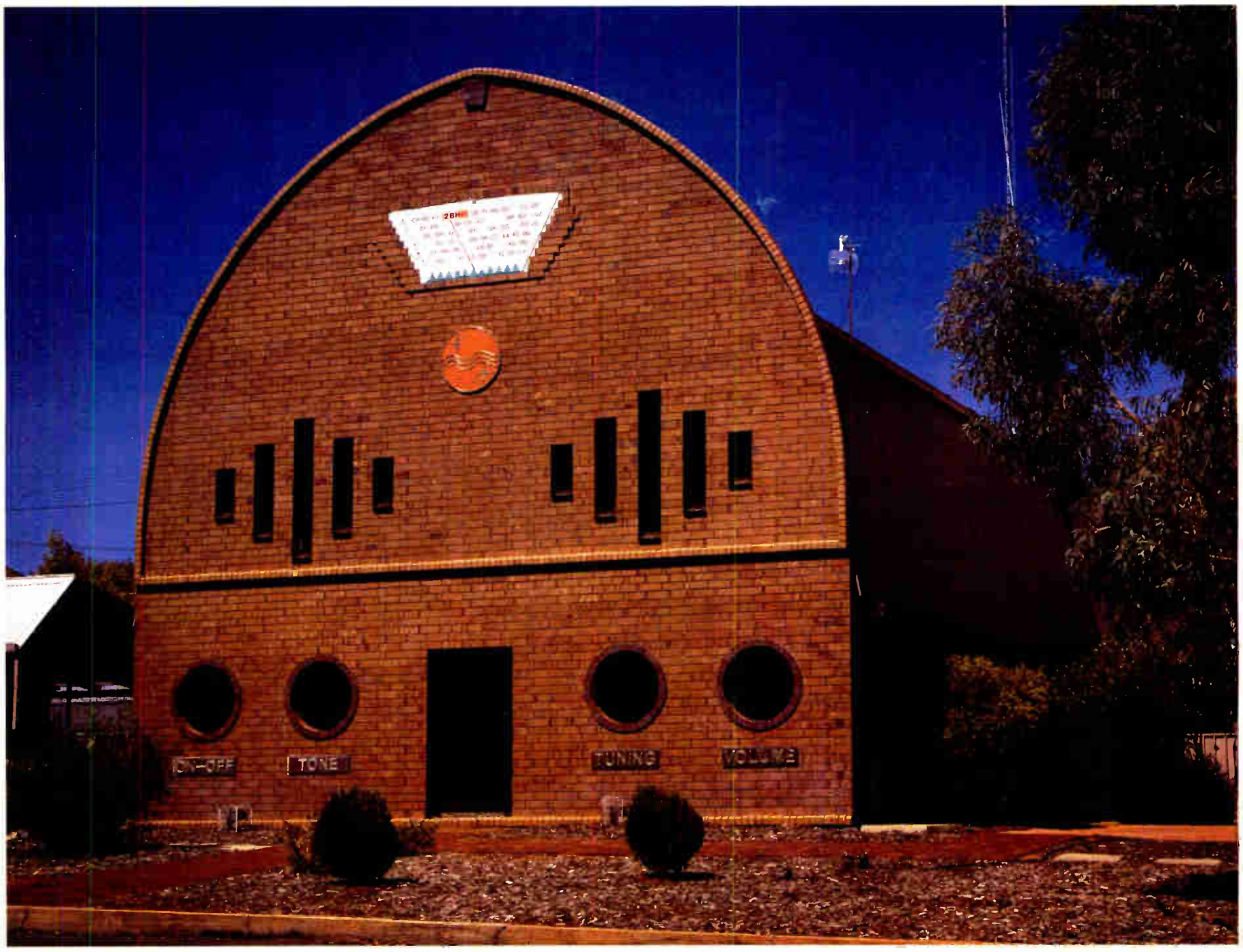
Radio Guide

Radio Technology for Engineers and Managers

February 2005

Is Your Station a Good Neighbor?



Inside Radio Guide

Any broadcast site in a residential area stresses neighborly relations. Few consumers understand why some receivers "go crazy" near a transmitter. Inevitably, complaints happen. How they are handled may shape the residents view of the station: good neighbor or a nasty enemy to oppose before local zoning boards.

"Your station is interfering with my stereo, and I am calling the FCC!" How many of us have received a call like this? What do you do? What *must* you do?

The *necessary* response is spelled out in 47 CFR 73.318 for FM radio and 47 CFR 73.88 for AM radio. The *desirable* response may be a different story! Regardless, take your time to think through and consider the whole picture before responding, so you have the *correct* response.

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Radio Guide

Contents

February 2005

Radio Guide

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Radio Waves

by Barry Mishkind – Editor

Driving the Train or Riding to Disaster?

You might liken the radio engineer to a locomotive engineer. In one way, he runs the engine for the Enterprise, but he cannot change the direction of travel, no matter what he does.

The engineer has to trust those directing him to send him down a section of good track and/or over a solid bridge at the right speed. Still, every so often a train crash makes the news. Many times, it turns out a section of track came "loose" or a bridge fell apart. The results are not pretty. And the engineer was the first to know.

Similarly, a radio engineer trusts his manager has a good grasp of where the industry is going, and will provide strong support and clear direction so the physical plant can be managed most effectively.

Unfortunately, it almost seems like some managers would be happy to drive the train right over a decrepit bridge, risking complete disaster. The technical budget is often too easy a target for them; perhaps they will even be on to a new city before the cuts create a major failure.

On the other hand, there are many wise managers who provide the technical department with the tools and budgets to do an exemplary job. They want to make sure all critical systems are backed up with more than just the sweat of the Chief Engineer.

Part of this "better" situation comes from good communication between the engineer and manager. The engineer *knows* what is needed and how to get there. But how can the engineer communicate this information and get it acted upon?

Such communication can be a real challenge for many engineers. Can we start a dialog toward the solution? Our "start" is on page 12.

Radio in the Field

by Jeff Johnson

Successfully Handling RF and Neighbors

Any broadcast site in a residential area stresses neighborly relations. Few consumers understand why some receivers "go crazy" near a transmitter. Inevitably, complaints happen. How they are handled may well shape the residents' view of the station: good neighbor or a nasty enemy to oppose before local zoning boards.

[CINCINNATI, Ohio] "Your station is interfering with my stereo, and I am calling the FCC!" How many of us in the radio business have received a call like this? What do you do? What *must* you do?

The *necessary* response is spelled out in Section 73.318 for FM radio and Section 73.88 for AM radio. The *desirable* response may be a different story. Regardless, take your time to think through and consider the whole picture before responding, so you have the *correct* response.

ANALYZING THE SITUATION

A key point: does your caller have a "protected device?" Protected devices are limited to fixed devices receiving RF. Your first clue in order to formulate a reply is found in 73.318b. "Mobile receivers and non-RF devices, such as tape recorders or hi-fi amplifiers (phonographs) are also excluded."

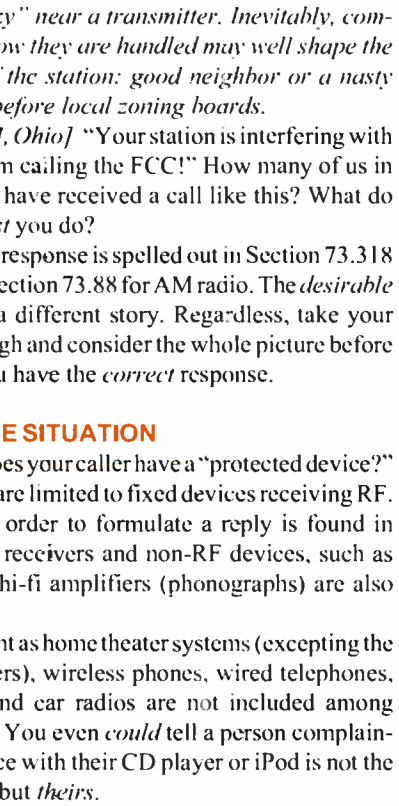
Such equipment as home theater systems (excepting the radio and TV tuners), wireless phones, wired telephones, portable radios, and car radios are not included among protected devices. You even *could* tell a person complaining that interference with their CD player or iPod is not the station's problem but *theirs*.

Garage door remote controls are RF, but how would anyone know it was your station allegedly interfering? Right there is a hint of what might be your first questions.

"How do you know it is our station? What did you hear and what time was it?" "How did you hear it?" The caller responds, "Well I heard someone say it was your station in our city just about noon, and it was on my kitchen clock radio!" You have been nailed by your legal ID! If it is the clock radio or the stereo system's radio tuner, for example – then it is your problem, but there are restrictions.

BLANKETING ZONE

The first of these is whether the interference is taking place within the "blanketing interference" contour. The second is the time interval since a change in your transmitting configuration spelled out in a Construction Permit. Section 73.318 for FM and 73.88 for AM detail the signal strength considered "blanketing." For FM it is 115 dBu (562 mV/m). AM blanketing occurs within the 1 V/m contour.



A comparison of the Blanketing Contour with typical coverage contours.

Essentially, the RF signal is so strong it "blankets" the adjacent reception zone. If you are applying for a CP, it would be wise to have your consulting engineer plot the resultant blanketing contour. Having that information may save a great deal of grief later.

DURING THE FIRST YEAR

How much later? Up to one year. When does that year begin? When program tests of a new or modified facility begin, or when the antenna is replaced. Section 73.318b states, "permittees ... *must* satisfy all complaints of blanketing interference. Resolution of complaints must be at *no cost* to the complainant." (Emphasis mine.) Furthermore, the broadcaster does not have to tell the neighbors of the change. Let them come to you.

In addition to exempting any mobile and/or non-RF equipment, there are exceptions for fixed RF devices. If a receiver is mis-tuned, malfunctioning (front-end overload, for example), or receiving spurs from an overdriven or nonlinear antenna booster, the broadcaster is exempted.

When you are approached within the time period by a complainant living within the blanketing zone, keep in mind the exempted equipment and conditions. Circumstances can vary so widely it is difficult to anticipate every scenario.

Be prepared to install RF traps notched at your frequency. In-line traps with 'F' connectors can be ordered, for example, from Microwave Filter Company, get Model 5KFM.

Also be prepared, in difficult circumstances, to replace offending equipment. A spectrum analyzer can help identify spur-generating booster amplifiers. It is not only your legal responsibly to do everything possible, but your responsiveness will establish you as a good neighbor. That may help in every way from bolstering your ratings to improving site security. Being concerned and responsive is not only required of you, but it is good business.

AFTER THE FIRST YEAR

We now enter the realm of ethics. The regulations state, "following the one year period of full financial obligation to satisfy blanketing obligation, licensees *shall* provide technical *information* or *assistance* to complainants on remedies for blanketing interference." (Again emphasis mine.)

After a year, you do not have to pay for anything beyond the value of your time; the amount of assistance is not specified. Note that this still encompasses only the blanketing zone. You can see how having a map of that zone can be beneficial.

It also does not say you must cure the problem, just be helpful. For example, a new neighbor moves into your blanketing zone after the one-year period has expired and complains of interference from you. Ask how they know it is you. Ask if it is on all radios, or just one.

Remember, most folks do not have a clue about RF, and just talking to them will often improve their attitude. If the problem is a cheap clock radio, advise them to wrap up the power cord to be as short as possible and move it around. Ask them to reverse the plug, if possible. Suggest testing a better radio. If it is the telephone, politely explain that telephones are not covered.

CALMING THE NEIGHBOR

One afternoon a person called me and said, "Is this the engineer for that radio station that is too loud?" I asked, "What do you mean 'too loud'?" She said, "I can hear your darned station all over my new radio!" I asked her where she lived. "May Street," was the reply. This gave me two clues.

May Street is literally in the shadow of our broadcast tower. The other clue was "new radio." After telling her that our antenna *was* on the tower outside her window, I asked if she had had this problem before. "No, I just moved in and bought this new radio. Now it has your station all over it and I'm calling the government – you are too loud!"

I knew that this person was not technically savvy, nor did she know about the FCC. We had not moved, she had. She was clearly in the "blanketing contour," but we had not changed anything affecting our signal for well over a year.

Accordingly, my response was very simple, "We broadcast legally and have metering to make sure of it. I am looking at it now, and our power and loudness are within legal levels. Unfortunately, you have moved very close to a broadcast tower. Since you just bought the radio, I recommend you take it back and tell the store you want one that will not have interference."

Having been able to talk to someone who was willing to listen to her problem, explain the reason, and suggest a cure, the woman calmed down considerably. I did not receive another call from her.

SOMETIMES A HOUSE CALL WORKS

Should the person seem reasonable during your conversation, you might suggest a visit to their home; but bring a good radio, a good phone, even a good portable TV with you. Do not touch anything of theirs, but demonstrate the ability of good equipment to avoid interference. If a known good receiver is affected, ask about antenna boosters, garage door receivers, etc.

I took another call concerning interference from a person living a number of blocks from our tower. I did not know if the address was within the blanketing contour. Nevertheless, it was well over a year since we had not changed anything affecting our signal.

Although the caller was not a new resident of the neighborhood, nor had bought any new equipment, our station had recently shown up on her TV, as well as the telephones. Obviously something had changed; I decided to visit her home in person.

I took a good telephone and radio – a GE "Superadio" – and demonstrated they did not exhibit interference. Since Since I had noticed a loose ground wire at the telco entrance when I approached the house, I pointed it out, suggesting the ground wire had apparently been pulled loose by a weed whacker.

