason, most stations require air personalities who become candidates to suspend their "on-air" appearances during their campaigns.

How about an advertiser who becomes a candidate and voices his own spots? Such spots become "uses," so equal opportunities apply here as well. A station would have to make comparable spots available for purchase by legally-qualified opponents.

Speaking of what rates may be charged, can the vexing complexities of lowest unit charges be explained in a few simple sentences? ... Oops, we've run out of space.

Political Manual

Of course, the specific rules are far more complex than this summary allows. For more information, you're welcome to download our firm's Political Broadcast Manual from our website:

www.wcsr.com/resources/pdfs/politicalbroadcastmanual.pdf

Even then, many questions will require the input of your communications attorney.

Peter Gutmann is a member in the Washington, DC office of the law firm of Womble Carlyle Sandridge & Rice PLLC, he specializes in broadcastregulations and transactions. His email is: pgutmann@wcsr.com

Model 730
Inovonics' Flagship RDS/RBDS Encoder

Supports RT+ Song Tagging

Featuring a front-panel LCD screen and jog wheel for instant on-site setup, the 730 may also be programmed easily through any of its data ports using the included Windows® software. USB, TCP(x2), UDP and serial ports can accept both ASCII and UECP command sets.

The 730 connects directly or can be networked with virtually any playout system and offers full support for RT+ 'tagging,' TMC traffic updates and other advanced applications. An Internet connection will assure accurate Clock Time and Date (CT) timekeeping.

Internal data diagnostics and transmission safeguards guarantee foolproof installation and operation, and field-upgradable firmware ensures compatibility with any forthcoming RDS/RBDS applications.

For full technical details, visit...

www.inovon.com

Inovonics
1305 Fair Ave. • Santa Cruz, CA 95060
TEL: (831) 458-0552 • FAX: (831) 458-0554
www.inovon.com • e-mail: info@inovon.com

Sicon-8 Internet & Voice Remote Control

The CircuitWerkes Sicon-8 Voice Remote Control

- Uses Dial-up, Internet Web server or free Sicontroller Software!
- 8 channels of metering, status and control (expandable to 32) and up to 5 alarms per channel.
- No accessories necessary to control your site right out of the box.
- Auto-ranging, auto-calibrating meters make setup a snap.
- Includes: Function scheduler, auto-logging & alarm reporting.

Internal Web Server

Free Sicontroller Software

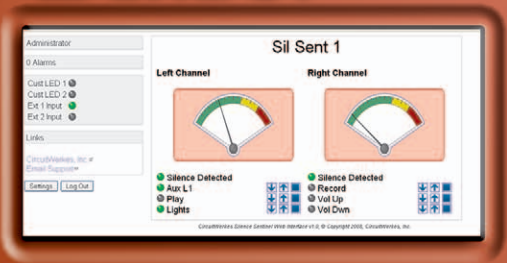
The Sicon-8 lets you control your site via Internet with its internal Web server, via telephone, auto-answering cell phone or with our free software. Setup is a breeze using the Sicontroller software that also includes scripting, e-mail alerts, multi-site management, virtual metering & much more!

NEW!! Web-Based Silence Sensor

Introducing the Silence Sentinal

Discover more online at www.circuitwerkes.com

- Detects Stereo or Dual Mono Silence (independantly adjustable channels).
- User-programmed relays (DPDT) close automatically or via Web control
- Balanced or unbalanced audio inputs.
- External trigger inputs activate user-defined actions.
- Optional Multi-Site monitoring software coming soon!



Remote Broadcasting Solutions

MicTel Mic/Line to Telephone Interface

- Outputs & Inputs for telephone handset, cellular phone or balanced line level at up to +10dBm.
- Operates up to 36+ hours on two 9V alkaline batteries.
- High quality, user-switchable, internal limiter prevents clipping.
- External power input with silent, auto-switching battery backup.
- Individual gain controls for send, receive & headphones levels.

Unattended Dial-Up Broadcasts with the DR-10

- The DR-10 is a Dial-Up remote control with balanced, telephone audio input & output that can control many automation systems or your audio console for unattended remote broadcasts.
- Our Silencer™ option removes control tones from the audio path.
- Use the DPDT relays to insert the phone audio directly into the program path when necessary, especially for emergencies.

TelTap Pocket-Sized Manual Telephone Coupler

- Can be used as a phone tap or a passive manual telephone coupler.
- Send or receive telephone audio.
- Compact size & low cost makes the TelTap a great addition to your remote kit for main or backup capabilities.

Lots More CircuitWerkes Problem Solvers

- Transcon-16 - Move up to 16 contact closures from room to room over an audio cable
- DT-232 - Turns DTMF sequences into user-programmed serial outputs & action steps.
- FSK Encoders, decoders, tranceivers and contact-to-FSK encoders/decoders.
- SUB-03 Subaudible tone decoder and SEN-6 Subaudible encoder.
- HC-3 telephone autocoupler and AC-12 rack of autocouplers
- DTMF-16 and DS-8 DTMF tone decoders.

Find Full product info & downloadable manuals online at www.circuitwerkes.com. 352-335-6555

Safety and Security

A regular column on protecting property and persons – with a technical slant.

Radiation – *Part 3*

by Jeff Johnson

As broadcasters we have learned that our lifeblood, RF energy, though a form of radiation, is not as dangerous or scary as it is too often made out to be in headlines and courtrooms.

It can, however, be damaging to life in the form of heating. Coming too close to an RF source, depending on strength, frequency, or lack of protection, will hurt us bodily – in the budget or in the legal arena.

Protecting Personnel

How can we as engineers, managers and owners protect our employees, the public, our pocketbooks and ourselves?

There are extensive standards and regulations concerning RF exposure. Research will reveal copious charts, graphs and regulatory tomes. All of this must be simplified to be effective. In a simple manner there must be go/no-go boundaries established.

Color can be visually very effective in conveying caution and danger. Combined with international symbols and explanatory text, strategically placed signage will protect our business interests as well as the health of all.

OSHA's Proposal

OSHA (Occupational Safety and Health Administration) has proposed five levels, areas, or categories for managing RF exposure.

The illustrations are for example only and were created by the author. Colors, except the green, are those used by Rfsigns.com

Category 1 Areas

Category 1 Areas

RF fields are lower than general public limits mandated by the FCC. No controls or RF safety program required. Advice: Enjoy your picnic!

Category 2 Areas and Category 3 Areas

Category 2 Areas

RF exposure potentials are controlled and in compliance with FCC public limits. Shielding and time averaging (shutting down) must be maintained.

Advice: You are getting close and are safe, but don't linger!

Category 3 Areas

RF is higher than permissible for the general public, but is less than occupational limits. Public access should be denied, and notice of a worker safety program is recommended. Personal protection is not required.

Advice: Do not enter unless you are authorized and know what you are doing and where you are.

Category 4 Areas

Category 4 Areas

RF exposure is at occupational limits and is controlled by time averaging and shielding. PPE (Personal Protective Equipment) is required.

Advice: Go into this area only with protection and knowledge of worker safety requirements.

Category 5 Areas

RF exposure is too "hot" to control. No protection is adequate, and RF burns will result from contact with certain surfaces.

A "WARNING" sign may be placed outside of a "DANGER" area.

Advice: "WARNING" that equipment must be shut down, and "DANGER" under any circumstance if it is not.

– Continued on Page 24 –

Meet the indestructible console engine from Axia.

Unpack it, install it... forget it.

Just add console •

Meet PowerStation™, the new, **self-contained console engine** that's over-engineered to ensure years of reliable, trouble-free service. Setup couldn't be easier: PowerStation needs just one cable to connect to an Element™ mixer. With over 1,000 already installed, Element is rapidly becoming radio's most popular mixing desk.

Lots of I/O •

Built-in audio connections make setup simple.

- **Two Mic inputs** with selectable Phantom power and studio-performance preamps.
- **Four analog inputs and six outputs** with 24-bit, 256x oversampling A/D converters for connection of CD players, recording devices, headphones and monitors, *et cetera*.
- **Two AES/EBU inputs and outputs** for DATs, satellite feeds and other digital audio devices.
- **Four GPIO ports**, each containing 5 inputs and 5 outputs, for start/stop control of audio sources, on-air lamps and other studio accessories.
- **Livewire™ ports** for single-cable connection to Telos phone systems, Omnia audio processors and other Axia gear — as well as broadcast equipment from partners like DAVID Systems, Netia, WinMedia, Zenon Media and others. See the complete list at **AxiaAudio.com/partners/**.

Simple networking •

Use PowerStation to build a stand-alone studio, or network as many as 4 studios without external switches. There are **16 built-in Ethernet ports**, including 2 Gigabit with SFP ports for networking with fibre. Axia is easily scalable — for larger networks, just add a core switch; Axia networks can handle as many as 10,000 stereo channels.

Fanless operation •

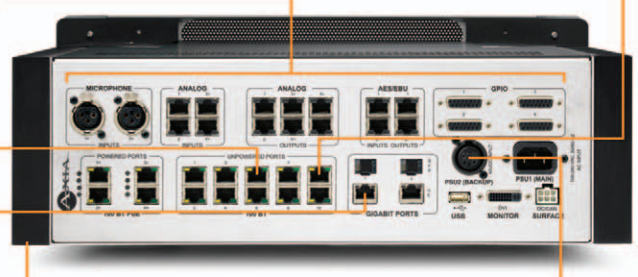
PowerStation is silent and fan-free. These large, extruded heat-sinks ensure cool operation.

Built like a tank •

This is Element. It's **built for heavy use**, with avionics-grade switches, heavy-duty optical encoders, silky-smooth, dirt-resistant conductive-plastic faders, high-impact Lexan module overlays and specially-designed switch guards that prevent accidental operation. All this is housed in a frame made from thick aluminium extrusions designed for rigidity and RF immunity. To read more, visit **AxiaAudio.com/Element/** .

Simply scalable •

Add a **PowerStation Aux** to double your Mic, Analog, AES and GPIO I/O. If that isn't enough, simply plug in Axia Audio Nodes for even more I/O.



Redundant Power •

Do your plans demand a **backup power supply**? No problem. Along with audio I/O, PowerStation Aux adds redundant power with automatic switchover.

Show Profiles •

Make and save snapshots of talent's **favorite mixer configurations** and recall them instantly, with just the press of a button.

Automatic mix-minus •

Complicated clean feeds are gone; Element **constructs them for you** — one for every fader. Phone callers and remote hosts hear only what they need to hear, with no need for operator intervention.

Voice processing+EQ •

Element **saves the expense** of outboard processors: Omnia™ processing can be applied to every Mic and Codec channel. Headphone processing is also built in, for times when it isn't possible to monitor your broadcast signal directly. 3-band parametric EQ can be applied to every channel, too, via software or drop-in module controls.

Integrated phones •

Operators don't have to take their eyes off the console — Telos multi-line phone systems are **controlled right from the surface.**

More options •

Element mixers are **built to your specifications**, from 2 to 40 faders in single- or split-frame configurations. Over a dozen different module types, with standard or motorized faders, let you create a board tailored to your exact needs.

AXIA
A TELOS COMPANY

AxiaAudio.com

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Safety and Security

by Jeff Johnson

– Continued from Page 22–

Category 5 Areas

Synopsis

CAUTION = Risk of RF shocks without Personal Protection Equipment

WARNING = Risk of RF burns without Personal Protection Equipment

DANGER = Risk of RF burns even with Personal Protection Equipment

Guidance is Available

These categories of areas and cautionary wording are not easily delineated.