Rather than reconnect the wire and extend my – and our station's – obligation beyond that required, I suggested she call the phone company to check and reconnect the ground. I was thanked to an embarrassing thoroughness, and did not hear from her again. I hope she still considers our station a good neighbor.

DEALING WITH UNHAPPY FOLKS

You probably do not want to personally visit those callers who remain intransigent on the phone; you will be blamed for everything that ever goes wrong. A more workable approach is to send them a copy of the pertinent Rules with the station's responsibilities highlighted along with the exceptions. That "Too Much Information" scenario, especially if it includes technical information, takes the fun out of any further complaining! You have supplied information and attempted assistance, which is all you have to do.

It would be a good idea to document these conversations with times, dates, phone numbers, persons involved. Keep any written communication in your files.

A complication does arise when the permittee is collocated; Section 73.318c is somewhat unclear. "Full financial responsibility" is required to remedy blanketing interference for a year, but is it only the permittee's own signal or that of all of the collocated signals? Concurrently collocating permittees must share responsibility unless, "an offending station can be readily determined." Keep in mind to ask how the complainant knows it is *your* station that is interfering!

The requirement to satisfy interference complaints is strictly limited in most instances, but is legally required in a few. Be quick to comply with the FCC Regulations. In the end, being a good neighbor will not only keep you legal, but also benefit your station as having a reputation for extending good will.

Jeff Johnson is a Network Engineer for Xavier University's X-Star Radio Network. You may contact him at: Jeff.Johnson@xstarnet.com

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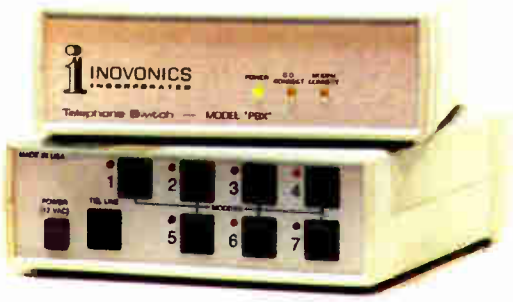

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Transmission Guide

by Phil Alexander

Measuring AM Power

Part 2: Indirect Power Determination

[INDIANAPOLIS, Indiana] In the first part of this discussion (**Radio Guide**, January 2005) we considered normal power measurement in an AM transmitting system, or what the FCC calls Direct Power Determination ("... using a suitable instrument for determining the antenna's input power directly from the RF voltage, RF current, and phase angle"), also called "direct power measurement."

Since most AM stations determine direct power by calculating it from the tower base current or common point current and the known resistance at that point, a typical station must find another way when resistance changes.

CH CH CHANGES

Yes, antenna resistance *can* change! There are many possible changes that may affect the base impedance of your tower. It might happen when a station adds an STL receiving antenna to its tower to eliminate the need for a program phone line, or perhaps mounts an RPU antenna on the tower. Suppose lightning strikes and burns out a tower lighting choke? If you cannot find an exact replacement, you may find unusual transmitter readings result.

It is equally possible that, over time, adjustments to a phasor in order to keep monitor points within limits may cause a shift in the common point impedance. If the station lacks the equipment needed for making impedance measurements and readjustment, and you know you are operating with less than normal transmitter output power, what can you do to keep the coverage your license allows and your GM demands, until your consultant arrives to make the adjustments?

This is where Indirect Power Determination saves the day.

INDIRECT POWER

According to Section 73.51(d), *"When it is not possible or appropriate to use the direct method of power determination due to technical reasons, the indirect method of determining operating power may be used on a temporary basis."*

Generally, anything that makes you question the correctness of a direct calculation or direct reading, such as a possible impedance change caused by hanging new things on the tower, a sudden change in the typical meter readings of either the transmitter or RF ammeter, lightning burning out the RF ammeter, an apparent increase or decrease in operating efficiency, or anything else that does not look right can be good cause for using indirect power determination.

Section 73.45(c) is even more specific, saying, *"Should any changes be made or otherwise occur which would possibly alter the resistance of the antenna system, the licensee must commence the determination of the operating power by a method described in Sec. 73.51(a)(1) or (d). ... Upon completion of any necessary repairs or adjustments, or upon completion of authorized construction or modifications, the licensee must make a new determination of the antenna resistance using the procedures described in Sec. 73.54."*

Please read that again, and notice it says, "which *would possibly* alter the resistance of the antenna system."

IT IS THE RULE

The important words in that Rule are "would possibly" and "must commence." There is no room for interpretation here. Anything that would possibly change the resistance means the station "must commence" indirect power determination and make a new resistance measurement.

When that measurement is made, Section 73.54(c) requires that you report it to the FCC and inform them you are resuming direct power determination. However, if the resistance changes more than 2%, 73.45(c)(1) requires filing Form 302 and waiting for FCC approval before resuming direct power determination.

Remember, the power level requirements remain the same as under direct power determination.

INDIRECT CALCULATIONS

Fortunately Indirect Power Determination is easy to do. Anyone using the indirect method should read and be very familiar with Section 73.51(e) of the Rules, but here is the essence of it: The antenna input power is determined indirectly by applying an appropriate factor to the input power to the last radio-frequency power amplifier stage of the transmitter, using the following formula:

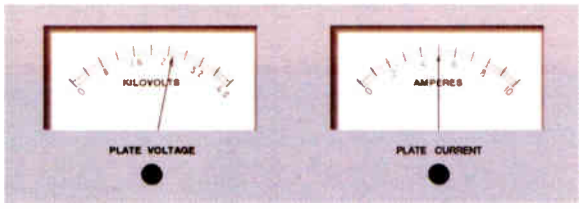
Antenna Input Power = E_P x I_P x F

Where:

E_P = DC input voltage of final radio stage.

I_P = Total DC input current of final radio stage.

F = Efficiency factor.



You will find some newer transmitters approved for use under the FCC's "Type Notification" system do not have specified efficiency factors because efficiency may vary significantly depending on exact power output and frequency.

There are exceptions for "Type Notified" transmitters and one or more cases of "Type Accepted" transmitters that do not directly measure one or both final stage parameters, and if that is the case you should contact the manufacturer for advice about the accepted method of indirect power determination for your equipment.

However, the manufacturer's stated efficiency factor is not necessarily at the top of the list of choices for efficiency numbers. There may be a better way if your transmitter has an established operating record.

FINDING THE RIGHT NUMBER

Good transmitter logs are useful for many things; among them is a more accurate efficiency factor. The Rule goes on to say, *"If the station had previously been authorized and operating by determining the antenna input power by the direct method, the factor F is the ratio of the antenna input power (determined by the direct method) to the corresponding final radio frequency power amplifier input power."*

In other words, the F factor can be calculated from previously logged readings for a station that has been in regular operation and has logs that support the calculation. For example, if you have logged current and voltage readings that show 6,500 watts final stage input to a 5 kW transmitter, your F factor would be 5,000 divided by 6,500, or 76.9%.

Of course, if there are few or no transmitter logs on hand to show the "normal" operational parameters and support an established F factor, you are put at a disadvantage.

In that situation, or for station equipment that has not been in regular operation, such as a new transmitter, you may use one of the two alternatives allowed by 47CFR73.51(f)(2) which says:

*"(i) The factor **F** as shown in the transmitter manufacturer's test report, if such a test report specifies a unique value of F for the power level and frequency used; or (ii) The value determined by reference to the following table:*

Factor (F)	Modulation Method	Max Rated Carrier Power	Amplifier Class
0.70	Plate	1 kW or Less	- - -
0.80	Plate	2.5 kW and Over	- - -
0.35	Low Level	0.25 kW and Over	B
0.65	Low Level	0.25 kW and Over	BC\1\
0.35	Grid	0.25 kW and Over	- - -

\1\ All linear amplifier operation where efficiency approaches that of class C operation."

KNOWING WHERE YOU ARE

Whenever a station is using the indirect method an inspector will want to see a chart at the operating point that shows power determination for conditions that may occur. Typically, this is a chart with a column of possible operating voltages and the accompanying minimum and maximum permissible operating currents for each of them.

This is essentially the same as an operating table for an FM transmitter using indirect measurement. What? You don't have one of those for your FM's? If not, making one before an inspection may save grief afterward.

There is no Rule that *requires* an operating chart or table for an AM station, but you may be asked how the "operator on duty" can know the station is operating in compliance with its license without such a chart

Next, you will probably be given the opportunity of proving you are in compliance, possibly followed by a thorough grilling about every aspect of transmitter control and measurement related to license compliance. It may be a memorable day, but not one of your better ones. Having a table helps make an inspection a more positive experience.

"Table of Acceptable Operation" is a good name, and there are several other possibilities. If the correct information is there and operating personnel are instructed in its use – especially what they must do if limits are exceeded – you have covered what is important, regardless of the title of the page.

As noted earlier, the Indirect Power Determination is the normal method used with most FM transmitters, and may be used continuously with them rather than as a temporary back up method, as it is in AM plants. So, if you maintain a number of FM plants, the following information also may be very useful.

DEVELOPING THE CHART

Generally, voltage is the variable factor that causes variations in transmitter readings, although temperature sometimes plays a part, causing shifts in tuned circuits. The FCC is not interested in the reasons for power fluctuations, only that your power is within the limits set by the rules and the conditions of your station license. However, we need a starting point for determining that operating power is within limits, and the non-adjustable variations in PA voltage, is a good place to start our table.

An indirect operating table can be as simple as four columns side by side showing a range of voltages that includes any the equipment may encounter, accompanied by the minimum, normal and maximum PA current readings for each voltage. The length of the voltage list can be as long or as short as you believe necessary for the transmitter and possible operating conditions. For example, look at Table I as a minimum. A notice on the table that operating personnel should contact you immediately if conditions go beyond chart limits of voltage or current shows you have given necessary consideration to possibilities for abnormal operation.

(Continued on Page 8)

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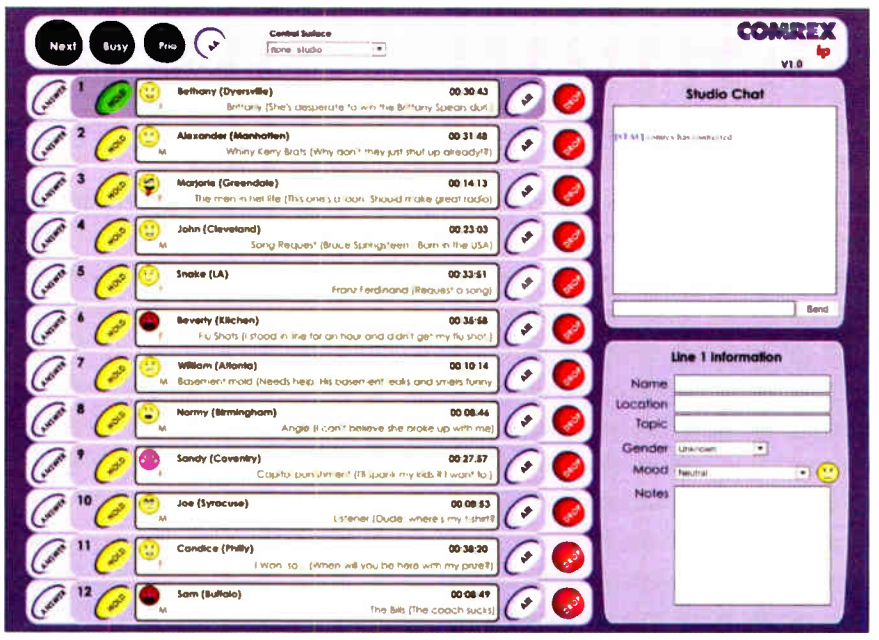

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COMREX

Transmission Guide

by Phil Alexander

Continued From Page 6

Table1 – Indirect Operating Parameters

PA Volts	Minimum PA Amps	Nominal PA Amps	Maximum PA Amps
2400	0.500	0.556	0.583
2425	0.495	0.550	0.577
2450	0.490	0.544	0.571
2475	0.485	0.539	0.566
2500	0.480	0.533	0.560
2525	0.475	0.528	0.554
2550	0.471	0.523	0.549
2575	0.466	0.518	0.544
2600	0.462	0.513	0.538

AUTOMATING THE CHART

Grinding out charts on a hand calculator can be a tedious, mind-numbing task, and possibilities for errors are endless. Fortunately, computer spread sheet programs such as Lotus, Excel, QuattroPro and others can crank out excellent tables quickly and accurately.

It is a simple matter of solving for current, over and over, doing it three times for each voltage on the table. If the station uses more than one power level, a separate table for each power level is clearer than condensing the information on a single page.

The formula is a simple one. First, we divide the station's licensed operating power by PA efficiency to get PA input power, and we also do the same for 90% and 105% of normal power to get the minimum and maximum powers.

By the way, please remember last month's discussion about how the licensed power and operating power of an AM directional station are *not* the same. Essentially, Section 73.51 boosts the operating power of directional stations 8 percent above the nominal licensed power for powers of 5 kW or less, and 5.3 percent for stations with nominal powers in excess of 5 kW to compensate for phasor and transmission system losses. Do not overlook this point when calculating PA input power for AM DA plants.

To summarize the calculations: dividing PA input power by input voltage shows the current required for that voltage. It is as simple as PIE: P = (I)(E), thus: I = (P/F)/E.