An excellent source for further information is written by David Maxson of RFSigns. The link to this white paper is listed at the end of this column.

Maxson points out that a complete sign should embody the following: A *signal word* panel, a *symbol* or pictorial panel, a *word message* panel

The signal word immediately conveys the alert level. The symbol or pictorial graphically displays the alertness required, especially in a multi-lingual environment. The word message conveys particular information.

A complete, informative warning sign.

Measuring Levels

With an overview of differing areas of RF exposure and danger having been outlined, there is the question remaining of measuring RF level. There are three categories of RF safety equipment: survey instruments, monitoring equipment, and personal protective equipment.

Survey Instruments – These are popularly called field strength meters and are used to determine the level of an RF field at a certain location.

Measurements made are to establish the five categories of exposure and the safety requirements of each.

Monitoring Equipment – Once areas are established, they must be monitored to ascertain continued compliance. Fixed equipment is utilized for area monitoring and portable equipment is carried for personal hazard warning.

Personal Protective Equipment – An "RF Suit" or RF protective garment is worn in high field strength areas. This is essentially a body-fitting shield – a modern-day suit of armor.

RF suits allow you to work in areas with high RF fields when the transmitter cannot be shut down or its power lowered to a safe level. A personal monitor will alert you when you are approaching or are in danger.

SafeOne and Narda XT personal monitors.

Personal monitors, such as those pictured above, are to be worn by personnel entering Category 3, 4 or 5 areas. They alert the wearer when specific public or occupational RF levels have been exceeded.

Jeff Johnson can be reached at: jeff@rfproof.com

To get Dave Maxon's white paper go to: http://rfsigns.com/rfsignswhitepaper2009.pdf

In radio, talk is never cheap.
We just made it less expensive.

Introducing the new Nx6 Talkshow System from Telos. It's got our most advanced digital hybrids ever, for great sound even with cell-phone callers. It handles up to six POTS or ISDN phone lines, and has four separate hybrids that you can use in single or dual-studio configurations. It provides Caller ID, of course, and the built-in mix-minus makes installation easy; no outboard boxes needed. Setup is even easier with a Livewire™ network — plug in a single CAT-5 cable and you're connected. The best part? You can get an Nx6 package with Assistant Producer call screening software and a Desktop Director for only $3,995 MSRP.

Telos Talkshow Systems. Give your listeners a voice. Give your talent a boost. Give your wallet a break.

Nx12

Need to control more phone lines? Check out Nx6's big brother, Nx12. Handles twice the number of phone lines, and can serve two independent studios simultaneously. An Nx12 package with a Desktop Director and Assistant Producer software is only $4,995 MSRP.

ONE-x-Six

A tight budget doesn't mean you should have to compromise. Get a ONE-x-Six package with switching for up to 6 POTS lines, a built-in Telos ONE hybrid for clear, clean calls, a Telos Switch Console, plus Assistant Producer software for only $2,995 MSRP.

Telos
AUDIO | NETWORKS

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Radio Never Sleeps. Neither do we. We're here for you, anytime, with free round-the-clock, 24/7 technical support. Call +1-216-622-0247.

Operations Guide

Broadcast Engineering? There's an App for That!

by Chris Tarr

It used to be that the Broadcast Engineer needed to haul a bunch of tools and calculators with him or her if they planned on doing any work outside the shop. Add to that, all of the different formulas and such that needed to be committed to memory.

My, How Times Have Changed!

First the desktop computer made the job easier. All of those texts and calculators could be stored on your desktop PC for easy retrieval. Of course that wasn't very portable. Then along came the notebook computer – portable, and easy to use. You could have all that information with you all the time, if you wanted to lug it around.

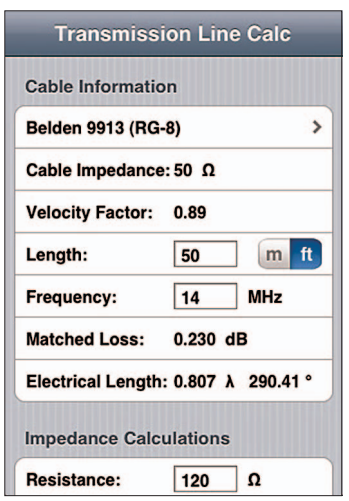
The next revolution is here! Nowadays, all you need is a smartphone or iDevice (iPhone, iPad, iPod Touch) and you'll have plenty of tools at your fingertips. From reading equipment manuals to referring to FCC Rules, to even accessing your desktop computer back at the office, there's a lot you can do from the palm of your hand. Let's look at what's out there:

iDevice

We'll start with these, since at this point it's the most common. A quick check of the iTunes store shows a virtual buffet of Engineering Apps.

RF Tools is a great little app for determining link budgets, cable loss and Fresnel zones.

Line Calc is a great transmission line calculator that gives you loss information on common cable types as well as an impedance calculator.



Resistance is a handy resistor calculator – enter the color bands, and it will tell you what kind of resistor you have, or do a "reverse lookup" by entering in the value you need and it will show you the colors.

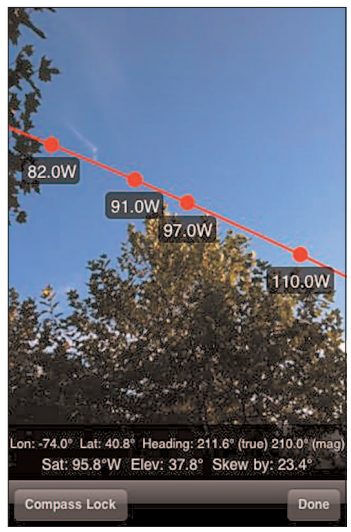
Finally, ***E-Formulas*** is a great formula database that includes common formulas like Ohm's Law, capacitive and inductive reactance, and resonance.

Android

The Android platform is picking up steam and becoming more and more common.

One of the most useful apps I've used is ***DishPointer Pro***. DishPointer Pro is an "augmented reality" app that uses the devices camera as a viewfinder.

Simply point your phone to the sky, and you'll see a "live" view with an overlay showing where the satellites are in relation to you. It makes finding the birds real easy!



Dish Pointer's Screen

Electrical Calculator is designed for electricians and is based on the NEC 2008 code. It includes an Ohm's Law calculator, as well as wire size and voltage drop calculations.

RF Pad Calculator is a tool to help quickly and easily determines the resistor values required to put together an RF attenuator pad.

Blackberry

Of course, the Blackberry is the go-to device for many companies. Unfortunately the pickins' are slim in terms of decent calculators.

The one I use is ***EE***, which computes Ohm's Law, with capacitance, frequency, and inductance calculators, and resistor color codes. Almost everything you need!

All Platforms

All of the above devices do have a group of programs shared among them – these are the "must-haves." Reading PDF's is important.

– Continued on Page 28 –

BROADCAST CONNECTION
equipment solutions

Terry Becht Texas 830.899.7012
terry@broadcastconnection.com

John George South Carolina 803.951.7443
john.george@broadcastconnection.com

John Shideler Colorado 970.227.1405
john@broadcastconnection.com

Eric Wandel, P.E. Indiana 812.490.7947
eric@broadcastconnection.com

Ken Perkins Colorado 303.674.6566
ken.perkins@broadcastconnection.com

Max Brown, **Corporate President**
Colorado 719.593.7198
max@broadcastconnection.com

Welcome Terry Becht

Radio specialist Terry Becht joins the experienced sales team at **Broadcast Connection.** Terry brings a wealth of knowledge with more than 25 years in broadcast sales.

Please contact Terry or any **Broadcast Connection** office nationwide for all your broadcast equipment needs.

REMOTE EQUIPMENT SOLUTIONS

audio-technica

$199.

FREE shipping

Audio-Technica's BPHS1 headset offers natural, highly intelligible and focused vocal reproduction, closed-back ear cups to seal out background noise, and a high-output dynamic microphone mounted on a flexible gooseneck boom.

The headset's microphone has a cardioid polar pattern tailored for pickup of speech with maximum voice intelligibility over a wide range of frequencies. It is more sensitive to sound originating directly in front of the element, making it useful in reducing pickup of unwanted sounds.

COMREX

FREE Comrex accessory kit

including spare battery, battery charger, 12VDC power supply and AAC option

while supplies last ($600 value)

The **Comrex ACCESS Portable** has complete flexibility and ultimate mobility for remote broadcasts without having to lug around unwieldy racks of gear or clumsy setups too difficult to configure in the field.

Designed for fast and easy connections in the field via a wide variety of data connections regardless of whether in the hands of "non-technical" personnel or seasoned remote "road warriors.

Tieline TECHNOLOGY

Buy a pair of G3 Tieline IP codecs and get a wireless module FREE

while supplies last ($995 Value)

Tieline Commander G3 field and studio rack-mount IP codecs are used by radio and television broadcasters for remote broadcasting, studio-to-transmitter links (STLs) and studio-to-studio audio distribution.

The Commander G3 can connect over a variety of network transports.

Interchangeable module slots, that can be customized to connect over a variety of connections.

PEAVEY

On-Stage Stands

$899.

2 PR15 PEAVEY Two-Way 15" 400 Watt Molded Speaker

1 XR 8300 PEAVEY 600 Watt 8-Channel Powered Mixer

1 SSP7950 ON STAGE Speaker Stand w/ Tote Bag (pair)

2 AT690-25 ON STAGE 1/4" to 1/4" Speaker Cable, 25' Long

Bob - Mid-South:	1-877-391-2650
Art - South-Atlantic:	1-770-632-1295
Jim - North-East:	1-315-623-7655
Bernie - Central:	1-731-695-1714
Pam - North Central:	1-513-376-8600
John - South-West:	1-210-775-2725
Mary - Mid-West:	1-513-899-3036
Doug - West Coast:	1-866-673-9267
Ric - Pro Audio:	1-877-640-8205
Lily - Latin America:	1-760-650-1427
Art - Bradley Div.:	1-800-732-7665
Bob - Bradley Div.:	1-301-682-8700

SCMS INC.

YOU KNOW WE KNOW RADIO!

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1-800-438-6040

sales@scmsinc.com

Operations Guide

by Chris Tarr

– Continued from Page 26–

Why Carry Manuals?

With the storage capacity in these devices, there is no reason to be carrying around manuals any more. iDevices have PDF viewing capabilities built in, look for one of the many file utilities in the app store for a way to save the PDF's to your device.

VNC on an iPad

Android users can use the built in Adode PDF reader and can simply store the documents to your SD card. Blackberry users will need to buy *Documents to Go*, which includes a PDF reader. From there simply load your documents onto your SD card.

Virtual Networking

All three devices also have VNC (Virtual Networking Computer) clients available. VNC allows you to remotely access a computer's desktop.

No more scrambling for a computer with an Internet connection to check on your server or reset a locked out account. Simply fire up your VNC client and get the job done – you don't even need to interrupt your lunch!

There is a trade-off when using these devices for things like VNC and PDF reading. Due to their small screen size (except for the iPad) you'll have to do a lot of panning and zooming to see what you want to see.

That can be a pain to do on a regular basis, but for emergencies or quick reference, it can be a life-saver!

Memory Issues

Of course, memory on these devices can be at a premium. Although most Android and Blackberry devices allow you to swap SD memory cards, the amount of memory in the iDevices are fixed.

Because of that, you may want to simply visit the manufacturer's website and download the documentation from there. All three devices have capable web browsers, though Android's is by far the most full-featured.

The Pros and Cons

There are pros and cons to each device and the way it handles input.

iDevices and Androids are generally touchscreen, while Blackberry's primarily use a keyboard and trackball.

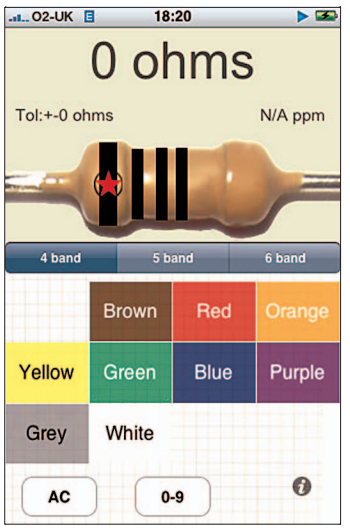
The upside of the touch devices is that you usually have a lot more real estate, while the downside is that the virtual keyboard is a little more difficult to master, and it can get in the way sometimes. While neither is perfect, both offer excellent and useful engineering apps in a small package.

Software

Some of the software listed in this column is free, while some of it is pay.

The nice thing about apps for portable devices is that they're generally less expensive than desktop ones, rarely exceeding $4.99.

Many are free! Don't let the cost dictate your decision however – many free programs are better than their paid counterparts.



The Resistance Screen

Pay attention to online reviews and ask other engineers who use the app about their experience with it before you make that purchase.

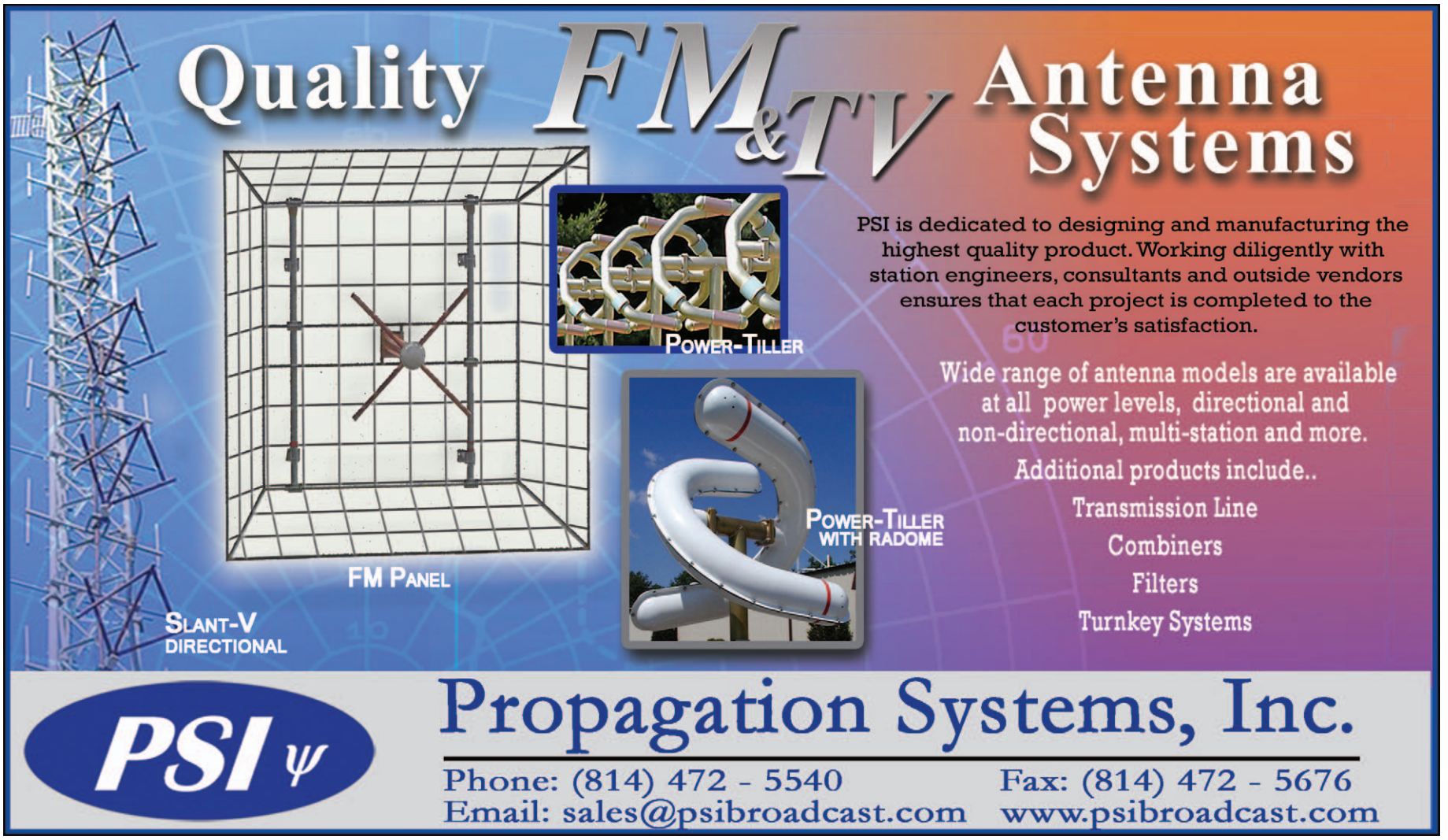
The New Mobile You

The bottom line is that, with one of these handy devices, you can bring your entire shop with you wherever you go. No more fumbling around for that manual, or trying to remember those pesky formulas.

Now, simply pull out that ubiquitous electronic device and have the information in seconds.

Christopher "Doc" Tarr is the Director of Engineering for IT at Entercom's in Madison and Milwaukee, Wisconsin.

If you have a Station Ops story you would like Chris to explore in a future column email editor@radio-guide.com



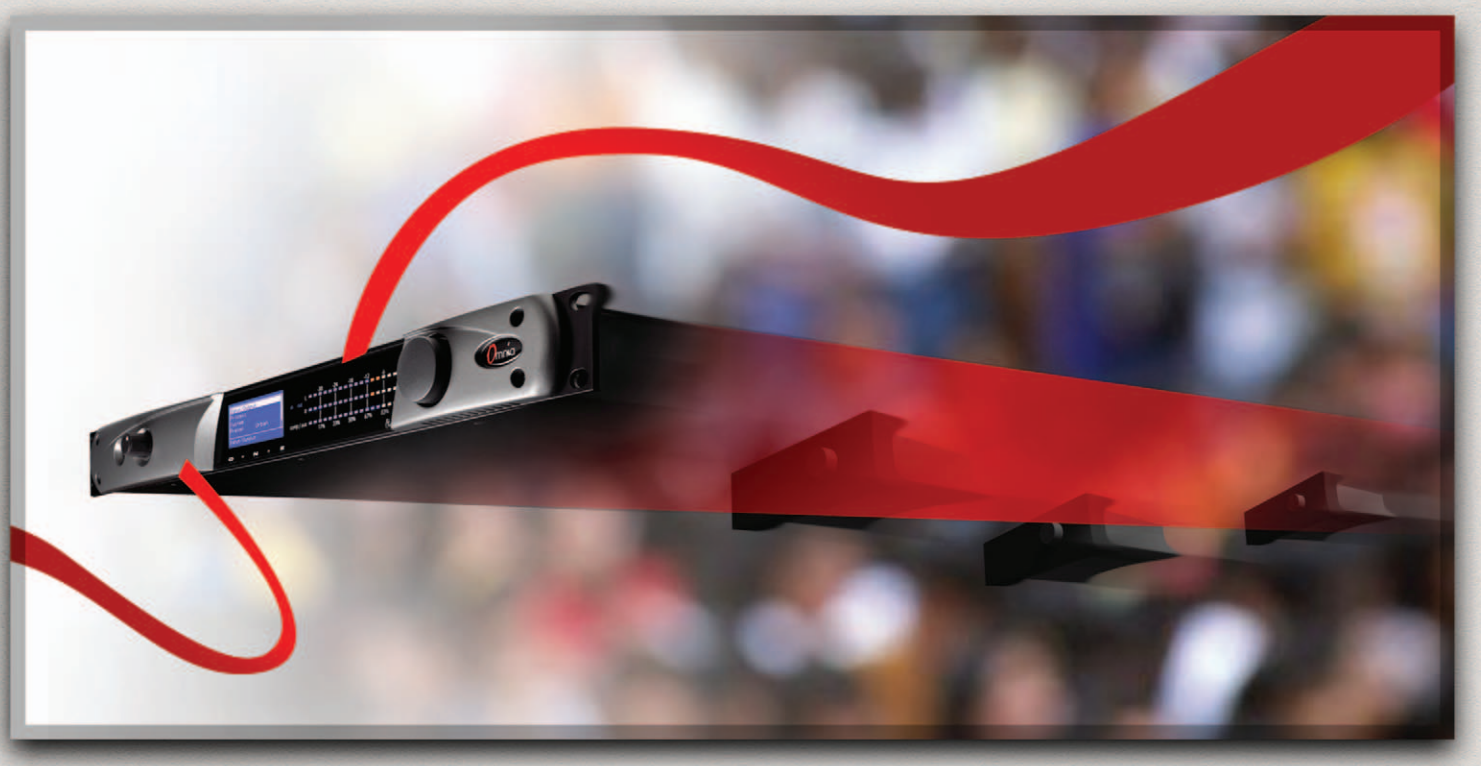
SOUND WINS!

The results are in.

Omnia.One wins at five thousand stations worldwide. CHR, News/Talk, Sports, Country, AC, Jazz, Classical, Oldies. FM, AM, Webcasting.

In today's stressful economic environment, competition is fierce, for listeners and for advertising dollars. To win ratings, you need captivating programming and a compelling sound.

It's well-known news that the flagship Omnia.6 is the processor of choice for ratings-winning stations in every major market. But Omnia knows that not every station can afford its top-of-the-line processor. Some facilities have many out-feeds to process, with rack space at a premium. Others need a versatile backup processor that can fill in on a moment's notice on FM, AM, HD/DAB, or streaming.



Omnia.One crosses the finish line far ahead of the also-rans.

THE OMNIA HERITAGE

Omnia.One features the same processing topology that made Omnia the sound win for more than a decade, built on an entirely new platform that's both cost and space efficient. It's designed to handle traditional analog broadcasting as well as the many forms of digital content delivery.

RADIO ISN'T JUST ANALOG ANY MORE

Omnia.One is a universal hardware platform. It's dual software bank enables two different styles (topologies) to be at the ready, changeable and updatable with a simple software download. Each processing style includes lots of factory presets to get close or spot on to your desired sound.

Omnia.One-FM gives you a no-compromise sound on the air. It includes Omnia's precision stereo generator with advanced distortion-controlled final limiting and clipping.

Omnia.One-MULTICAST–for streaming, HD, DAB, podcasting, any feed utilizing codecs–features the exclusive Omnia SENSUS™ audio conditioning technology to minimize bit-reduction coding artifacts.

Omnia.One-AM has all the processing power you need to stay competitive in all but the largest markets.

Omnia.One-STUDIO PRO–with its very low latency–is ideal for mic processing, program production level control and sound tailoring.

WHY TRUST ANYTHING ELSE?

Since its debut two years ago, the one clear winning choice has been Omnia.One.

Hear the difference.

SOUND WINS!