Table 2 – Enhanced Parameter Listing

Transmitter Power Output:	1000	Nominal PA Voltage:	2500
Transmitter Efficiency:	75	Voltage Differential Interval:	5

1240 KWXZ Acceptable Transmitter Operation
Indirect Power Determination

PA Volts	Minimum PA Amps	Nominal PA Amps	Maximum PA Amps	PA Volts	Minimum PA Amps	Nominal PA Amps	Maximum PA Amps
2250	0.533	0.593	0.622	2500	0.480	0.533	0.560
2255	0.532	0.591	0.621	2505	0.479	0.532	0.559
2260	0.531	0.590	0.619	2510	0.478	0.531	0.558
2265	0.530	0.589	0.618	2515	0.477	0.530	0.557
2270	0.529	0.587	0.617	2520	0.476	0.529	0.556
2275	0.527	0.586	0.615	2525	0.475	0.528	0.554
2280	0.526	0.585	0.614	2530	0.474	0.527	0.553
2285	0.525	0.584	0.613	2535	0.473	0.526	0.552
2290	0.524	0.582	0.611	2540	0.472	0.525	0.551
2295	0.523	0.581	0.610	2545	0.472	0.524	0.550
2300	0.522	0.580	0.609	2550	0.471	0.523	0.549
2305	0.521	0.578	0.607	2555	0.470	0.522	0.548
2310	0.519	0.577	0.606	2560	0.469	0.521	0.547
2315	0.518	0.576	0.605	2565	0.468	0.520	0.546
2320	0.517	0.575	0.603	2570	0.467	0.519	0.545
2325	0.516	0.573	0.602	2575	0.466	0.518	0.544
2330	0.515	0.572	0.601	2580	0.465	0.517	0.543
2335	0.514	0.571	0.600	2585	0.464	0.516	0.542
2340	0.513	0.570	0.598	2590	0.463	0.515	0.541
2345	0.512	0.569	0.597	2595	0.462	0.514	0.539
2350	0.511	0.567	0.596	2600	0.462	0.513	0.538
2355	0.510	0.566	0.594	2605	0.461	0.512	0.537
2360	0.508	0.565	0.593	2610	0.460	0.511	0.536
2365	0.507	0.564	0.592	2615	0.459	0.510	0.535
2370	0.506	0.563	0.591	2620	0.458	0.509	0.534
2375	0.505	0.561	0.589	2625	0.457	0.508	0.533
2380	0.504	0.560	0.588	2630	0.456	0.507	0.532
2385	0.503	0.559	0.587	2635	0.455	0.506	0.531
2390	0.502	0.558	0.586	2640	0.455	0.505	0.530
2395	0.501	0.557	0.585	2645	0.454	0.504	0.529
2400	0.500	0.556	0.583	2650	0.453	0.503	0.528
2405	0.499	0.554	0.582	2655	0.452	0.502	0.527
2410	0.498	0.553	0.581	2660	0.451	0.501	0.526
2415	0.497	0.552	0.580	2665	0.450	0.500	0.525
2420	0.496	0.551	0.579	2670	0.449	0.499	0.524
2425	0.495	0.550	0.577	2675	0.449	0.498	0.523
2430	0.494	0.549	0.576	2680	0.448	0.498	0.522
2435	0.493	0.548	0.575	2685	0.447	0.497	0.521
2440	0.492	0.546	0.574	2690	0.446	0.496	0.520
2445	0.491	0.545	0.573	2695	0.445	0.495	0.519
2450	0.490	0.544	0.571	2700	0.444	0.494	0.519
2455	0.489	0.543	0.570	2705	0.444	0.493	0.518
2460	0.488	0.542	0.569	2710	0.443	0.492	0.517
2465	0.487	0.541	0.568	2715	0.442	0.491	0.516
2470	0.486	0.540	0.567	2720	0.441	0.490	0.515
2475	0.485	0.539	0.566	2725	0.440	0.489	0.514
2480	0.484	0.538	0.565	2730	0.440	0.488	0.513
2485	0.483	0.537	0.563	2735	0.439	0.488	0.512
2490	0.482	0.535	0.562	2740	0.438	0.487	0.511
2495	0.481	0.534	0.561	2745	0.437	0.486	0.510
2500	0.480	0.533	0.560	2750	0.436	0.485	0.509

Operator Warning: Contact the Chief Operator IMMEDIATELY if current is below Minimum Amps or above Maximum Amps for the operating voltage, or if the operating voltage of thetransmitter cannot be found on this chart. Call 555-555-5555

SPREADSHEET DETAILS

Using this basic formula and the replication power of a spreadsheet, it is easy to generate a simple form like the one shown in **Table 1**, or the enhanced version shown in **Table 2**. Copies of an Indirect Power Table Generator spreadsheet can be downloaded from: radio-guide.com/pwrcht.wk1 This is a simple, basic spreadsheet in the universal Lotus 1-2-3 .WK1 format for portability, and loads into virtually any spreadsheet of the past ten years.

However, simplicity does not limit its power. It can generate operating tables with 99 voltages around any typical reference voltage entry and allows any desired differential between voltage steps. After loading it into your spreadsheet program you can enhance it with call letters and your choice of type face, and if you are familiar with spread sheets, change the number of voltages in the chart. However, the fundamentals you need for accurately turning out indirect power tables on demand are all there.

LEGAL AND DOCUMENTED

Keeping an AM station within authorized power limits is simple. Maintain an accurate impedance measurement on file, as discussed last month in the first part of this article. Use it and the authorized nominal power on the station license for calculating the correct current range at the measurement point. Make regular entries of operating parameters.

Whenever you make tower changes or suspect impedance may have changed, begin indirect power determination and make a notation in the log. Make a new impedance measurement as soon as possible, or have one made by someone experienced who has the right equipment. Then follow up with the proper paperwork required by the FCC.

Keeping everything legal and documented really is cheaper in the long run than the alternative. Better yet, you will know you are getting all the coverage the station license permits.

Phil Alexander operates Broadcast Engineering Services and Technology in Indianapolis, IN, when he is not squeezing out more coverage for stations in the Midwest. You can email Phil at: dynotherm@earthlink.net

Full Duplex

by George Nicholas

Resource Management 101

[CEDAR RAPIDS, Iowa] A successful engineering manager must have knowledge spanning several disciplines: electronics, personal relations – and something I call "resource management." Resource management is nothing new – it is just a fancy name for being able to find the right answer, easily and quickly.

Most working engineers eventually amass a large collection of books, magazines, white papers, brochures, catalogs, tapes, pictures, and article scraps of all shapes and sizes. Some of those resources are timeless, some are outdated; some may even be missing, having been loaned to a colleague.

In this edition of Full Duplex, we focus on some of the better Engineering resources that are available. Of course, this is only a basic list – a place to start. There are *many* books and resources out there, including many I have never seen or used. If you have a favorite book or resource, please share it with us. As time goes by, we ought to be able to help each other build up some great libraries.

THE BIG BOOK

There are several key books most engineering shops should have. The top of the list includes the *NAB Engineering Handbook*, now in its 9th Edition. You will find it at the NAB website (http://www.nab.org) or on display at the NAB bookstore at the annual conventions. It is large and has a large price tag – typically around $175.00. But when you consider how many topics it covers (including what is on the CD ROM), it is really a good deal.

The *NAB Engineering Handbook* is updated every few years; as technology rapidly changes, any current volume will have both new and outdated material. Fortunately, most broadcast engineering theories and principles have been pretty much in effect since the late 1930's. Thus, even the older editions have value: a "hand-me-down" edition from another engineer who has just replaced his might contain transmitters that could well be under your care today!

KNOWING THE RULES

The next resource I recommend is access to a set of FCC Rules. There are several ways to get the Rules.

The best and most expensive is to subscribe to a Rules "service." You will receive informative bi-monthly updates and newsletters from the publisher, in either printed form or on CD ROM. The updates help you stay on top of the latest FCC Rule changes. But they are also expensive – in the neighborhood of $375 per year, or more.

Alternately, you can purchase the CFR books from the US Government Printing Office. The applicable sections include Part 0, 1, 17, 73 and 74 and can usually be had for less than $100. A third, and far less expensive option is via the Internet. The FCC website (http://www.fcc.gov) has links to a Rule search. There are a few other sites out there with FCC Rules and search engines, including http://www.hallikainen.com.

A word of caution: most printed FCC Rules are from the last release to the US Government Printing Office, typically in October of each year. So if you buy your set of books in, say, August or September, they are already almost a year old, with new versions coming in a few weeks.

OTHER RESOURCES

Another great resource is the *AARL Antenna Handbook*. Granted, you may not refer to it daily, but mine recently helped a friend and I design a long wire antenna when their main AM tower fell in a windstorm. By brainstorming and referring to the AARL Handbook, we were able to design the system on the first try and get them back on the air quickly.

If you are charged with maintaining an AM directional antenna system, Jack Layton's *Directional Antennas Made Simple* is a great resource to have on hand. It is chock full of directional antenna principles, including analysis and step-by-step instructions on directional measurements

Since many of you also have IT duties, I suggest *any* of the *Administrator's Pocket Consultant* series by William R Stanek (Microsoft Press). They include Windows XP Professional, Windows Server 2003 or Windows 2000 among others. I found mine at Barnes and Noble. There are many reference books on IT, and you should find the type that works best for you; I happen to like Stanek's style and layout.

Those looking for some basic "how to" and "why" textbooks cannot beat Noble Press. Their books include *Radioman's Manual of RF Devices* by Harold Kinley and *Spectrum Network Measurements* by Robert A. Witte, both around $75. Perhaps you are mentoring a high school or college student, looking at broadcast or electronic communication as a career. *Modern Electronic Communication* by Gary M. Miller is a great textbook that covers all of the different types of communication, including cellular.

There are also many math formula and other reference formula books out there. *Pocket Ref* by Thomas Glover will literally fit in your pocket or tool bag. Available at many hardware stores for $10, just about every formula known to mankind is in there. You can amaze your friends with the Greek alphabet or Periodic Table trivia!

PASS IT ON

Finally, a plea to some of you who are retiring, leaving the business, or simply have more books than they need. If you have a local engineer you mentored, or have a public library in need of broadcast and engineering resources, please consider donating your library to those in need.

Before our next meeting, I would like to hear from you! Let me know what books and resources you recommend. We will list those, as well as some great websites and links.

George Nicholas specializes in technical and communications consulting throughout the US. If you have an experience to share, or an idea you would like to explore, email him at: georgenicholas@csi.com

by Craig Bowman

One Step Forward Two Steps Backup

[DURAND, Michigan] How many times have you told the Production Director, Traffic Manager, Sales Manager, etc., that their current crisis would have been avoided had they only backed-up their data? As we stand there smiling, in the back of our minds we wonder when *we* last backed-up.

I do not want to get into the pros and cons of the various backup media, I just want to emphasize that it be done – today!

JUST DO IT

Of course, DVD drives rock. The media now is inexpensive, and thus the media of choice in my world. It is so simple that I have a batch file that, at a command window prompt, does a back up of all my necessary files each and every day.

When I come in my office, the DVD drive is open and the backup staring at me indicates a successful backup from the day before. The disk is removed, and the next day's disk is inserted. This occurs Monday through Friday using the RW media, so disks last for months. Once a month or so a complete backup is taken off site.

CRASHES HAPPEN

There are many reasons for crashes. Sometimes it is the hardware – after all, there is a finite life span for hard drives. Sometimes it is a software problem. One hopes software crashes are not the result of a virus, but it does happen. However, most often, some file gets corrupted and all heck breaks loose.

A reminder: when backing up, take a moment to see if you are backing up enough. Different applications use different sets of data, often stored in different places. Be sure to catch them all.

For example, we had a Netware server crash. At first, we thought "Hey that's OK. We have all the necessary files (CBSI, etc) backed up." That much was true. But our *GroupWise data* was not backed up. Suddenly, everyone at the station who was using GroupWise as their filing cabinet for each and every company email ever sent or received was complaining, loudly. It will never happen again – now we backup GroupWise.

ANTICIPATION HELPS

One afternoon about 4:30, due to an intermittent network card in our Logitek audio engines, our network routing table (the .NCO file) became corrupt. Fortunately – just the day before – I noticed the name of the table we were using did not make sense, and I copied it to a name which better reflected the stations for which it was in use. I also had made a note to update the filename the next time we had any major changes to the configuration.

In one way, I hate that I may have used up all the luck I have in this one incident, but it sure got us back on the air quickly – almost better than a Lotto ticket. But, this too, will never happen again. We now include the .NCO file, and all the other \logitek\ files, in our daily backup.

KEEP SUFFICIENT BACKUPS

We use Scott Studios automation, and not long ago we lost the boot drive in our Dispatch machine. It was not the end of the world by any stretch – especially since we had all the data backed up. True, we did have the backups, but unbeknownst to us the Dispatch data had been getting corrupted for weeks and we did not have one *old* enough backup to restore completely. When is having a backup too recent been a problem? Shoot; now we keep weekly backups for more than a week.

The idea to write this article came to me last night while I was lying in bed, mentally solving all the world's problems, and not sleeping. The fact that my laptop had been acting strange all day probably planted the seed. Sure enough, this morning when I tried to boot my laptop to start writing this article, XP would not boot.

I am using a backup (nope – I did not back up) hard drive in my laptop whilst feverishly attempting to get as much data from my old drive as I can. The good news is there are companies who can retrieve your lost data. The bad news is they cost around $150.00 per hour (minimum) with the average time of 10 hours. Wait a minute – a Google search shows classes in data retrieval. Maybe I will have to add another service to my business card.