Sound Winning Features

Easy-to-use front panel interface with LCD screen and LED level metering
Web browser for remote control and configuration
Wideband AGC for smooth "hand-on-the-pot" gain riding
Four-band AGC to build density and maintain consistency
Four-band Peak Limiter, with the lower bands optimized for bass punch and warmth, the upper bands optimized for sparking clear upper mids and highs
Livewire™ (RJ45 Ethernet), analog (XLR) and AES/EBU (XLR) I/O with auto fail-over on loss of input audio
Digital FM stereo coder/generator with advanced peak control, subcarrier input, two composite outputs
Headphone amplifier with front panel jack and volume control

Omnia
A Telos Company

Radio never sleeps. Neither do we. We're here for you, any time, with free round-the-clock 24/7 technical support.
+1.216.622-0247 • support@OmniaAudio.com • www.OmniaAudio.com

Chief Engineer

The Story of Two Rebuilds – *Part 3*

by Scott Schmeling

In my last two columns, I chronicled our radio evolution, starting with a single studio rebuild in 1994 then jumping up to 2008 when we converted offices to studios, doubled the size of our TOC, and grew overnight from four to seven stations. After all that, it *must* be time to take it easy for a while – or not!

Proving that nothing is more constant than change, we started planning the rebuild of three of the original studios. Two of those had been virtually untouched for over 20 years; the third studio is the one that we rebuilt in 1994.

Studio One

The first studio of the three had been the "FM Production" studio. More recently, it had also been used for the live local morning show of our "oldies" station.

After the morning show, that station went to satellite and the room was used for production the rest of the day.

New plans called for this studio to become the home of one of the recently acquired FM stations. This station is live all day and it has a two-headed morning show with occasional guests.

The current configuration of the room made it impossible to use for this application – it had been designed for one person producing commercials.

There's no way we could accommodate three people on the air at the same time. So we had some design planning to do, to reconfigure the room.

Studio Two

The second studio had been the home of the first FM in the building. The only change in over 20 years was the removal of the turntables and CD players some time after switching to computer-based audio.

This station was already doing a two-headed morning show. The room was functional, but it was long overdue for a face-lift. The console in this studio was not as functional as those installed in the majority of our other studios, and this was limiting the functionality of the room.

These first two studios are very similar – in fact, they share a common wall. Both would be built as "stand-up" studios. In addition to the standard equipment compliment, both needed three microphones plus guest headphones. In addition, both rooms would also need the standard cabling pulled in.

We planned to do one studio at a time. During the construction phase, the station involved would be broadcasting from one of the other studios in the building.

Studio Three

The third studio, KTOE, is the studio for our original AM station, and has unique requirements when compared to the other two.

We had rebuilt this room in 1994 to make it more interview-friendly, and included space for two guests. A few years ago we added to the counter top for a co-host.

But more and more, we needed space for additional guests, and the co-host modification really didn't work well. The whole room needed to be redesigned with our specific needs in mind.

In addition to the main host (board op), we needed a better co-host position, and we wanted to be able to accommodate up to four interview guests at once. This room also needed a new console. Unlike the other two studios, this would be a sit-down operation.

KTOE Before the Rebuild

Bringing in The Troops

We enlisted the services of two local professionals to help with the room design and decorating. Gary Rudolph of Cherry Creek Cabinetworks and Cyndi Christenson of Quartz Surfaces, both in Mankato, MN. Gary is a Certified Kitchen Designer and Cyndi would be helping us select the best color and edge-treatment for the Cambria quartz countertop.

– Continued on Page 32 –

MT-MR Platinum STL System

Why the MT-MR Platinum?

-For its **excellent quality-price** value.

-For its **adjustable transmission power** output from 0 to 20W for any selected operational frequency.

-For its **double conversion receiver** that makes it apt for **digital codification** (Up to 4 audio channels).

-For being **digitally synthesized** in 20 MHz operational band for frequencies from 150 MHz to 960 MHz.

-For the fact that **both the transmitter and receiver can measure the modulation percentage and pilot signal level** (19 KHz stereo without disconnecting the audio from the transmitter).

-For its **remote control**.

-For its **analog telemetry**.

-For being made for **mono or stereo (MPX) signal**.

-For its **capability to work with AC power voltage from 90 to 250 V, 50/60 Hz**, and also with external battery if needed.

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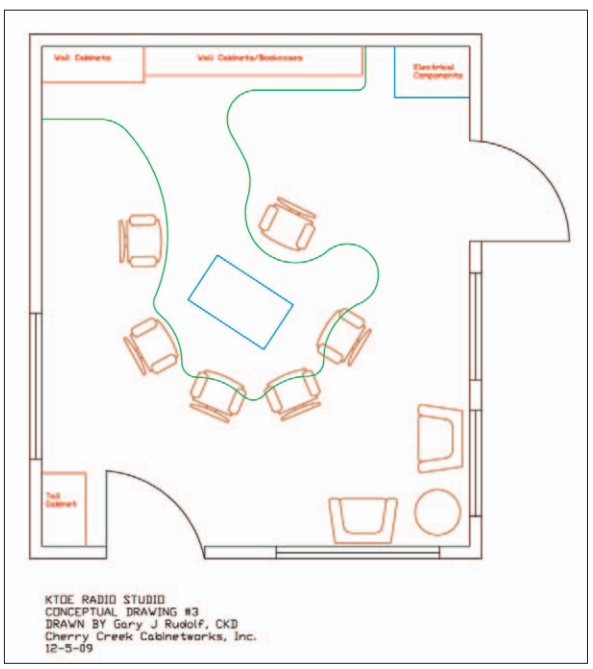
Chief Engineer

by Scott Schmeling

– Continued from Page 30 –



The Final KTOE Studio Design

You may ask, "What does a Kitchen Designer know about radio studios?" When you think about it, they are more similar than different. Both contain equipment specific to the room. Both are designated work spaces. Both need proper lighting and traffic flow. And most likely food is eaten in both – but I won't admit that here.

Project Planning

Meetings were held with Gary and Cyndi, and the air staffs of each respective station – management and engineering all in attendance. The specific needs and wants of each station were discussed. Then measurements were taken, and Gary and Cyndi went to work.

In the case of the first two studios, Gary brought back printouts and computer renderings of his designs.

We looked them over, listed the pro's and con's, and suggested changes and refinements. Once each design was approved, cabinets and counter tops were ordered.

Special Considerations

I mentioned earlier the unique requirements of the AM studio. For that, Gary did additional research. He showed us examples of other multi-guest studio designs.

We discussed each one and found the one closest to what we wanted. Using that design as a starting point, we reworked things to the point where we thought it would fit our needs.

Gary took everything back to his office and started refining the plan. When he was ready, he brought drawings and his laptop with 3D renderings for us to see. The renderings allowed us to look at the room from any angle.

Again, questions were asked and answered and some changes were made. I even got a space for my punch blocks concealed inside a cabinet above the counter!

Scheduling the Build

Once we had delivery dates for cabinets and counter tops, demolition and construction were scheduled.

On-Air operations were moved to a temporary studio and the room was gutted. New cabinets and countertop were set in place. Then the job of actually making the room into a studio began.

That phase of the job never goes fast enough, but there is a lot of detail to which attention must be paid!

Two of the studios got much-needed new consoles and given the scope of the AM studio project, I again brought in Marv Olson, a contract engineer and friend from Austin, MN, to help. All three rooms were coordinated efforts, working with and around cabinet and counter setters, carpet layers, painters, electricians, and HVAC people.

KTOE's New Look

The End Result?

We how have three showcase studios that we can be proud of. The time spent on planning, and designing have proven to be well worth it. By involving all air staffs, they have ownership of and pride in their rooms. Now if they'd just stop eating in there. What do they think this is – a Kitchen!

Scott Schmeling is the Chief Engineer for Minnesota Valley Broadcasting, a 16 station group in Southern Minnesota. He can be reached via email at: scottschmeling@radiomankato.com

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Field Guide — Isocouplers

WNTK Uses LBA to Reap Revenue From Towers

by Bob Vinikoor

Koor Communications, Inc. is a small, privately owned group of five radio stations in New Hampshire and Vermont. We have four AM's with FM Translators and one Class A FM.

The stations are WCNL AM 1010 10 kW daytimer/FM 94.7, WCFR AM 1480 5 kW daytimer/FM 106.5, WUVR AM 1490 1 kW/FM 98.1, WCVR AM 1320 1 kW, and WNTK FM 99.7 6 kW.

LBA Made Rental Space Possible

We were approached back in 2001 by a cellular company that wanted to co-locate their equipment on our existing WCNL tower in Newport, NH.

The tower is a series fed 10 kW AM stick, so co-location at the time seemed remote.

However LBA designed co-locator coils to isolate our 10 kW AM signal from their cellular equipment and all has worked fine since.

More Renters More Revenue

We have added four other cellular carriers to that tower and have ten other cellular leases divided up amongst our other AM towers – fifteen leases and one paging company in all.

Since that initial call, we have made sure that our towers are listed on all the data bases that cellular carriers search for possible co-location sites. This is an important step to reach possible space renters.

LBA Made It Easy

The equipment we got from LBA has worked flawlessly over the years.

LBA made the process easy for us by taking care of all the technical paperwork that was needed.

LBA did the necessary filings of FCC Form 321 Impedance measurements and there is no appreciable difference to the AM signals.

Koor's Tower in Lebanon, NH

The Noticeable Difference

The only noticeable difference is the significant revenue these cellular leases generate to the bottom line of operating radio stations in small markets.

In fact the WCNL AM 1010 daytimer won the 2009 New Hampshire Association of Broadcasters Station of the year, and is a finalist for the 2010 NAB Marconi Awards.

It's Easy Money

If anyone has reservations about allowing cellular companies to co-locate on their towers, I would highly recommend that they re-consider that decision.

Once construction is done, it's pretty much seamless and the cellular companies operate in the background.

No Additional Environmental Issues

Adding the cell renters to the tower had no additional impact to the environment or to the wildlife in the area.

Wildlife at the Lebanon, NH Tower Site

The local deer, other wildlife and the visiting Canadian Geese still congregate near the base of our towers to feed and frolic.

Bob Vinikoor can be reached by e-mail at bob@koormedia.com or via cell at 802-236-1629. For more information about LBA products and services visit LBA's web site: www.lbagroup.com or call LBA Technology at 800-522-4464.

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Field Guide — Remote Control

Broadcast Devices Sentinel-4

by Michael Bradford

Tucked into a corner of the transmitter room at WILS in Lansing, Michigan, are two Mid Atlantic equipment racks full of equipment that constitute the up-link for the Michigan Farm Radio Network. This satellite delivery provider began almost 30 years ago, serving affiliates with farm market news that impacts a three state area.

Increase in Services Provided

When Saga Communications purchased the system, they moved it to the present location and expanded services to include becoming the up–link site for five Professional Sports teams, the Illinois Radio Network with studios in Chicago, and most recently, the Minnesota News Network, with its main studios in Minneapolis/St. Paul.

For many years we have depended on various Broadcast Tools equipment to permit dial-up audio monitoring, remote switching and, most recently, Internet-based control of re-boot functions for two Nexus ISDN codecs using the Broadcast Tools "Web Switch." It soon became obvious that we needed more capability than existed with our previous dial-up units.

Project Planning

The engineering team decided that the new system must permit access to all five affiliates' T-1, ISDN, dial-up and alternate program systems.

This is where the Broadcast Tools Site Sentinel-4 entered the picture.

The recent installation of a hi-speed Internet connection into the up-link site to accommodate our Web Switch opened up a whole new venue for remote control and monitoring.

The Site Sentinel-4 is a cost-effective, one-third-rack size device for web-based remote control, monitoring, status alerts and relay interface with other equipment from virtually anywhere you have access to the Internet, including the newest web-capable hand-held devices.

Perfect Fit

Reviewing the Site Sentinel's capabilities gave me the immediate impression that the designer had been sitting in on our brain-storming sessions all along.

Here was a "tool" that includes analog metering for four separate channels, status monitoring for four channels, and four logic relay interfaces for direct interface with other equipment.

In addition, it includes a stereo silence sensor, a built-in power loss detector, a separate set of contacts for remote power control via a third-party device, and an optional temperature probe.

All of these features are programmable in numerous manners to accommodate a host of user requirements.

Internet Connectivity

Every feature of the Site Sentinel-4 can be accessed over any IP network, including a private network, and, of course, the Internet.

It even features a logging system for parameter snapshots, alarms, status, metering and temperature sensing that will e-mail anyone of eight recipients with routine metering and/or alarm situations.

Security – Password Protection

Each channel of control can be password protected, making it possible to assign security clearance for each of our four separate affiliates at the up-link to have its own password. Everyone can monitor what's going on at any time, but this limits control functions to those with specific password authority.

Of course, the Site Sentinel-4 has the regular features we've all come to expect from Broadcast Tools. The manual with screen shots makes setup and operation a breeze.

Michael Bradford is the owner of Bradford Broadcast Audio Services in Jackson, MI. He can be reached via email: mbradford@triton.net

A little extra for good measure

The combination of MR-PRO and XL2 offers you extra flexibility and extra performance providing a complete and easy-to-use audio measurement solution.

MR-PRO

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- User stored signals and signals for polarity and delay testing
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MR-PRO XL2 (with M4260 microphone)

XL2

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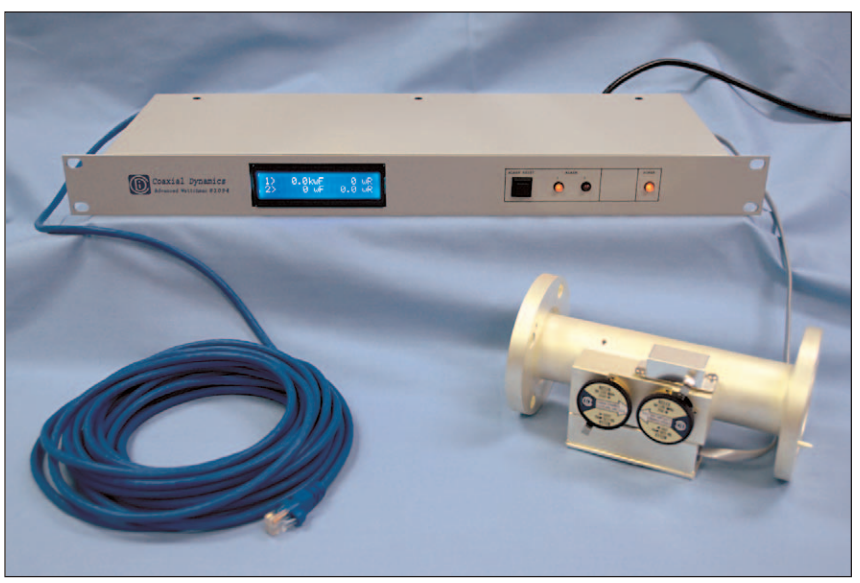

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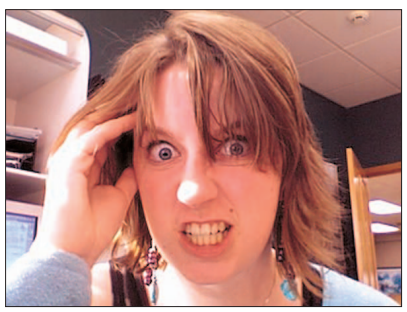

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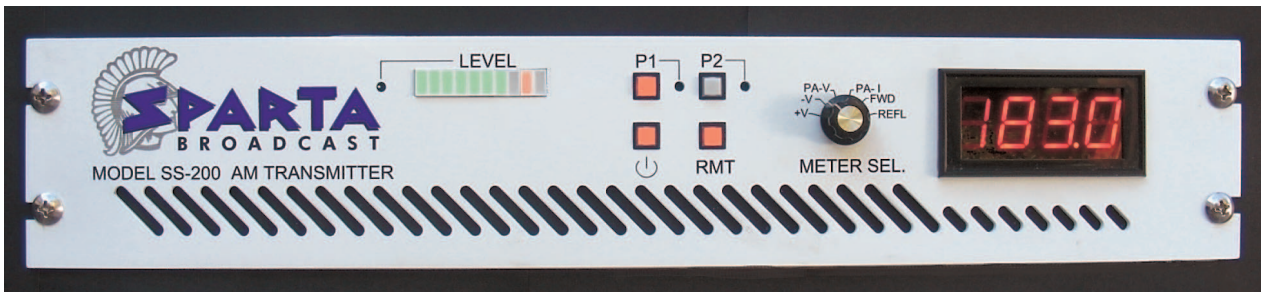

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Practical Engineering

Report It!

by Mike Callaghan

The magazines are full of ads touting all sorts of new digital recorders, and how easy they make it to record news and interviews out in the field. Without taking anything away from any of them, there's a way this can be done conveniently and without breaking the bank.

Netbook Field Recorder

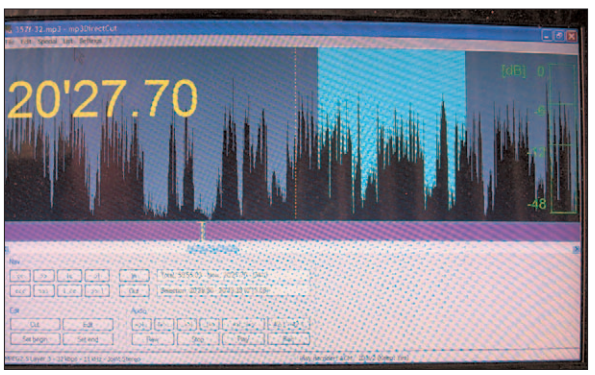
Small netbook computers, the ones in the $200-$300 range, are equipped with stereo mike inputs, headphone level outputs, and offer a huge range of versatility that dedicated recorders cannot match.

Weighing a mere 2-3 pounds, these have hard drives that can handle *days* of material. They record in stereo or mono, and come with Windows operating systems – either the benchmark XP, or the newer Windows 7.

Editing Freeware

There are a number of freeware audio editors that will run on these netbooks. I find the favorite with our news people is an extremely friendly program called *MP3 Direct Cut.* This records and edits stereo audio as a native MP3 file.

Compared to other editors, it saves a tremendous amount of time by not having to convert the audio into different formats just to get it edited. It has cut and paste, shows the waveform being worked on, and does automatic fades and gain changes. It's about perfect for actualities and interviews. You can get it from any freeware web site.



MP3 Direct Cut Screen

Word Processing

If you are planning on doing scripted interviews, you can install a word processor into the netbook. Then you can either type in the script or load it from somewhere else with a USB drive. Once the script's on board, it can scroll up the screen for you and the guest to read while *Direct Cut* records the dialogue in the background.

Field Produced Programs and News

For news events, the netbook will capture actualities one after another. If you've loaded the news intros into the computer, you can cut and paste complete newscasts together in the field.

WiFi Upload

The netbooks come with Wi-Fi, and now McDonald's does too, so you can piece them together and then send them back to the station while you grab a cup of coffee or a Big Mac.

If the Golden Arches aren't convenient, a USB jack on the netbook will accept a GS3 card to ship the files through the cell system.

If you want to send photos back for the station's website, the netbooks also have SD card readers. Or you can import camera data into the USB ports and then send it.

Suggested Accessories

To start putting one of these packages together, you'll need a list of accessories to make sure you have all possible uses covered. My shopping list is on page 40.

(Continued on Page 40)

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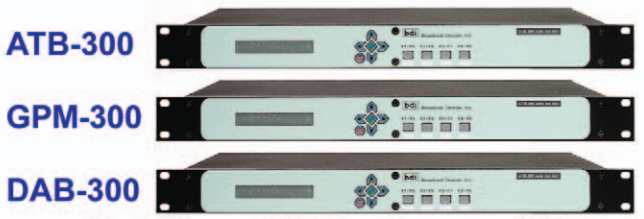

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	3.0 kW	2007	BE FM3C *Solid State, New Never Used*
	3.5+1.75kW HD	2007	BE FMi301 *Solid State*
	3.5 kW	2007	Harris ZX3500 *Solid State*
	4.0 kW	2007	BE FM4C *Solid State*
	14+5 kW	2005	BE Fmi1405 *Solid State*
	20.0 kW	2005	BE FM20S *Solid State*
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Practical Engineering

by Mike Callaghan

Record It!

– Continued from Page 38 –

Mike's Suggested Shopping List

• **The Netbook Itself** – These have 1 GB of RAM, a 160 GB or so hard drive, and a minimal battery. You should explore getting the largest battery pack available.

Typically rated for 6 hours, these are cheap insurance against losing something important over a low charge. Also, using a GS3 card or WiFi extender can reduce the battery life. While McD's does have WiFi, not all have user-friendly AC outlets, so you may be on your own for extended periods.

• **A Broadcast Quality Mic** – The audio electronics in the computer are certainly up to broadcast use, so a good microphone will make a difference. A super-cardioid will cut down side and background noise, and focus on the speaker.

For interviews, take two mics and an adapter to feed them into both channels together. There's no advantage to recording the interview in stereo, unless you want to take the file back to the station and edit it so it sounds as if someone else is asking the questions. In that case, two mikes feeding two channels makes sense.

• **Headphones for Editing** – These can be the earplug variety, but for hours and hours of intense cutting and pasting you'll want something more comfortable.

There are some really small "over-the-ear" headsets that are positioned by curved plastic arcs that fit behind the ear. These work well, and they fold up for transport.

• **A Logitech V-220 Cordless Mouse** – The receiver this uses slides into the bottom of the mouse and switches it off in the process. No dead batteries because you left it on.

Also, the scroll wheel clicks to the left and right, and this can be set up to go forwards and backwards in the browser. You will love it, trust me. Don't even try editing with the computer touch pad – unless you forget to pack the mouse.

Booster speaker plugged into computer.

• **A Small Battery-Operated Booster Speaker** – The speakers in the netbook can make noise, that's about it. If you will be playing back parts of interviews or files for you and someone else to hear, this will be important.

• **A 6-Foot RJ-45 Cable** – If all else fails, you could find a friendly net port somewhere. If you do, you may not be able to find a cable to borrow – always bring your own.

• **Two Sets of Spare Batteries** – For *everything* that uses them. Don't assume any installed battery is fresh.

• **A Pouch to Carry it All** – Simpler is better – there needs to be the larger zipped compartment for the netbook, and a smaller one for the headphones, mouse, speaker, AC charger, etc.

The mics may be too bulky for this carrier and will travel separately in their own pouch that will also carry the mike cables and the adapter that plugs into the computer.

A fledgling staffer with the complete package.

Looking at the photo it's easy to see how compact the complete package is, plus it weighs under 4 pounds.

I use a separate carrying case for the microphones, cables and adapter which isn't shown in the picture. You can design your system to fit your needs, but remember the key is to keep it as compact as possible for easy transportation.

A Great Idea With Multiple Uses

Not only will it do a great job of capturing news and interviews, it surfs the web and sends and receives email as well

It's become an important part of the on-air presence, and the cost was less than taking the sales staff out to lunch.