Craig Bowman has been a radio engineer for over 25 years. His contracting firm, Bowman Engineering, is based in Durand, MI. Contact Craig at craig1@shianet.org

Operations Guide

by Mark Mitchell

Is it "Budget Planning Time" Already?

[HOUSTON, Texas] It is a new near, and time to start planning for next year's budget. Wait. I can already hear some of you saying "Plan for next year? I haven't even got started on this year's budget!"

LOOKING FAR ENOUGH AHEAD

I know that this might seem like a silly idea but like any other long term project, planning is the key. And whether you work in a large market or a small market now is the time to start making plans and planting ideas for the future.

While some of these ideas can be used for both Capital as well as Operating budgets I am going to focus on Operating budgets here. Although a lot of this can be considered basic, it is amazing how many engineers not only do not plan for budgets, but do not have the steps in place that will make it easier to do budgets easily and in a timely manner.

Instead, most of us just throw together something at the last minute, usually consisting of bumping up the numbers from last year the three to four percent that is allowed across the board. This is not only ineffective but also inefficient. What I would like to do is to show you an overview of some things that help me not only prepare my budget but also prepare my management for the recommendations I make in my budget.

BUILDING THE WISH LIST

As you go through the year, you and your workmates will have thoughts and ideas of things that you would like to change or accomplish. But as we get busy just doing the day-to-day tasks, those ideas get lost or forgotten. I have found one of the best ways to help me remember is to start each year with a sheet of paper, a computerized task list, an erasable wallboard or some other place where I can write down the ideas as they come to me.

This serves a couple of purposes. The first is that I do not forget the idea. The second is so that down the road I can re-evaluate the idea to see if it is still feasible. Often times it will spur my thoughts to other related items that I had not thought about at the time. And finally it gives me a yearlong list to work with when the budget process begins.

The nice thing about this list is that you can be as outlandish as you wish. Do you find you need an additional person? If you have it on your list, you can take the opportunity throughout the year to document the occasions where having that extra person would have saved you money by reducing the time a station was down.

What about those occasional projects that need to be done? Like having bees removed from a transmitter site. You can document the time of year that the problem occurred, and whether or not you had the same problem the previous year. You can also use this list for big projects that occur every few years such as painting a tower, building, or making major fence repairs that you can see will be needed.

You should also prepare for any large ticket items that you may not need, such as a new tube, because you never know when a lightening strike or power surge is going to take out the one you just put in. Whatever you feel the need is, as you think of it or come across it, put it down on your list.

PACKING IT IN

"But wait," you say, "If I do that, my list is going to be bigger than the three volumes for my transmitter!" And I say, "that's okay." Remember the list is just going to be used as a guide for when you start putting your budget down on paper.

This year's list has been started; it already includes items like backup cards for my Intraplex and new tower light sensors. I put the tower light sensors in after that helicopter crash because when I looked at the ones I had inherited, I saw that most of them were pretty old and was unsure how reliable they were.

That is another important aspect of this list. Use it to put down items that need to be replaced due to obsolescence. Even as technology changes rapidly, the reliability of our stations is of paramount importance. We need to make sure we have the technology that suits our stations best and makes our jobs as worry free as possible. After all, we have personal lives too. (Of course, this excludes those engineers that seem to live at the station!)

Another area that you do not want to forget is safety. This means items such as fire extinguishers and their annual service. If your sites are like mine were, the fire extinguishers may not have been serviced in five to ten years.

You should have an extinguisher in your generator room, and one or two in your transmitter room. Make sure you have the correct type for electrical fires. Even if you have a fire suppression system installed in the building, having a couple of extinguishers handy could take care of something small before the larger system goes off, and save you several hundreds of dollars.

Also for safety, make sure that you remember items like hearing protection, eye wash stations, mud mats, stepping stones or gravel, as well as items like gloves, face (breathing) mask, and eye protection. Think about the ladders that you have. Do they present some type of risk to the user? For instance, aluminum ladders should not be used at transmitter sites. Do you have lock out/tag out kits? With the increase in liability when you have contractors on site, these types of items are not only desired they are needed to protect the station from lawsuits.

DELETIONS/ADDITIONS

As you create this list, indicate items you may have had in the budget in previous years but no longer need. For example, if you just got a new solid-state transmitter, make a note to delete "replacement tube."

At the same time you also need to make sure you budget for a replacement or spare solid-state module as, well as for repairs to one or two modules. Face it – at least one of them is going to blow up at the most inconvenient time during the year. You surely do not want to tell your GM you need to spend two to three thousand dollars – and spend several days or weeks repairing a module – to get you back to full power during ratings.

Consider the tools you use for the studio. Do you have what you need or are you just trying to make do with what you already have? What about extra cable and connectors to replace ones that die? Have you thought about what you are going to do if one of your microphones goes out?

PREPARE THE GM

These are just some of the types of items that you need to consider putting on your list. But there is something more that you need to consider while you are putting this list together. As you add items to your list throughout the year, take the opportunity to let your GM know. Present it to him while it is fresh in your mind.

Tell him you do not have to have the item immediately, but it is a department or station need you want to put into the budget for next year. Then when you bring it back up, you can refer to the earlier conversation. And since it will not be a surprise, he is more likely to accept it and help keep it from being cut during budget reviews.

As you talk about these budget items with your GM, frame them in a way that shows why they are needed. Explain how a particular item, service or repair will save the station money in the long run.

For example, you may want an annual service contract for a generator you have been servicing yourself. Explain the benefits and cost reduction factors and/or reliability/down-time issues. Let the GM know that when you have to perform this type of work yourself, it takes time away from you keeping the transmitter staying at its most efficient operating state.

Remember the better prepared you are to show your GM how something will increase revenue, reliability, and ratings, the easier time you will have keeping that item in the budget.

Sure, I can hear some of you saying, "How does getting my generator serviced by someone else increase revenue, reliability or ratings?" Consider this: if you have a professional perform even the routine maintenance on your generator, they are likely to spot potential problems that occur with that particular generator of which you may not be aware.

This *will* increase reliability as you will be less likely to have a generator failure when it really counts – such as in the middle of morning drive. As you well know, that is exactly when old Murphy will stick his head in to cause a problem. Instead of disaster, when the power goes out in the middle of ratings you will be on the air with the scoop on the biggest thing going on in your area.

BUDGET TIME

After you have taken these steps throughout the year, the day finally comes when you will have to put it all together to present a budget. If you have written down some type of justification as you saw it at the time, this part should be a lot easier and the budget you present will be much better.

Start by going through the entire list. Do this several weeks before the budget process actually begins. Take a few minutes and evaluate each item. Ask yourself if that item and the reasons behind adding it are still valid. Because circumstances change throughout the year, there will be items you will look at and immediately decide they can be stricken from the list.

Once you have eliminated what you believe is unnecessary, schedule a little bit of time with your GM and go through the remainder of the list. This will accomplish a number of things.

One is to refresh your GM with items that you had casually mentioned to him previously. Two, it will give the two of you a chance to go over all the items when you are not pressed for time. Three, your ideas may prompt him to suggest items that you had not thought about. Finally, you will have the opportunity to make any adjustments the two of you come together on.

Now lest I forget, there is one other person/department that you want involved with this process – the Business Manager.

The Business Manager can help you put together the numbers to show the cost savings/benefits. Many times they can help you with the presentation of an item so it will most likely make it through the budget cutting process. If you can make changes in your budget that will make it easier for them, such as having a bill from one vendor instead of several bills from multiple suppliers, they are more inclined to help push through your ideas.

Try some of these suggestions; you will find the budget process can be made easier when you take the time to plan ahead and involve others in this process all through the year.

Mark Mitchell is currently a Chief Engineer in Houston, TX. You can email Mark at HoustonChiefEng@aol.com

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FCC Focus

by Bruce Eisen

Broadcasting Telephone Calls

The morning crew just had a hilarious phone call ordering 500 pizzas for delivery. Your news anchor got the Mayor to admit to a scandal. But can you put such calls on the air?

[WASHINGTON, D.C.] One area of continued FCC enforcement does not have the sex appeal of indecency, but still generates significant broadcast fines each year because stations fail to follow a relatively simple FCC regulation.

A primary example of a Rule that can go unnoticed or misunderstood is the Rule against broadcasting telephone conversations. Sometimes it is the desire of a radio announcer to be current or controversial that trumps the need to stay compliant. No matter the reasoning, it is tempting fate to ignore the Rule.

PRIOR NOTIFICATION

The FCC (Section 73.1206) requires a broadcaster to provide prior notification of its intent to broadcast a telephone conversation to the party whose conversation is to be aired. It is not relevant whether the conversation is being recorded or is broadcast live – the proper notification must still be given.

There is a single exception, and it is a corker: a number of cases have turned on the question of whether or not the party was aware or may have been presumed to be aware from the circumstances of the conversation that it was being or likely to have been broadcast.

But before anyone scoffs at this regulation and believes that the exception is so subjective that any case can be won simply by strongly arguing that the party should have been aware of a broadcast, you must understand that the FCC has ruled that awareness is presumed to exist *only* when the other party to the call has some association or affiliation with the station.

That cuts the exception to ribbons, but it does not mean a broadcaster cannot show that a party knew, or should have known, that the conversation is being or will be broadcast. For instance, the rule presumes that a person is aware that a conversation will be aired if that person originates a call to an on-air call-in show.

PROBLEM AREAS

Actually, problems with the Rule ordinarily arise because many radio shows are driven by spontaneity, a quality that can prove exciting to an audience. And what could be more spontaneous than a discussion with a listener about a controversial or even inflammatory topic? We have all heard or seen man-in-the-street interviews, comedic or otherwise, and these exchanges can be legitimately entertaining as long as they do not cross over into areas of indecency or defamation.

Unfortunately, some of the spontaneity may be lost when a person realizes that he or she is to be on the air. But that trade-off comes with the privilege of being a broadcast licensee. The FCC has held the Prior Notification requirement ensures the protection of an individual's right to answer the telephone without having his or her voice or statements transmitted to the public by a broadcast station live, or by recording for delayed airing.

This right to privacy is, I think, fundamental to we Americans, and the FCC has held that clear notice to an interviewee of an intent to record that person for broadcast requires *specific notification* to that effect. Recently, the agency has even stated that a voicemail message constitutes a conversation within the meaning of the Rule, and that "it is reasonable and desirable to retain for individuals the right to answer the telephone without having their voices or statements transmitted to the public," absent prior notice.

Therefore, it is important for broadcasters to understand that the right to answer without having one's voice transmitted to the public exists irrespective of whether the voice is broadcast or recorded for later broadcast, is live or is lifted from an answering machine. The FCC means business and provides very little wiggle room to avoid sanctions under the Rule.

FORGIVENESS IS *NOT* EASIER TO GET

There simply is no way to address this problem after the fact. Once the conversation begins, it is too late! The FCC has held that notification must be provided to an interviewee *before* initiating the recording. The violation occurs when the telephone call is recorded for broadcast use *without the called party's prior knowledge*. Granting permission after the recording and before the actual broadcast still breaks the Rule.

Station personnel must be informed that embarrassing folks during morning drive time is totally off limits. That is, of course, unless you can absorb the cost: of an FCC forfeiture – they start at $4,000, and can run significantly more if the FCC finds an upward adjustment is needed under the facts of the case. But even non-embarrassing exchanges can still run afoul of the Rules.

To reduce problems it is a good idea to develop a station "telephone broadcast policy" before trouble happens, and ensure the entire air staff understands not only the policy, but the legal reasons behind it.

As a matter of fact, for a whole range of FCC issues, it makes great sense to have periodic meetings to address some of the Rules and Regulations that historically lead to fines. The meeting should be followed up with an appropriate memo outlining the requirements of the Rules. It is well worth the effort.

Bruce Eisen, of Kaye, Scholer, has been a communications attorney for some 20 years. If you have a question regarding an FCC Rule, you may send an email to Bruce at beisen@kayescholer.com

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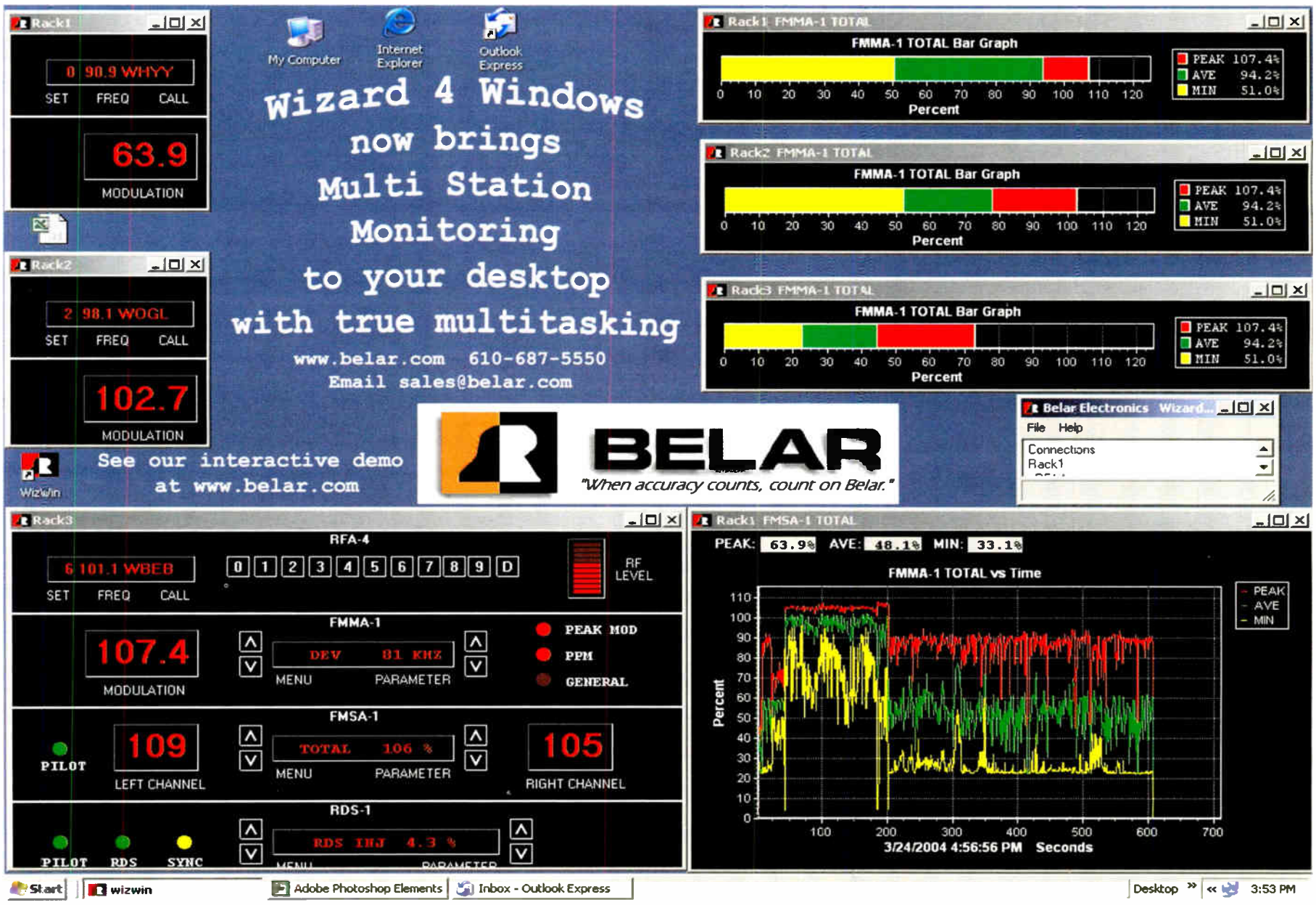


Tower Topics

by Leonard Weenou, P.E.

The Truth About Towers

Part 5 – Wire Rope

[SEDONA, Arizona] In past months, we have discussed how the process of tower design is based on working backward from the projected loads and the location. We have also noted how that process is interactive and not linear.

This situation also affects this column. No sooner do we address one element of the design, fabrication or construction process than we find that we need to address adjacent components to fully illuminate the very points we have just made.

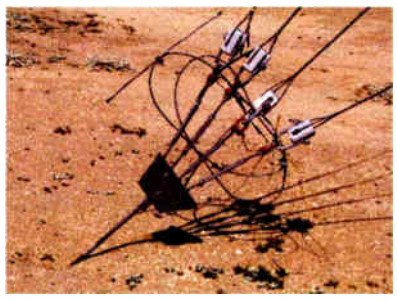
In the last installment of The Truth About Towers, we addressed some of the physics and math of how a steel tower is kept vertical. In a guyed tower like our fantasy structure for WQRM-FM, that need for verticality is provided by guy lines. Guy lines are normally made of wire rope (see sidebar) and those guy lines are attached to the earth with an anchor that is predominantly concrete.

So in this column we will deal in steel *and* concrete.

LARGE LOAD, SMALL FOOTPRINT

When you think about it, a guyed tower, like the WQRM-FM fantasy mast, only touches the ground at the base and at the anchors. At these loci, a guyed tower has the minimal footprint foundations needed for the purpose, a great financial and construction advantage. But – these foundations have to be sufficient.

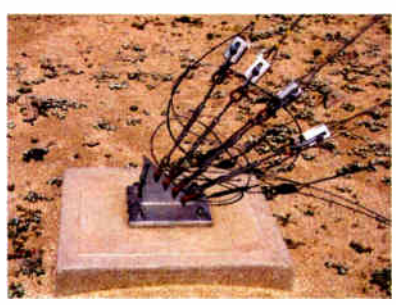
Let us first consider the tower anchors. We should mention that they come in multiple design styles selected as a function of the site layout and the soils (or lack of soil) encountered. In general these can be divided into three design groups.



A typical drag anchor.

The most ordinary is the "drag anchor," made up normally of a concrete underground structure below the frost line embracing a steel, typically galvanized rod or beam that travels above ground to be connected with the guy lines.

The "block anchor" is a concrete structure that starts below the frost line, but that continues above grade. The only metal part visible is the connection plate or point for the guy lines.



A typical block anchor

A third type, the "rock anchor," is where a suitable steel connector is either screwed or grouted into a crevasse or drilled hole in solid rock.

Hopefully the WQRM-FM tower will be able to use drag anchors since these are the least expensive to install. If the soil is firm enough and there is little or no ground water seepage, one can carefully dig down with a backhoe to the design depth proscribing the "form" of the anchor in the ground. In construction vernacular this is called an "earth form."

The reinforcement steel (rebar) can then be carefully placed in this form along with that anchor rod mentioned above. The concrete is then poured in like filling a cake pan and – voila! – your anchor is made.

Properly designed anchors resist the uplift tension on the guy lines caused by the physical weight of the tower (overturn moment) and the wind on it by providing "drag resistance."

This is an accumulation of four contrary forces: the weight of the concrete and steel; the wedge resistance from the leading edge bottom phalanx of the concrete anchor wanting to drive itself into the ground; the weight of the overburden or cover; and finally, the vector resultant of the horizontal drag through and over the earth surrounding the anchor assembly.

ANCHOR ELEVATION ISSUES

Probably the least thought about item in the anchor design is "sinking settlement." This is the tendency of the mass of the anchor to sink or settle into the ground, analogous to the design study to confirm that the tower base has enough displacement to keep the tower from sinking.

Why would this sinking be a consideration? Are not the guy lines pulling up on the anchor all the time? Not necessarily so.

Guyed towers are seldom ever really balanced exactly or, so to say, standing perfectly straight up. Resultant tension on an anchor can be much less than the calculated static tension when perfectly plumb. Early designers knew this by instinct (or discovered this phenomena by painful experience), and anchors in questionable soil tended to be broader and flatter than high. This is still the norm today, but we have a better handle on the numbers.

Because of this broad and long format, the design of the anchor, and especially the rebar internal structure, is important. The anchor must move (if it moves at all) as one unit. Even an inch of sinking can precipitate a major change in static tension when tension returns on that anchor as the tower "leans away."

KEEP AN EYE ON TOWER ALIGNMENT

This is a good moment to mention that any new tower should *always* be checked for plumb, tension, tightness and distortion six months after its erection. From the above discussion of soil settlement and compaction, and since the greatest changes occur in that first six months, you can see why even exact settings on a new tower will need to be touched up.

As with any construction project, creation of a meaningful artwork or any great fabrication (including this evening's dinner), the project is always divided into two parts: The selection of ideal materials, and the execution of the work. Putting up a perfect tower is no exception to that premise. Coming up will be some more information on what goes into tower bases and guy anchors.

Select your steel and concrete well and strive for a perfect installation.

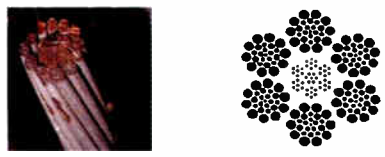
Leonard Weenou is a legendary consulting engineer with extensive tower project experience. Contact him at editor@radioguide.com

Wire Rope

[SEDONA, Arizona - February 2005] Many have claimed invention of wire rope; as with any such success there is always a multitude of progenitors. However, the purveyor who undoubtedly brought wire rope design and manufacture to its 19th century zenith was John Augustus Roebling, who, among many triumphs, was also the designer of the Brooklyn Bridge.*

ALL TWISTED UP

Wire rope is made up of multiple strands of steel wire evenly twisted together to achieve the final, desired diameter and strength. In larger sizes, wire rope is made up of multiple small wire ropes once again twisted together. IWRC is a particular type of wire rope that has a single 'racer' strand running straight through the middle.



Guy wires are made up of many smaller wires.

As mentioned, normally the smaller strands are twisted together. This slight tensioning into a bundle provides us several advantages. The first and most desirable is that the wire rope is very flexible for its diameter, which allows it to be rolled on a drum for transportation and ease of deployment and use.

The second is that the multiple strands produce distributed and equalized strain on the line enhancing its strength under duress. For many reasons, when strain is introduced into a solid, it is never evenly felt across the cross section of the object.

STRENGTH IN NUMBERS

A solid object, such as a solid cylinder, could be viewed under stress conditions as having a "strain line" running through it. Each of the wires in a wire rope have a strain line running through them but their capability is times each wire's capability, times the number of wires at equalization.

The fundamental difference between the limited strain line in a solid of comparable cross section and the multiplication of strength from multiple strain lines in a cluster of wires is the secret of strength in wire rope.

Size In. Dia.	Strand Count	Wire Size Dia. in	Ultimate Strength	Initial Tension	Turnbuckle Size (typical)
1/4 EHS	7	.080	6,650 lbs.	700 lbs.	1/2"
5/16 EHS	7	.104	11,200 lbs.	1200 lbs.	5/8"
3/8 EHS	7	.120	15,400 lbs.	1600 lbs.	5/8"

Details of Extra Heavy Strength (EHS) galvanized wire rope typically used in tower construction. (For a more extensive table go to: http://www.wrca.com/galvanized_strand.html)

Those engineers who design in steel primarily look to the AISC (American Institute of Steel Construction) Manual of Steel Construction for the strength of the steel material they will use.

Interesting enough there is no data on wire rope in this manual so in this instance we have to follow code limitations,** our own instincts and calculations based on the data supplied by the manufacturer.

Although already taken into account by the manufacturers, it is interesting to note that galvanizing normally reduces the strength of the steel used in the wire rope by 10%.

* If you have not read it, much of Roebling's story and consequently that of wire rope is contained in 'The Great Bridge: The Epic Story of the Building of the Brooklyn Bridge' by David McCullough. This saga of exceptional prose is a must read for all, especially engineers. American Heritage magazine calls it one of the greatest books about our past.

** ANSI (American National Standards Institute) recommendations require as a minimum a 3 to 1 safety margin when using wire rope. The U.S. Army Corp. of Engineers requires more in some cases based on the precise application and use of the wire rope.

Digital Guide

by Rob Meuser

Digital Transmission

Part 1 – The Digital Engine

[NEW YORK CITY, NY] With so much discussion of all things digital these days, it might be helpful to many, for us to lift the hood and see what is really going on. This will help us understand what will be required to maintain these systems.

A LONG STANDING TECHNOLOGY

Digital transmission is far from new. At the beginning of radio transmission we had exclusively digital transmission. That "system" was known as Morse code and transmitted as an on/off pulsed carrier. Reception was deceivingly simple; it depended on the complex analog computational abilities of the human brain. This allowed for a lot of distortion of the digital pulses to occur before any information was lost.

Development of analog AM modulation followed those first digital transmissions by decades.

Some may think using Morse code, as an example of digital transmission is a stretch, so let us look at the first digital transmissions between machines – teletype. This technology dates to the 1930s and introduces the use of FSK, frequency shift keying.

Again, the use of digital FM predates the use of analog FM modulation.

Modern digital transmission utilizes a combination of several higher order modulation and coding schemes so this must be what is new. Wrong again; Google "SIGSALY." It is truly a complex system that in many ways is similar to modern digital systems. It was built and deployed in the early 1940s and was so advanced the patents were kept secret until 1976.