Mike Callaghan is the Chief Engineer at KIIS FM, in Los Angeles, California.

fanfare fm

FP-TRO

The Ultimate IBOC Receiver/Translator

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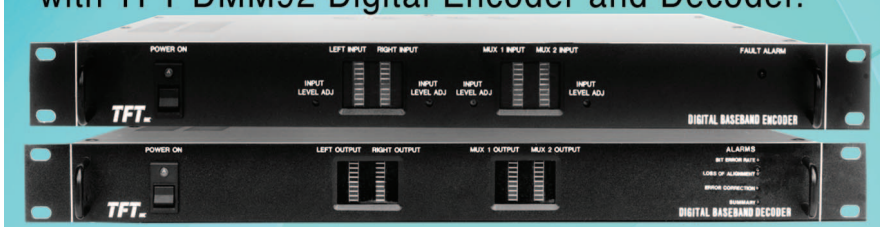

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Small Market News

Perception of AM Decline Not Borne Out by Economics ...Yet

by Judith Gross

Heritage AM stations in major and medium markets simulcasting on FM, AM properties failing to sell; Clear Channel actually donating AM stations to help further minority ownership and a Galveston AM leasing it's airwaves 24/7 to a Chinese-government-run news agency – all sound a lot like more nails being hammered into the coffin of radio's first frequency band.

Then there are those ridiculous sale prices on AM stations in small markets. Is there any good news ahead for AM radio?

Ever since the rise of FM music stations and the eroding of the fidelity of AM signals as radio manufacturers responded to interference, the industry has been pinning its hopes on the "next big thing" to save AM.

Hopes Falter

First came AM stereo – a chaotic morass of competing interests, as a newly deregulated FCC refused to set a technical standard. Then came a resurgence of talk radio – and optimism for AM rose again.

Today, many AM broadcasters have high hopes for HD radio. Especially since the FCC corrected its shortsightedness with the stereo question by setting at least a defacto standard. Now, though, with the industry abuzz over interference problems with HD on AM, and with a majority of the radio listening audience under 55 not even bothering to push that AM button, things look bleaker than ever.

AM Still Has Value

You would think, then, that AM stations would be declining more rapidly in value than FMs and that buyers for AMs would be impossible to find. But, so far, this perception doesn't align with reality. Not even in small markets.

"All stations are selling for less than what they were," says Richard Kozacko, President of Kozacko Media Services. "It's part of the recession that we've gone through. Just like housing, stations are not getting the prices they were commanding a few years ago."

AM Stations Still Sell

As a broker for the sale of stations who is based in Elmira, NY, Kozacko has a chance to work with buyers and sellers of both AMs and FMs. He estimates that stations have lost about a third of their value since the economy took a downturn. But are AMs declining more rapidly than FMs? Not noticeably, he says.

"People are still buying AM stations," Kozacko says. But he adds, "Of course the demand for AM stations is not as great as for FMs, because of the smaller listenership."

But What About Small Markets

Well, what about stations in smaller markets? Surely their value is declining faster than in large markets? Not by Kozacko's experience.

He admits it's tougher owning a radio station these days than it used to be, but he says that's true across the board – not just for AM stations and not just in small markets. More than ever, "Radio is not a game for amateurs," says Kozacko.

HD: An Uncertain Savior

So, what can bring hope to a weary AM station owner in these tough economic days, with on-line technologies more popular than ever? HD?

"A big *'if,'*" Kozacko says. He cites a Media Brokers Association breakfast where out of 50 members present, only one had an HD radio.

It's All About Programming and Localization

In the end, Kozacko and others like him echo the sentiment that savvy industry leaders have been repeating: it always comes back to programming.

"People will continue to turn to AM for specialty programming, ethnic shows, provocative talk and for news and sports," notes Kozacko. And in small market stations, nothing trumps serving the local community.

"It won't do for a station to simply pass through syndicated programming from a satellite in lieu of giving the local listeners what they want."

Kozacko adds, "And people will always still respond better if you call the station and instead of an automated voice mail menu, you get to talk to an actual human being."

This is part one of an on-going look at AM Radio in the Small Market News Feature.

Judith Gross is a writer and radio producer with her own freelance marketing and media company in Binghamton, NY. You may contact her at email: judithgrossradio@gmail.com

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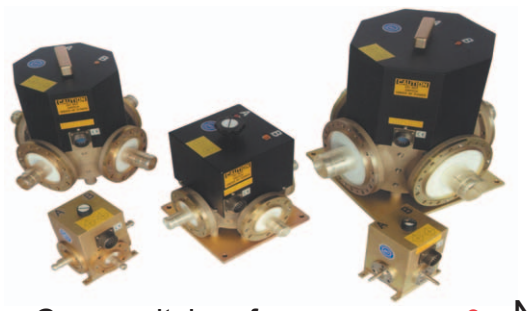

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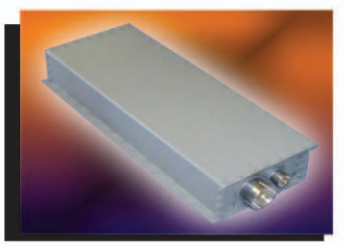

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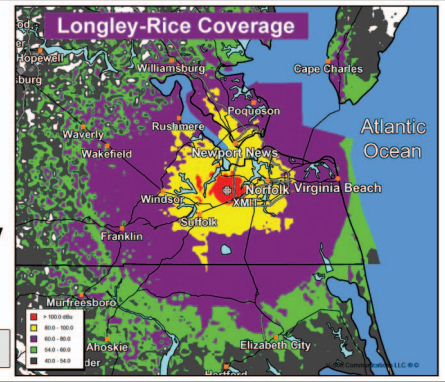

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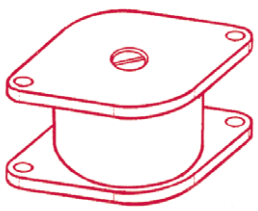

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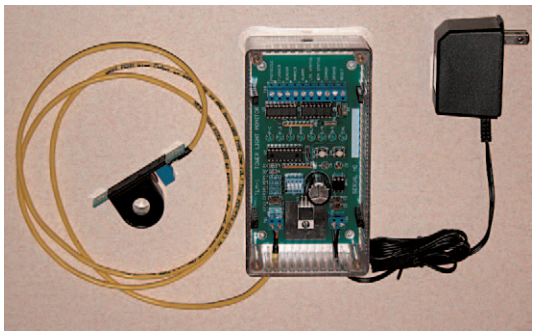

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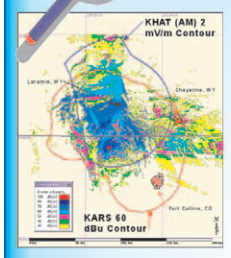

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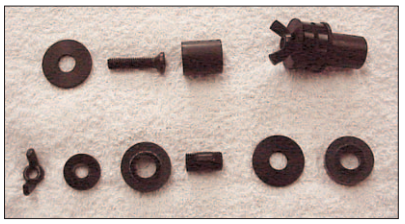

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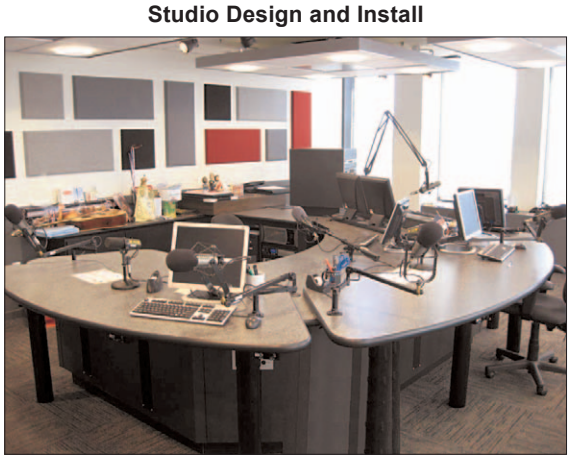

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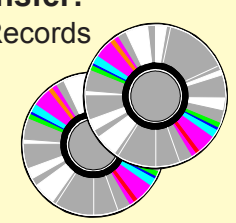

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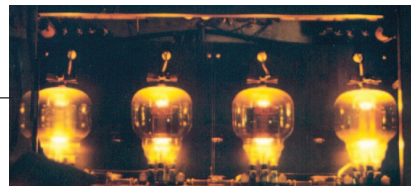

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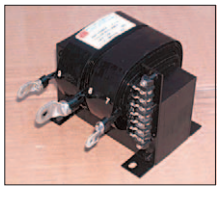

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the Audio-Pod Series

1. A Microphone ON-OFF controller with an integrated high output stereo headphone amplifier featuring both 1/4" and 3.5mm front panel jacks, maximum gain set control to limit maximum output, selectable phase reversal of the output, and 3.5mm jack and terminal strip rear audio inputs. Various mic control options are available including a high quality mic pre-amp with selectable phantom power, and top or front mounted Mic ON-OFF buttons including cough control. Rear panel XLR mic input and output connectors are standard. Audio-Pod Mic controllers are ideal for remote broadcasts and talk studio applications.

2. A dual stereo headphone amplifier featuring sufficient gain to please the most demanding requirements of your talent. Features include both 1/4" and 3.5mm front panel jacks, maximum gain set control to limit the maximum output, selectable phase reversal of each output, and 3.5mm jack and terminal strip rear audio inputs.

An Audio-Pod System consists of from 1 to 4 Audio-Pod Modules and a Power Supply which can power up to 4 Audio-Pod's of any type or option. Audio-Pod's can be table top mounted using the supplied rubber feet or Hook & Loop material, or permanently mounted using the optional tilting table top bracket or recessed into the work surface using an optional flush mounting bezel.

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IMAGINE THERE'S NO IP HASSLE. IT'S EASY IF YOU TRY.

Preface... Clear your mind. All that anxiety that you've come to associate with the typical AoIP network install is going to leave you now... Think of cool clear water flowing into the coffee maker and the sound of sprinkles hitting fresh, hot donuts... OK. Ready?

1.OPEN

Confront your boxes. You know they're there. They know they're there. But only YOU have the power to change that. Go ahead... open them.

10:03am

2.LOOK

Take a good look at what's in the boxes. You've got a control surface mixer item and rack mount BLADE something or other. They sure look pretty. And they are. Using this stuff you are gonna be a chick magnet. Or a guy magnet. Whatever, you are going to be IN CONTROL. Cool part is, THAT is only moments away!

Every BLADE has all the information about your entire network stored in it. Should any part of the network go down, the rest continues to function perfectly. Simply plug in a new BLADE and you'll be where you started in moments!

10:09am

3.RACK EM UP

Rack mount the rack stuff. OK, we're going to be brutally honest here. THIS SINGLE ONE STEP takes the longest of the entire setup process (unless you have a REALLY dull knife in step 1). Of course you'll need your own rack and screws, but hey, if it's a deal breaker, we'll work it out.

10:20am

4.PLUG IN

Time to hook them up. You knew it was coming. Your little tummy is wrapped around your throat. I mean, it's gotta be a real hassle, right? Interfacing these things? Setting them up? Getting them to talk to each other? Somebody get me an antacid. Wait... is that a CAT-6 cable? You know what that is. And that's all it takes? Mmm Hmm. Yep. You bet.

11:02am

It's literally this easy. WheatNet-IP has all your bases covered. CAT-6 cables hook up the BLADES and surfaces. Regular audio cables for the rest.

5.PUSH THE BUTTON

OK. Everything all hooked up (meaning, is the CAT-6 cable plugged in)? Great. Now we're gonna configure the system. We start by turning it on. Then? Um... that's it. It configures itself. Every piece talks to every other piece and does what it's supposed to do. What? Doesn't EVERY IP Audio system do it that way?

WheatNet-IP does ALL the work of configuring your system EVERY BIT OF IT! It knows when you are adding on or when you are taking something out. You concentrate on content. We concentrate on getting it where it needs to be.

11:05am

6.IT'S WORKING!

You've got a system! From here on out, it's just like the analog stuff you're used to. Except ultimately more flexible. And much more reliable. And better sounding. And completely expandable. And such a joy to use. Yes – you heard it – I said A JOY TO USE! (Bet you never thought you'd hear an IP system described that way. Certainly not one from the other guys).

11:06am

7.CELEBRATE

Time for that cup of coffee and donut we talked about in the preface. Let's face it...the whole process was painless. AMAZINGLY PAINLESS. So painless, you are already up on Facebook and Twitter talking about what a stud muffin you are with your technical prowess. Don't get cocky, kid. But DO enjoy a delicious coffee and donut. And remember, next time you even think about installing new gear, you've gotta call your Uncle Wheaty...

11:07am

3:40am

8.SLEEP EASY

With a WheatNet-IP system, rather than having to be on the phone to who-knows-where in the middle of the night, you can take your emergency engineers off the clock and let them get a good night's sleep. We ARE here, 24/7, in beautiful New Bern, North Carolina, and if you need us, we'll talk to you all night long. But with Wheatstone's reliability record, chances are much greater that those visions of sugar plums will just keep dancing in your head.

AoIP ADVANCED...

It's great to be able to say you invented something (whether you did or not). Turning that invention into a viable, workable solution for modern applications is what's needed if we are going to take this technology to the next level. The status quo was a pretty good starting point – but taking it out of the vacuum and into the workplace requires a fresh, objective yet passionate approach to advance it. WheatNet-IP certainly advances it, making your workflow everything it should be. We cost the same or less. We can handle 10 times the bandwidth. We are far more reliable. And we're poised for THIS decade as well as the NEXT one. We're Wheatstone! This is what we do! What else would you expect?

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Scott's KTOE Studio Rebuild Photo Album *(story on page 30)*

Demo Starts

New Lighting Being Installed

Scott, Venting Frustration on the Countertop

The New Countertop

Out With the Old

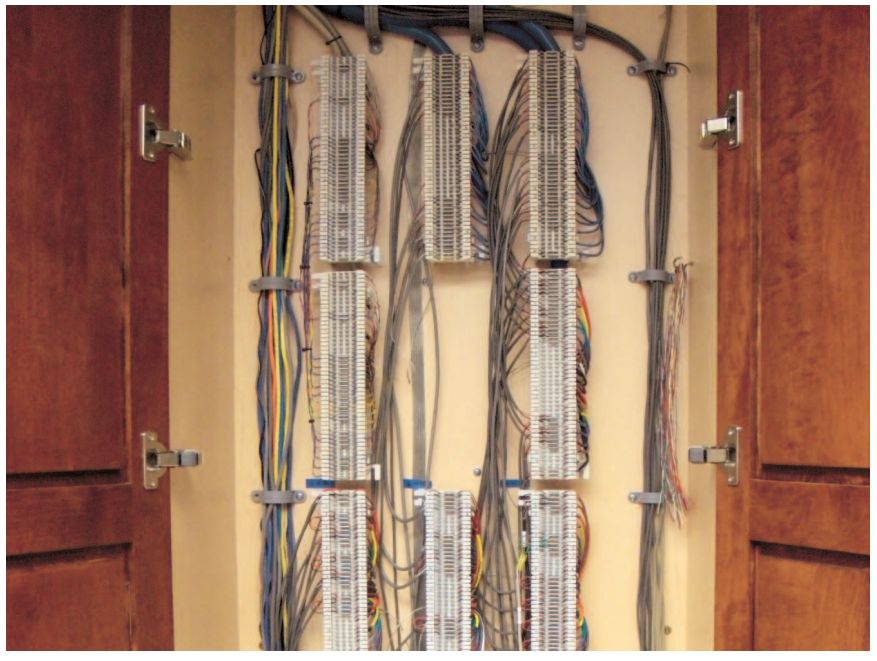
Studio Begins to Take "Shape"

Wiring the Console

Cutting Holes in the Counter Top

Scott's Wire Closet

The Finished Product



Wire Closet Close-Up

A different Angle

KTOE Before – Taken the Last Day the Old Studio Was Used

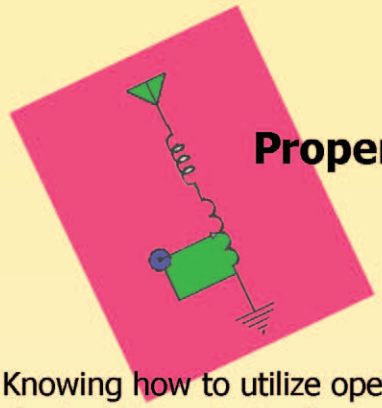
Plenty of Room for Guests

KTOE's New Look

The First Interview in the New Studio

Grand Opening Ribbon Cutting

Another Shot of the First Interview



Properties of Opened and Shortened Feedlines

By: Roger Paskvan, WA0IUJ

Knowing how to utilize open and shorted transmission line can be an advantage in any antenna project. From matching stubs to impedance measurements, this valuable information can make the difficult, look easy.

The author was able to look into transmission lines using a network analyzer to provide a visual display of waveforms. For these measurements, the new AIM 4170 provided an economical means of accomplishing the task. This box provides your laptop with a large display in several colors that actually shows what is really going on inside the transmission line. The author has compared the readings of the AIM4170 to that taken with an HP 8714 network analyzer and both agree with in 1% under 150 Mhz. It's a well made beautiful instrument priced within most amateur's budgets.

So let's take a minute to look into the properties of open and shorted end lines. Set up the analyzer and connect a piece of open ended (not shorted) coax to the port. So lets run the calibration routine and interpret what you will see.

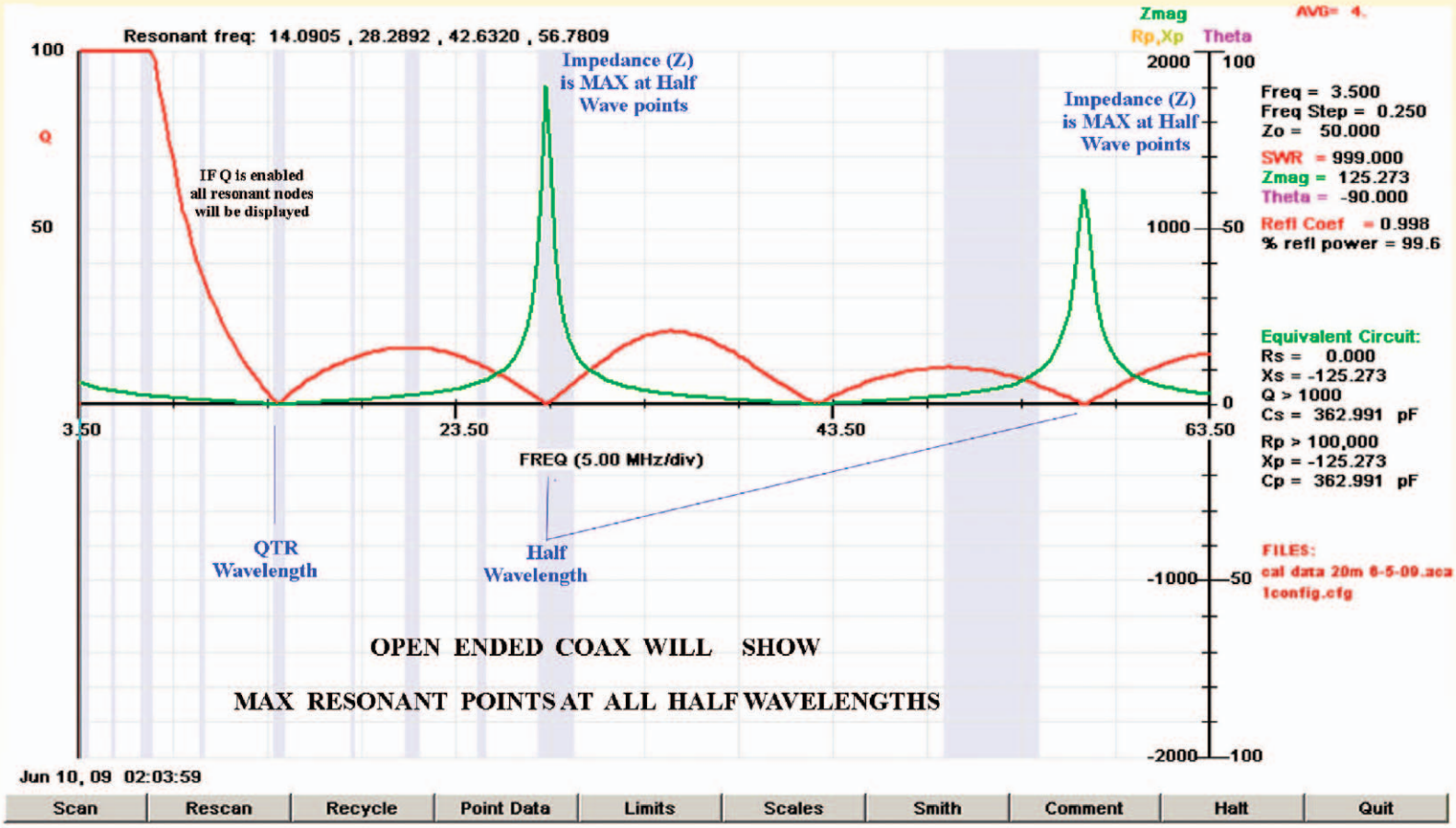


Figure 1. Typical screen shot from a Network Analyzer looking into a piece of open coax cable.

Continued on Page 2

Taking advantage of the known factors of open and shorted coax can be used to determine the exact length of any cable. A length of coax with the end open will have minimum impedance (Z) at all even quarter wavelengths measured at the input end. This same coax has very high Z at all half wave multiples, measured from the input end.

If this same line is shorted on the end, it will have max Z at quarter wavelength multiples and minimum Z at the half wave points.

A quarter wave line that is shorted at the end will have a very high Z to the source point. A half wavelength of coax shorted on the end will have a very low Z at the feed point.

This information can be used to measure a length of coax for quarter or half wave pieces. The nice thing about a Network analyzer verses other methods is that you can actually see this theory in real time.

A Network Analyzer such as a HP8714 or AIM4170 will show these impedance maximums and minimums on fractional wavelengths of coax that are open ended. You can use this info to find a quarter or half wavelength.

How to determine a quarter wavelength of coax using a Network Analyzer

Set up the Network Analyzer to measure impedance and enable Q if you have that function available.

1. Decide on a frequency and a type of transmission line

2. Calculate an approximate physical quarter wave length as follows: 11803/Freq = 1 wavelength (y) in inches; divide this number by 4 then multiply by the velocity factor of the line. (most coax is .66)

3. Add a few extra inches and this is your starting point. Cut a piece of coax to this physical length.

4. Now multiply the frequency you chose by two (2) and set up the analyzer display.

5. Set the Net Analyzer to sweep 10 MHz or more above and below the times two frequency.

6. Measuring impedance (Z), cut the open end off in little chunks until the first peak in impedance occurs at the desired (times two) frequency. This will be the point of a quarter wavelength at the **desired frequency** since we are at two times that frequency. We are actually measuring half wavelengths at the two times frequency.