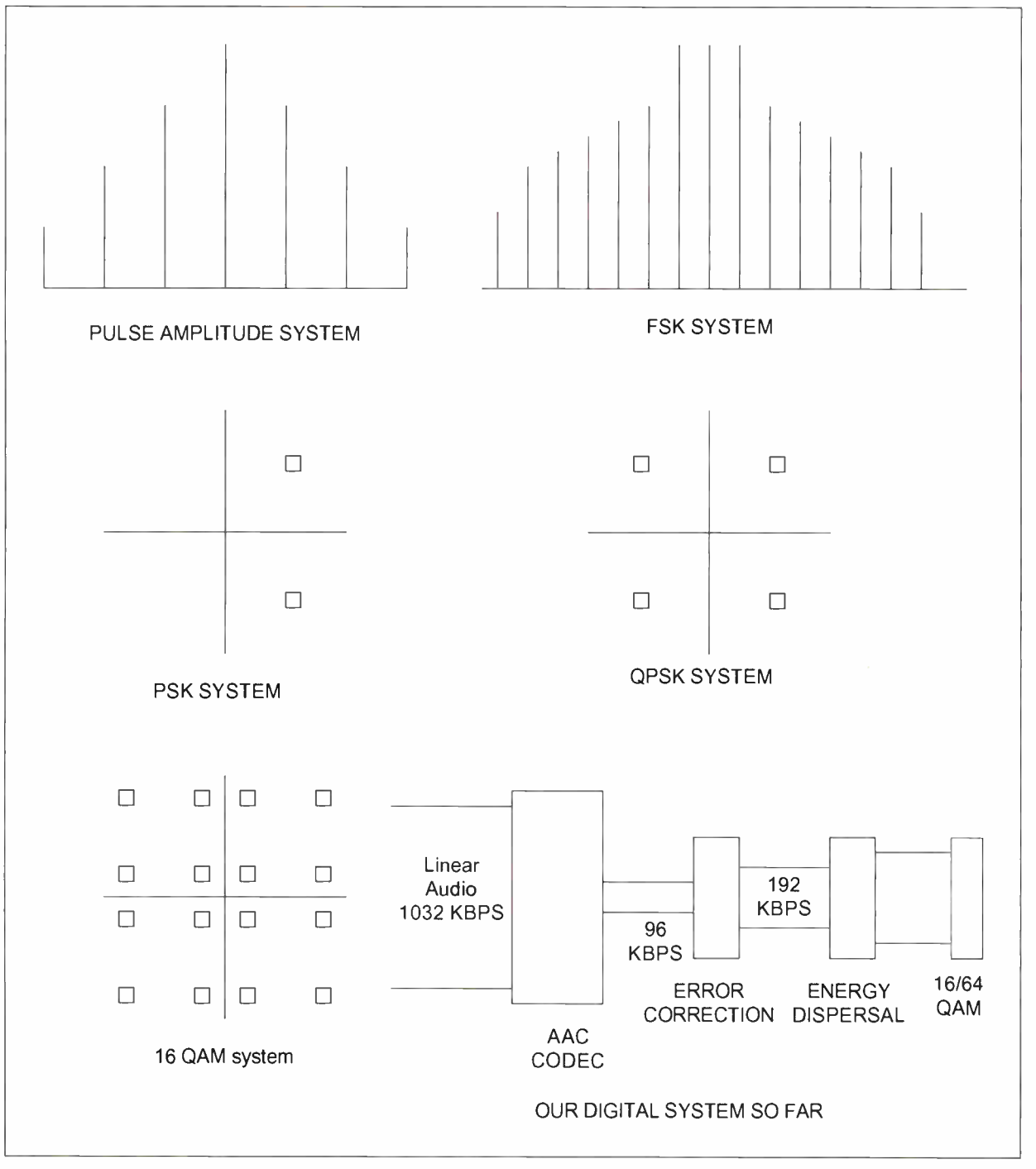
If these techniques have existed for so long, why is radio broadcasting 65 years behind? A SIGSALY terminal weighed 55 tons and required a highly trained staff to make it function. The technologies we now use in broadcasting are possible because of small affordable DSP chips.

DIGITAL BROADCAST 101

Digital broadcasting is really about two things, bandwidth and protecting the digital information from interference.

Bandwidth is the first concern. If we go back to basics and use the old on/off model of CW transmission, we will need at least double bandwidth, that is, at least double the data rate. If we sample at 15-kilohertz stereo signal at 32 kilobits per second, we have a data rate of 1,024 kilobits per second.

If that signal modulates a pulse amplitude system, we have a signal that is at least 2.048 megahertz wide. Actually the bandwidth is greater because of the Fourier series generated by the digital pulses. This system would have problems with noise and interference as well. We could apply the FSK model and solve the noise and interference but the bandwidth would increases. Just as analog FM needs a wider channel than does AM.



CODEC SOLUTIONS

Everyone is familiar with the ISDN codecs used for remote broadcasts. We know that by removing masked or redundant information, we can transmit acceptable audio at 24 to 96 kilobits per second. If we use 96 kbps as an acceptable FM replacement, we end up with a channel over 192 kilohertz wide. However, for any of these schemes to really work you need additional bits for error correction and other housekeeping things; this all increases bandwidth. We need a way to reduce bandwidth in the modulation scheme.

Before we look at some more efficient modulation methods, we should visit a cousin of FSK – PSK, or phase shift keying. The principle is simple: the carrier is shifted 180 degrees between a one and a zero. This solves some of the noise issues of AM, but does not solve bandwidth issues.

We can expand the PSK system by adding a second signal in quadrature. Now we have a second signal that has four possible states.

LESS IS MORE

QPSK can permit the coding of two bits at the same time. The data rate and consequently the necessary bandwidth is half as much. This principle can be expanded by adding more states. The next commonly used scheme is 16 QAM. To achieve 16 states, both the amplitude and phase of the signal is involved. With 16 states, 4 bits are coded at the same time. This rate is usually called the symbol rate.

With 16 QAM we now have a symbol rate of 0.24 K for the 96 kbps coded signal. The theoretical bandwidth is now 48 kilohertz. In practice, up to 64 QAM can be used for terrestrial broadcast and 256 QAM is used on cable TV systems. Noise and interference limits how far one can go with the modulation schemes in practice.

These systems with AM components must be amplified by some form of linear amplification. This has great day-to-day impact on broadcast operations and will be discussed in future installments.

REAL WORLD APPLICATION

All of the systems described so far are basic building blocks, and would not work in such a simple form in the real world. For example, as mentioned earlier, extra bits must be added for forward error correction. Error correction moves us backwards on the bandwidth scale and increases bandwidth by 25 to 100 percent.

Another problem is that the modulation schemes described so far must have constant state changes for practical operation. Common to landline digital approaches, a series of ones will cause a DC term and the actual bandwidth will vary. More bits are needed to effectively scramble the data and make it a constant stream of ones and zeros.

As you can see, we are moving backwards in reducing bandwidth. Another problem: while QAM systems are used directly on satellite links, they are not practical as described so far on terrestrial circuits, because the channel must be low in noise and relatively phase stable.

Other techniques are necessary. We will cover this next time as we add more blocks to our system and end up with a real digital radio system.

For over three decades, Robert Meuser has focused on the latest technologies for broadcasting. He welcomes your comments at robertm@broadcast.net

Leading POTS Codecs Compared.

	Comrex Matrix	Tieline Commander	**Zephyr Xport**
Audio Bandwidth @ 24 kbps	14 kHz	15 kHz	**15 kHz**
@ 19 kbps	11.2 kHz	9 kHz	**15 kHz**
Direct Internet Software Updates	No	No	**Yes, via Ethernet port**
Digital PC Audio Input	No	No	**Yes, via Ethernet port and supplied driver**
Audio Metering (XMIT/RCV)	Transmit only	One-at-a-time	**Simultaneous**
Audio Processing	None	Simple AGC	**Digital multi-band AGC with look-ahead limiter by Omnia**
Remote Control	No	RS-232 and dedicated computer	**Ethernet via Web browser**
Auto Dial Storage	19 Numbers	50 Numbers	**100 Numbers**
Frequently-Used Settings Storage	none	none	**30**
Standards-based POTS Codec	No - Proprietary	No - Proprietary	**Yes - aacPlus (MPEG HEAAC)**
Transmit-Receive Quality Display	No	Yes	**Yes**
Contact Closures	2	2	**3**
Display Resolution	120x32 LCD	120x32 LCD	**128x64 LCD**
Analog Cell Phone Interface	Optional	Standard	**Standard**
Mixer Inputs	1 mic, 1 mic / line	2 mic / line	**1 mic, 1 line**
Phantom Power	No	No	**Yes - 12 volt**
Automatic Voice-Grade Backup	No	No	**Yes**
Power Supply	External	External	**Internal auto-switching**
Local Mix Audio Outputs			
Headphone	Yes	Yes	**Yes**
Line Level	Yes	No	**Yes**
Direct Receive Audio Output	No	Yes	**Yes**
Uses ISDN at the Studio Side for More Reliable Connections	No	No	**Yes - your Zephyr Xstream becomes universal POTS and ISDN codec.**
Available ISDN Option	$850.00 (adds MPEG L3 & G.722)	$850.00 (adds G.722)	**$495.00 (adds G.722 & state-of-the-art AAC-LD for high fidelity and low delay)**
List Price:*	$3,700.00	$3,650.00	**$2,495.00**

The world's most advanced POTS codec
is also the world's lowest priced POTS codec.

Telos
AUDIO | NETWORKS

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Technology Guide

by Barry Mishkind

The Consumer Electronics Show – 2005

[LAS VEGAS, Nevada] Something on the order of 150,000 people jammed the Las Vegas Convention Center (LVCC) during the first week of January to view the yearly array of astounding electronic products on display.

From the radio broadcaster's point of view, the main attractions were the promised innovations in digital radio. There was a predicable "blizzard" of press releases from Ibiquity, Sirius and XM, as well as a few surprises.

WHERE ARE ALL THE BROADCAST FOLK?

Perhaps due to habit from attending the Spring NAB over the years, my feet just naturally took me to the North Hall. The overwhelming "thud, thud, thud" instantly made me aware it was not NAB, but the "Car Audio Hall." It was jam packed with high-end car systems, including amplifier and speaker forests, plus cars "tricked out" in every possible way – scores of exhibits trying to "out thump" each other.

CES is a Consumer Electronics Playground!

One of the interesting "enhancements" to these car-assaulting sounds systems was the addition of various displays, including everything from DVD players to GPS mapping to entire computer systems – computer, printer, fax, and wireless Internet connections. Some cars included four or five displays; imagine driving down the road with the entire family "multi-tasking" at their own touch displays and keyboards!

Car enthusiasts never had to leave the North Hall, there was plenty to see and hear. But, there was much more than just car radios displayed in the hall. Ironically, or perhaps as a coincidence, the key digital broadcasting systems also were on display in the North Hall.

DIGITAL RADIOS

Sirius and XM had rather large booths, and Ibiquity was there, too. The satellite services were showing a number of radios, both for cars and new models for portable use, including the new xm2go from Delphi, a portable radio the size of a cell phone.

Not to allow the satellite companies too much lead, Ibiquity held a press conference just as the show began to announce "an industry historic agreement to accelerate broadcast conversion" of 2000 stations to the Ibiquity "standard." The information was that "21 leading radio groups" now were committed to bringing the total number of IBOC stations to at least 2500.

A map was displayed in the booth, showing the potential coverage achieved, if that many stations begin to operate in digital mode.

Ibiquity folks were very pleased to learn they received the "Next Big Thing" Award from CNET in the Car Technology category.

Ibiquity booth with estimated coverage map.

Meanwhile Clear Channel announced having put their 65th IBOC station on the air. They are also on in 48 of the top 50 markets with a new RDS/TMC service, in connection with Audiovox, to provide traffic and other information by subscription.

LOOKING FOR RECEIVERS

Although the new receivers on display in Las Vegas were mostly oriented to the satellite services, Ibiquity claims more IBOC receivers are in the pipeline. Other companies have announced plans for services, including downloading music on demand, which might attract interest from listeners. Perhaps the payoff is that there will be a lot of new radios shown in the spring, and possibly even price reductions.

True, there were receivers for IBOC shown. But, the number is still too low, and even in the Ibiquity booth, it looked like they planned for more receivers than were available to fill the holes. On the other hand, there was an announcement that NPR is planning to make a bulk purchase of as many as 50,000, making them available for sale through local affiliates.

Watching the CPB grants and the NPR "Tomorrow Radio" plans, which include multiple program streams on the same carriers, it is at least impressive – no matter what your opinion of IBOC is – to see the push by the non-comm sector. If IBOC succeeds, commercial operators will owe a big "thank you" to the public radio stations.

One other receiver-oriented note: I am sure you have seen "retro radios" that look like the old units from the 30s and 40s. There were models of all sorts all over the place, including one company that seemed like they were just "dropped into the Hall" from 1955. There was even a press release from Crosley, noting their re-release of some older model styles.

Another indication that "standards" are starting to settle down was the display of a prototype IBOC monitor. Although, the DaySequerra unit still awaits final specifications from Phillips, they are actively discussing features with radio engineers involved with IBOC stations.

DaySequerra prototype monitor.

It ought to be interesting to see what will be on display at the NAB Show in April, as we go into a relatively new area of technology for most engineers.

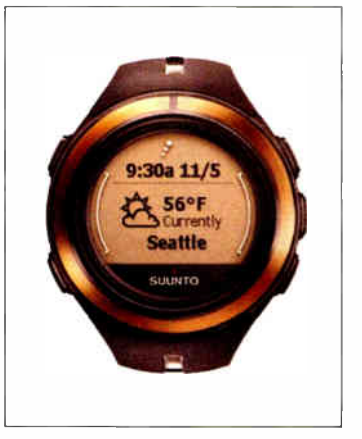
Looking around for other things of interest to broadcasters, I noted several weather products, including a lot of wireless outside monitors that will feed temp/humidity, etc, into the studio without wiring. There were also some new SAME receivers at modest prices, including the First Alert brand from Sima (www.simacorp.com), that can receive the NWS warnings, AM/FM – and one model even has a programmable LP-1 setting!

And speaking of wiring, what do you think of speaker wires, microphone cable, even a new version of Belden Cat-5, in a *flat*, peel and stick configuration? Not a bad idea for some applications.

5.1 AND THE CORRECT TIME

I made a quick stopover to chat with the folks at Neural Audio. They continue to show a working system to provide 5.1 audio – with the ability to edit in two-channel mode. What can I say? 5.1 sounds wonderful; it is a real ear pleaser.

Another area of direct interest to broadcasters, especially FM, was the major push Microsoft had for its MSN Direct digital "Smart Watch" series, fed via SCA around the country. The watches, of varying pricing levels, are capable of receiving news, weather information, sports, stock market information, and more.