7. To test the original frequency, solder a short across the open end of this coax. The entire display pattern now shifts to the left.

8. Re-adjust the Network Analyzer for the original frequency you want and sweep 10 MHz above and below this frequency. The impedance peak should be centered at the desired frequency for a quarter wavelength. If Q is enabled, there will be a red line that will dip at this node.

9. The reason we double the frequency is to allow cutting an open ended coax. If we used the original frequency to find a quarter wavelength, you would have to short the end before each measurement.

The author has noticed that above 1000 MHz, this (X2) method is not reliable due to stray capacitance problems. Above 1000 MHz, you will have to cut a quarter wavelength direct and short the end for each measurement. For Stubs at these frequencies, Heliax works better since it is not affected by heat, bending and stray hand capacitance of coaxial cable.

Continued on Page 3

If you are using an AIM4170 Network Analyzer, Impedance is called Zmag. The instrument has a Q function that can be turned on. This red line will actually show the minimum resonant points along the scan line taking all the guess work out of interpreting the display. It is an actual physical display of the wavelength theory. Under the function menu is a tab called ¼ wave stub. IF you enable this function, the program will tell you how much needs to be cut off to meet the resonant quarter wave point. (Details are in applications under the help menu.)

From the screen diagram (see Fig 1), you will see the relationships between impedance, for open sections of various lengths of feed line. The impedance "seen" looking into various lengths of feed line is maximum at all half wave points along the line. Impedance is minimum at all odd quarter-wavelength points (¼, ¾ and so on) as measured from the input end along an open line. A ¼ wavelength feed line that is open at one end presents very low impedance to a signal generator.

At all even quarter-wavelength points (½, 1, $^3/_2$ and so on), the impedance is maximum and *voltage* is maximum. A half wavelength feed line that is open at one end presents very high impedance to a signal generator. You should also notice that the impedance is resistive at multiples of quarter wavelengths. At points in between quarter-wavelength marks, the impedance is capacitive or inductive. So let's change gears and deal with the same piece coax that is now shorted on the end. (See Figure 2)

If we look at a shorted end piece of transmission line, we will see that the impedance shifts from maximum at half wave points for open line to maximum at quarter wave points along the line with a short at the end of the feed line.

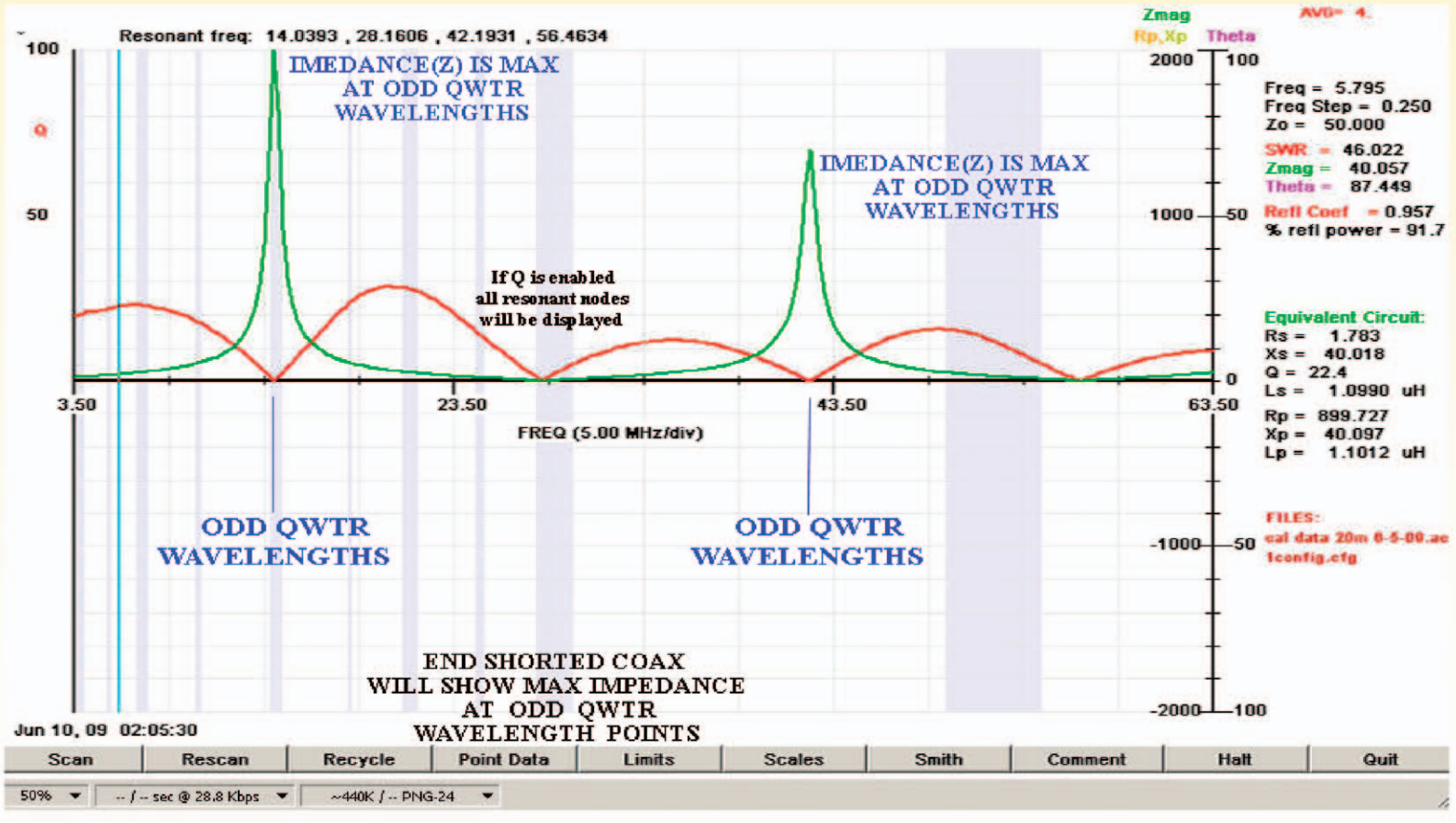


Figure 2. Typical screen shot from a network analyzer looking into a piece of shorted coax cable

Continued on Page 4

Shorted lines can he considered in a similar manner. For example, a $^1/_8$-wavelength line that is shorted at one end presents an inductive reactance to a signal generator. A ¼-wavelength feed line that is shorted at one end presents very high impedance to a signal generator. A ½-wavelength feed line that is shorted at one end presents very low impedance to a signal generator. Also notice that the impedance is resistive at multiples of a quarter wavelengths. With Q enabled, a node is shown at each resonate point along the transmission line. With this information, you can determine the velocity factor of any transmission line.

Finding the Velocity Factor of coax...

English system

Connect a piece of open ended coax to the Network Analyzer, any length and sweep it with a wide enough bandwidth so you will see at least two peaks on the screen.

Measure the frequency of one peak and then the frequency of the second peak. (say it is 14 MHz for the first one and 42 MHz for the second peak) Subtract these two Frequencies = 28 MHz (call this F)

Now measure the actual physical length of the coax piece in inches. Say it is 140 inches (call this L)

Velocity = 2 * L * (Change in Freq in MHz or F)
7840 = 2 * 140" * 28 MHz

Velocity factor = Velocity/C (speed of light in same units as L)

.663 Or 66% = 7840/11817

Metric users

Now measure the actual physical length of the coax piece in meters. Say it is 140 inches or 3.55m (call this L)

Velocity = 2 * L * (Change in Freq in MHz or F)
198.8 = 2 * 3.55 * 28 MHz

Velocity factor = Velocity/C (speed of light in same units as L)

.663 Or 66% = 198.8/ 300

So what have we learned from this experience? The physical properties of transmission lines can be utilized to determine quarter or half wave lengths of line and provide a means of determining velocity factor of unknown coax or parallel line. Let's summarize some of these properties and give some examples of applications for this theory.

1. In any half wave length of transmission line, the voltage and current are in-phase at the input to the line and at the load end of the line. This occurs at all half wave multiples in any transmission line. This makes the impedance looking into the line, maximum at all half wave points.

Continued on Page 5

2. Utilizing the information in item one, the input impedance (Z) of any half wavelength line, regardless of its own impedance, will be the same as the load impedance. This is very useful if you want to measure the input impedance to your new beam that is 60 feet in the air. Cut an exact half or full wave piece of transmission line and connect it to your antenna. Measure the impedance using a network analyzer as if you were on a ladder next to the feed point. With any network analyzer, it is also possible to calibrate the line (null out) so it doesn't exist in the measurements, but that's a topic in the manual.

3. With a quarter wave piece of transmission line, the voltage and current are out of phase at opposite ends of the cable. At all quarter wave points along the transmission line, the impedance is minimum looking into the line.

4. As a notch filter, a quarter wave piece of transmission line cut to a specific frequency, shorted on the end, provides high impedance to the source but a deep notch at the desired filter frequency. This is usually put into a "tee" connector arrangement at the source looking into the line.

5. Utilizing this information in item, a quarter wave transmission line becomes an impedance (inverter) transformer just by the physics of its properties. You could call it an impedance doubler since it will multiply the load impedance by two. If you have an antenna feed point that comes to 100 ohms, a quarter wave transformer will provide a good match to a 50 ohm input.

6. To make a quarter wave transformer:

a. Cut an exact quarter wavelength of transmission line as outlined on page 4.

b. Multiply the two impedances you want to match and take the square root of the product. This will give you the impedance of the quarter wave transmission line you will need to match these impedances. (In our example; the square root of 50 ohms x 100 ohms equals 70.7 ohm coax)

$$\text{70.7 ohms} = \sqrt{50 \times 100}$$

(use 75 ohm coax)

This is close to 75 ohm coax, so cut the quarter wavelength out of 75 ohm line to complete your transformer. The coax transformer impedance must satisfy the formula to be efficient. Other transformer impedances will require creativity to achieve the product impedance. For example, matching 75 ohm cable TV coax to 50 ohm coax will require a quarter wave of 61 ohm coax. (This is actually available from supply houses.) Matching a 25 ohm beam feed point to a 50 ohm coax will require 35 ohm coax piece that is a quarter wavelength. This can easy be made by putting two 75 ohm coaxes in parallel making their impedance 35 ohm (just like resistors). Cut these two coaxes to a quarter wave length and parallel the center conductors and the shields. Remember, quarter wave transformers are **single band items**. They will only work for the frequency range they are cut to operate. This is usually the entire amateur band since the bandwidth is fairly broad. In so many words, don't try and use a quarter wave transformer cut for 40m on 20m. It won't do the job since the quarter wavelength is no longer a quarter wave at the new frequency.

In summary, knowledge of transmission line properties can be beneficial in matching and feeding antennas. Utilizing a network analyzer makes the job of cutting a critical length relatively easy. Compared to the days of dip meters, network analyzers are a miracle in a box.

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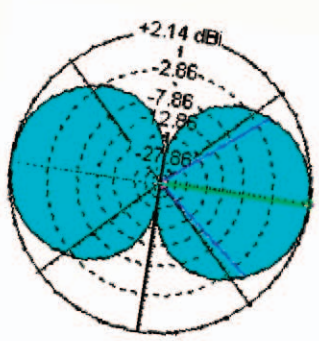
He is a practicing broadcast engineer and has held an Amateur Radio License since 1963.