Over the past year, these systems have been installed in over 100 cities around the country. Watches retail for $100-700 and there appear to be a couple of subscription programs available for various services. It will be interesting to see if Microsoft will be able to make this one work. (At least you can get a quote on your company's stock, and the start time of your favorite movie.)

COMPUTERS AND PARTS

Since computers are such major components in radio studios, finding sufficient room for all the keyboards and monitors has stressed many an engineer. Dealing with the noise is another issue.

Zalman USA and Hush Technologies were among the companies showing super quiet computers – even high-end units – that operate without fans. Using "heat pipes" and other ways to redirect the heat load, these units are not noticeable in a Control Room. Hush Technologies systems already are in use in broadcast environments in the Far East, so we may well see the technology adopted here. (www.hushtechnologies.net)

Developed initially for high end home sounds systems, pricing for such "silent computers" is still not "cheap," but as quantities increase, they may well become a viable option for US broadcasters.

In addition to the many mobile systems for cars, etc, smaller computers were on display, as chips

(Continued on Page 22)

The routing switcher gets a new twist.

(About five twists per inch, actually.)

Everybody needs to share audio. Sometimes just a few signals — sometimes a few hundred. Across the hall, between floors, now and then across campus. Routing switchers are a convenient way to manage and share your audio, but will your GM really let you buy a router that costs more than his dream car? Unlikely.

If you need a routing switcher but aren't made of money, consider Axia, the Ethernet-based audio network. Yes, Ethernet. Axia is a *true network*. Place our audio adapter nodes next to your sources and destinations, then connect using standard Ethernet switches and Cat-6. Imagine the simplicity and power of Ethernet connecting any studio device to any other, any room to any other, any building to any other... you get the idea.

Routers are OK... but a network is so much more modern. With Axia, your ins and outs are next to the audio, where they belong. No frame, no cards, no sweat.

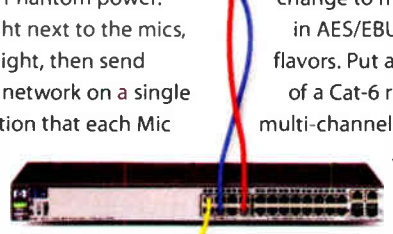
Scalable, flexible, reliable... pick any three.
An expensive proprietary router isn't practical for smaller facilities. In fact, it doesn't scale all that well for larger ones. Here's where an expandable network really shines. Connect eight Axia 8x8 Audio Nodes using Cat-6 cable and an Ethernet switch, and you've got a 64x64 routing switcher. And you can easily add more I/O whenever and wherever you need it. Build a 128x128 system... or 1024x1024... use a Gigabit fiber backbone and the sky's the limit.

Are you still using PC sound cards?
Even the best sound cards are compromised by PC noise, inconvenient output connectors, poor headroom, and other gremlins. Instead, load the Axia IP-Audio Driver for Windows® on your workstations and connect *directly* to the Axia audio network using their Ethernet ports. Not only will your PC productions sound fantastic, you'll eliminate sound cards and the hardware they usually feed (like router or console input modules). Just think of all the cash you'll save.

There's a better way to get audio out of your PC. No more consumer grade ¼" connectors — with Axia your digital audio stays clean and pristine.

Put an Axia Microphone Node next to your mics and send preamplified audio anywhere you need it, over Ethernet — with no line loss or signal degradation.

Put your preamps where your mics are.
Most mainframe routers have no mic inputs, so you need to buy preamps. With Axia you get ultra-low-noise preamps with Phantom power. Put a node in each studio, right next to the mics, to keep mic cables nice and tight, then send multiple mic channels to the network on a single Cat-6 cable. And did we mention that each Mic Node has eight stereo line outputs for headphones? Nice bonus.



Put your snake on a diet.
Nobody loves cable snakes. Besides soldering a jillion connectors, just try finding the pair you want when there's a change to make. Axia Audio Nodes come in AES/EBU and balanced stereo analog flavors. Put a batch of Nodes on each end of a Cat-6 run, and BAM! a bi-directional multi-channel snake. Use media converters and a fiber link for extra-long runs between studios — or between buildings.

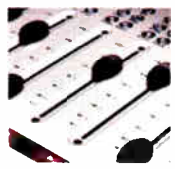
An Axia digital audio snake can carry hundreds of channels of digital audio on one skinny CAT-6 cable. We know you're not going to miss soldering all that multi-pair...

With a little help from our friends.
A networked audio system doesn't just replace a traditional router — it *improves* upon it. Already, companies in our industry are realizing the advantages of tightly integrated systems, and are making new products that reap those benefits. Working with our partners, Axia Audio is bringing new thinking and ideas to audio distribution, machine control, Program Associated Data (PAD), and even wiring convenience.

ENCO SYSTEMS INC
Scott Studios
radio systems
BALSYS

Axia is already working with some great companies. Like Enco Systems, Scott Studios, Radio Systems, Balsys Technology Group, and of course Telos and Omnia. Check AxiaAudio.com/partners/ to find out who's next.

Would you like some control with that?
There are plenty of ways to control your Axia network. For instance, you'll find built-in webservers on all Axia equipment for easy configuration via browser. PathfinderPC® software for Windows gives you central control of every audio path in your plant. Router Selector nodes allow quick local source selection, and intelligent studio control surfaces let talent easily access and mix any source in your networked facility.



Control freaks of the world, rejoice: intelligent Axia mixing surfaces give talent complete control of their working environment. Reconfigure studios instantly and assign often-used sources just where they're most useful.

"This sounds expensive." Just the opposite, really. Axia saves money by eliminating distribution amps, line selectors, sound cards, patch bays, multi-pair cables, and tons of discrete wiring — not to mention the installation and maintenance time you'll recover. And those are just side benefits: our hardware is about half the cost of those big mainframe routers. That's right... *half*. Once you experience the benefits of networked audio, you will never want to go back. AxiaAudio.com for details.

AXIA
A TELOS COMPANY

Technology Guide

by Barry Mishkind

Continued From Page 20

incorporate more in less space. The new BTX motherboards will fit in a much smaller case. Linspire was displaying their new packaged Linux OS, and its implementation in a new laptop, to be sold for $499, complete. A quick check – the keyboard felt much better than I expected.

A pretty impressive display of video and audio cards, as well as CD and DVD burners, was mounted by Mad Dog Multimedia (www.mdmm.com). They also have a range of replacement power supplies and other peripherals to maintain the computers in your shop.

SORE FEET AND PLEASANT SURPRISES

The show was spread over the entire LVCC complex, and spilled out into the Hilton exhibition areas. One entire floor was devoted to the Far East manufacturers. Literally *hundreds* of versions of MP3 players, portable audio and video gear, batteries, cables, and every application from business to security were around every corner. Although this was my first CES, it was clear that this was the place to make contacts to import products of all sorts.

Perhaps the easiest way to explain it is that my feet *hurt*! Even with the shuttle buses and the monorail, I must have put more miles on my soles than two or three NABs put together! The highly promoted monorail was in operation during the show, with only minor glitches. The cost is $5 per ride, or $10 per day. It runs down from the Sahara through the Hilton and LVCC to the hotels on the west side of the Strip.

Since there was no COMDEX (the yearly computer show) last fall, some of the high tech wizardly items found their way to CES. Many Internet applications were among those displayed.

VoIP was an example of an item shown by many manufacturers. VoIP Voice (www.pdtuk.com), for example, showed a phone that could operate over either the public phone network or the Internet, seamlessly.

As with many such phones, you can plug-in anywhere in the world. VoIP Voice says they can even provide service on dialup facilities. And the price is under $100; this may be of special use to contractors, or others who might be able to use the "network" at client stations, or from the transmitter, piggybacked on the new digital STLs.

SMALL PACKAGES

I was impressed with several smaller items, including a USB "key" that will remember all your passwords, and fill in all the browser windows, etc, with your log-on info. When you remove Pass2Go, all the info is "gone" as it was never put on the local computer. If you have to use lots of different computers, and/or visit different locations, this is a great buy at $30.

Several companies took advantage of the increase in spyware and other "stuff" that the bad guys try to put on your computer to develop cleaning programs for your hard drive.

For the computer user on the go, Hawking Technologies displayed some Wi-Fi antennas to increase your opportunities to "connect." Meanwhile, another company showed an "easy to setup" password control system for Wi-Fi, to keep your system secure.

You can now buy digital cameras of every possible size and style at prices that would have been impossible a few years ago. Even digital movie cameras with MP3 players could be found for under $300.

MUCH LARGER PACKAGES

However, the most potent "attractions" at this CES were the large screen High Definition Monitors and TVs. If it seemed like there *was* a competition for the largest screens, that is because there was a competition. The largest LCD Screen shown was 65 inches, but LG had a 71 inch plasma screen, for only $75,000.

Finally, if you just cannot get a large enough grasshopper in your living room, how about a seven-foot version? Samsung's 102 inch projection TV took the honors (this week) for the biggest screen at the show. Yes, during the NFL playoffs, there were large crowds watching what was a head-spinning display. – *Radio Guide* –

MORE PRODUCTS... MORE APPLICATIONS

TT-1

The tiny TOOLS™ TT-1 is more than just an ordinary telephone line coupler. The TT-1 is a rack-able compact telephone line powered auto-answer and auto-disconnect hybrid. The TT-1 utilizes dual-hybrid transformers providing full duplex audio at a plain old coupler price. We provide a rear panel multi-turn hybrid NULL trimmer to allow the user to achieve 20 plus db separation figures. TT-1 features include: Front panel Line Seize button; call Drop button; Auto-Answer/TAP switch; Audio Mute switch; Off-Hook and Ring indicators. The rear panel is equipped with a RJ-11 jack for the telephone line and a second loop-thru RJ-11 that may be configured to disconnect attached devices when the TT-1 goes off-hook. Screw terminals are provided for balanced send and caller audio; remote optically isolated seize and drop functions and one SPDT off-hook dry relay contacts. The TT-1 may be set on a desktop, mounted on a wall or up to four units mounted on the RA-1, Rack-Able mounting shelf.

The TT-1 Telco Tool

The DTD-16 DTMF Tone Decoder

The tiny TOOLS™ DTD-16 is a full-featured DTMF tone/sequence decoder that is user programmable to decode up to six tone sequences or a single tone and assign it to any one of four relays, twelve open collectors and/or the RS-232 serial port. The relays/open collectors may be programmed to close for the duration of tone, pulse immediately after completion of detection, latch/unlatch or exclusive operation.

The DTE-16 DTMF Tone Encoder

The tiny TOOLS™ DTE-16 is a feature rich DTMF tone/sequence encoder that is user programmable to encode up to 15 tone sequences or a single tone via any one of 16 contact closure inputs and/or the RS-232 serial port. Each input may be programmed to generate a tone for the duration of the closure or tone burst immediately on command. A passive mixing network is provided to mix both the program and encoder audio if required.

The VAD-2

The tiny TOOLS™ VAD-2 is a user programmable two-input multi-number voice/pager auto dialer with integrated stereo silence sensor, designed for dial out paging and/or voice message notification. Two SPST relays are included for remote control functions.

More products added monthly. Be sure to check our web site frequently.

The DC-8

The DC-8 Plus Dial-up Remote Control allows the user to control and monitor external devices from any touch-tone, telephone. The DC-8 Plus when called, will answer the phone line after a user programmable number of rings (up to 20), accept an access code (none to eight digits) and if valid, allow the control of six SPDT, two 2PDT relays and the monitoring of eight logic level status inputs. The DC-8 Plus is equipped with an adjustable audio hybrid, allowing the user to send and/or receive external audio, while controlling the unit

The STI-II

The STI II provides a hybrid interface between a single POTS line and a users PC COM port. The STI II is equipped with a programmable serial port, allowing control and monitoring via the users PC application software. This product makes those remote call-in recordings a snap while eliminating the DTMF tones. Various LED's, relays, pushbuttons, dipswitches and serial port comprises the user interface to the STI II.

The TS-6 Telephone 6 Six-Line Telephone Call Director

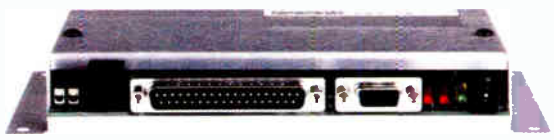
The TeleSwitch Six call director offers a low cost solution to interfacing up to six telephones lines to almost any hybrid. The TeleSwitch Six is supplied with one Switch Console and Controller. The units are interconnected via CAT 5 cable. A total of four Switch Consoles may be attached to the controller. The TeleSwitch Six is a dual-buss device, meaning that calls can be answered on the telephone set, while calls are active on the hybrid. With TeleSwitch Six, lines can be answered, placed on hold (MOH audio input), busied out and routed to a telephone set and/or hybrid.

The STA III Smart Telephone Autocoupler III

The STA III provides the interface between telephone line and user equipment. The STA III provides a self-null hybrid with balanced input and outputs. The STA III monitors the telephone line for CPC calling party control and long dial tone hang up signals, allowing use behind PBX telephone switches and POTS lines

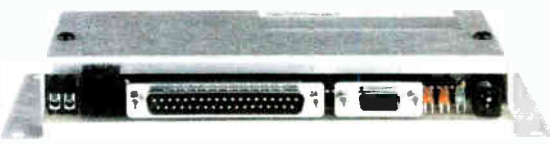
The AVR-8 Voice Remote Control

The AVR-8 is a voice remote control system that automatically reports changes detected on any of its eight status inputs to a remote telephone and/or pager. After speaking a greeting message that may identify the source of the call, the AVR-8 then speaks a unique message for each status input. The user may customize each factory-recorded message. Additional features include; four SPDT control relays, balanced telco audio, access codes, eight phone numbers per input.



The DEC-16

The DEC-16 may be used as a dial-up; dial-out or direct connect DTMF decoder. The DEC-16 is capable of automatically calling out, answering calls or connecting to an ENC-16, DTMF encoder or other DTMF encoder



The ENC-16

The ENC-16 may be used as a DTMF encoder, dial-up, dial-out or direct connect interface. It is capable of automatically calling and connecting to a DEC-16 either on a dial-up telephone line or a direct wire connection. There are 16 input lines. Each input can be used to generate DTMF tone strings from 1 to 16 digits long. The ENC-16 can operate as a master or slave device. Set as a master it will it will automatically establish a connection to its slave encoder. If the connection is lost, it will re-establish contact automatically. Contact closures and/or its RS-232 serial port may control the ENC-16.

BROADCAST tools

Ph: 360.854.9559 • Fax: 360.854 9479
support@broadcasttools.com
www broadcasttools com

Manufactured with Pride in the USA

Products

Audio Design Associates (ADA)

Tune Suite – AM, FM ,WX, HD, XM Tuner

www.ada-usa.com • 914-946-9595

Tune Suite is a group of components designed to receive broadcast radio transmissions in custom installed home entertainment systems. The Quadratune chassis can house up to four tuner modules, capable of simultaneous play, so that different people in the same home can listen to different broadcasts at the same time. Modules include XM Satellite Radio, AM/FM/WX (Weatherband) or the new HD Radio module.

Users can custom order the Tune Suite beginning with just two radio tuner modules or more. Many Tune Suites can also be combined in a single system for more demanding residential or commercial environments (i.e. tanning salons with independent radio in each tanning room; medical, dental, or law offices; bars and night clubs; hotels).

Tune Suite accessories also include AM and XM antennas, antenna line amplifiers (used to remotely locate antennas from equipment racks), and antenna splitters (used to direct signals to multiple tuner modules). Tune Suite can be controlled by ADA's family of music controls, ADA's PC Tune Suite program, as well as touch-screen and IP based control systems.

Audio Technologies (ATI)

SLM-100 – SPL Meter

www.atiaudio.com • 856-719-9900

One of the most important tools you can place in your audio toolbox is a sound pressure level (SPL) meter. ATI's new **SLM-100** is a battery-powered handheld device with a built-in microphone and a large, easy-to-read analog VU meter.

It has a wide dynamic range (50-126 dB) and A and C weightings, along with fast and slow meter ballistics. An RCA output jack permits connection to test and measurement equipment. A threaded insert provides for tripod mounting. It even has a calibration adjustment to maintain its +2dB accuracy after that accidental drop on the last job.

The SLM-100 is a precise, versatile instrument – perfect for your next set-up. Price: $79

Contact: Audio Technologies Inc. at 856-719-9900 or see them on the web at www.atiaudio.com.

Audemat-Aztec

NAVIBOC and Goldeneagle HD – HD Test Sets

www.audemat-aztec.com • 305-249-3110

Audemat-Aztec is currently developing two HD radio products and plans these two products to be available in the 2nd quarter of 2005.

The first product is called **NAVIBOC**. It is a mobile metering unit dedicated to coverage analysis of HD and FM signals. It includes a GPS receiver for automatic mapping overlay.

The second product is called **GOLDENEAGLE** HD. It is a monitoring unit dedicated to the permanent monitoring of the quality and continuity of HD and FM signals as well as PAD and RBDS data. An embedded spectrum analyzer is available as an option to monitor power of the sidebands and other parameters. GOLDENEAGLE HD has an embedded web server and SMTP server for alarms notification as well as a touchpad screen on the front panel.

Installed at the transmitting site, it can also be used as a remote control unit by adding up to 16 digital inputs, 16 metering channels and 16 relays outputs.

GOLDENEAGLE HD will be available in an AM version end of 2005.

Audioarts Engineering

D-75 – Digital Radio Console

www.wheatstone.com • 252-638-7000

The new Audioarts **D-75** is a modular digital radio on-air console with a traditional control layout. A tabletop design, the D-75 has four stereo output busses, dual phone caller capability, and independent monitor feed selection for both control room and studio. All modules are plug-in and the hinged meterbridge swings open to provide unrestricted access to I/O connectors and programming dipswitches.

All input channels have A/B source select and universal opto-isolated mic and line control ports, allowing you to interface microphones, mic processors and source machines in any combination you wish. A clock, timer and built-in cue speaker are standard, along with two VU meter pairs. The D-75 is available in both 12 and 18 input mainframe sizes.

Audio Science

ASI6416 – PCI Sound Card

www.audioscience.com • 302-324-5333

The **ASI6416** is a broadcast-specific PCI sound card that provides CobraNet audio networking. Using a Texas Instruments 32bit floating point DSP, together with Cirrus Logic's new CS18102 CobraNet interface allows the card to simultaneously record and play up to 8 stereo or 16 mono streams of 24 bit audio over a 100 Mbps Ethernet network. All the features of AudioScience's other ASI6000 series adapters will be available such as MPEG Layer 2 and 3 compression, MRX multi-rate mixing, TSX time scaling and flexible mixing.

Drivers are provided for Windows 2000, XP and Linux. AudioScience supplies software that allows CobraNet routing connections to be made between the ASI6416 and any other compliant CobraNet device on the network. Alternatively 3rd party management software may be used such as CobraNet Manager from D&R Electronica B.V. (www.cobranetmanager.com)

The ASI6416 will be available in March 2005. For pricing and further information, contact Richard Gross at 302-324-5333.

Danagger Audio Works

Plan B Deluxe – Silence Sensor

www.danagger.com • 888-892-8346

The **Plan B Deluxe** is the newest and most versatile member of the Plan B family of dead air prevention systems. The self contained unit features a digital silence sensor; replacement audio from hard drive, Compact Flash or CD-R; Internet and phone line accessibility; WAV, MP2 and MP3 playback; simple remote control; a global listen line; and switching options for a secondary live program source (AES or analog).

When the Plan B Deluxe senses silence or constant amplitude noise for a user defined period, it injects replacement audio appropriate to the current daypart. Rotation rules can be easily set up to select playback cuts from user directories, just like an automation system. Files can be directly uploaded to the Plan B Deluxe from most automation systems via the web or an in-house network. The unit can also be programmed to automatically put itself on the air at a specific time of day.

Outages are reported by phone or email, and are recorded in a web-accessed log along with the cuts the unit played during the outage. The system is reported to be surprisingly easy to set up and use.

in Focus

Find the Latest Product Updates Here

Dielectric

HDR Plus – Digital FM Antenna

www.dielectric.com • 800-341-9678

The **HDR Plus** antenna allows " lossless" combination of the existing analog and new HD digital sideband signals without the need for additional tower space.

The array is made up of two completely separate interleaved antennas, which both meet the FCC specified coverage requirements. The HDR Plus antenna utilizes a reverse polarization interleaving technique to provide, in excess of, 42 dB isolation.

This isolation is more than sufficient for satisfactory operation without the need for any additional components. It has been discerned that by offsetting the two arrays with respect to the tower, the azimuth coverage from each antenna is, in effect, the same. The digital portion may also be utilized as an auxiliary for the analog in an emergency situation.

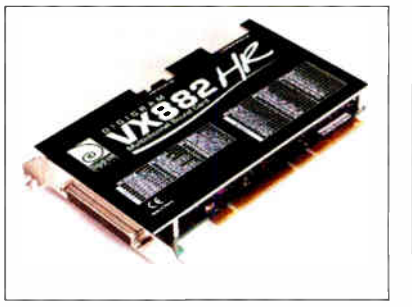
The HDR Plus advantages are threefold: It does not require any additional aperture on the tower. Because there are no losses incurred due to this method of analog and digital signal combination a very low power digital transmitter may be implemented. The low Digital power requirement means that a type N cable is sufficient to carry the signal from the transmitter to the antenna.

Digigram

VX882HR/VX881HR – PCI Sound Cards

www.digigram.com • 703-875-9100

The VX882HR professional multichannel sound card, and its sister model VX881HR, are the first boards with eight inputs and eight outputs of Digigram's standard setting VX range: analog and digital I/Os for the VX882HR, and digital I/Os only for the VX881HR.



Designed for demanding applications in broadcast such as production, on-air, and logging, they boast the key features of the recently unveiled High Resolution series: 24-bit/192 kHz converters, and hardware sample rate converters for simultaneous recording of digital signals with different sample frequencies.

Additional features include a comprehensive set of drivers including Digigram np, WDM DirectSound, Wave, and ASIO drivers, a 66 MHz/64-bit PCI interface, a companion board connector for Digigram or custom add-on cards, and all this in the compact short-length PCI format (only 6.875 inches long). An optional breakout-box is available to master the multiple I/Os.

Digital Jukebox

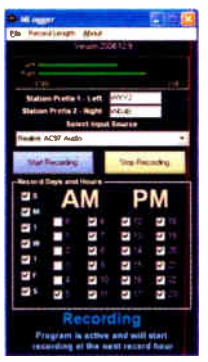
Digital Audio Logger and MLogger

www.digitaljukebox.com • 740-282-7638

Digital Audio Logger

The **Digital Audio Logger** is designed for logging just one station in stereo or two stations in mono. The **MLogger** can record up to 10 radio stations on one PC in Mono.

The Digital Audio Logger allows you to setup the hours and days of the week for low quality logging. You can also tell the software to record certain hours on certain days of the week in high quality.



MLogger

The Digital Audio Logger will work with any windows standard issue audio card and saves the files as MP3 files and can be listened to on any windows MP3 player.

The MLogger program can record up to 10 radio stations on a single PC. You can run up to 5 instances of the MLogger on your computer, and you need up to 5 audio cards like SoundBlaster live cards or a single multi channel record card like those from M-Audio.

The MLogger allows you to record segments of 15, 30 or 60 minutes in length. After the files are recorded, the software will actually split the left and right channels into separate audio files.

LEA International

PowerVantage™ – Surge Suppressor

www.leaintl.com • 800-881-8506

The LEA International PowerVantage™ unit features low clamp modules (LCMs) that use a patented MOV design, delivering both low clamp and over-voltage capabilities. Enhanced diagnostics are provided and the system has been designed to be easy to service, featuring field-upgradeable LCMs.

Housed in a 24 x 16 x 8.8 inch enclosure, the PowerVantage uses color-coded, field-replaceable modules, allowing surge capacity to be upgraded from 200 kA to 600 kA. The LCMs are color-coded, compact modules with two simple attaching screws and are therefore simple to bolt-on for quick service.

A standard, user-friendly digital readout on the PowerVantage system features a touch pad interface which provides enhanced diagnostics including a surge counter and audible alarm.

Three models are available, the PV200, PV400 and PV600 – with surge capacities of 200 kA, 400 kA and 600 kA per phase, respectively. The system is also available in a number of voltage configurations.

LEA's commitment to quality and safety is backed by a 10-year unconditional warranty on purchases of the PowerVantage product.

PowerVantage surge suppressors are affordably priced from $2,600.

Henry Engineering

MultiPhones – Headphone Controler

www.henryeng.com • 626-355-3656

Henry Engineering is pleased to introduce "MultiPhones," a new product that provides multi-user headphone listening facilities for broadcast stations, recording studios, A/V installations, and other audio applications.

The MultiPhones system consists of a Master unit and up to 12 Guest Pods: compact "listening stations" that can be conveniently located near the user. Each Guest Pod has its own headphone amplifier, volume control, and headphone jacks. The Guest Pods are connected to the Master unit with common CAT5 cable.

The MultiPhones System provides multiple users with reliable, audiophile quality listening facilities, where each listener has his own volume control and can use any type of headphone without affecting other users in the system.

The MultiPhones System is now available from all Henry Engineering dealers.

List Prices: Master unit: $295; Guest Pod: $75.

Telos Systems

Profiler – Audio Logger

www.telos-systems.com • 216-241-7225

Telos ProFiler is the efficient, set and forget way to automatically log your radio station's program audio. Forget tape decks and expensive logging hardware – ProFiler runs on a standard Windows 2000 or XP PC to produce time-stamped audio archives you can listen to on standard MP3 players.

ProFiler is ideal for stations required by law to log program content, and since you can also listen to live audio over IP as it's being logged, it's an excellent choice for program consultants or group PDs. Production Directors and Morning Show Directors will appreciate the integrated audio browser that lets them tag segments and export them as Wav files for further editing.

ProFiler includes a Telos audio card with pro-level balanced audio inputs and buffered parallel closure inputs that you can use either as a start/stop trigger, or to let an active microphone trigger a high-quality capture mode. The starter kit lets you log a single stereo or two mono streams; add more audio cards to capture as many as eight mono streams simultaneously. ProFiler starter kit retails at $595.00 USD.

Radio War Stories

by John Hettish

A "Tap" on the Arm

Those guys who climb towers are not loafing up there. Conditions can be dangerous, and there is little margin for error. And then, there is the ice.

[SHELBYVILLE, Tennessee] Even though I am the owner of a two-way radio shop, I started my electronic life 33 years ago with a First Class license. I discovered the two-way radio business in the early seventies, but never lost my love for broadcast engineering work.

When Nextel grabbed a significant number of my customers in the mid-90s, I changed my emphasis to tower work. I describe myself as an RF Technician with 33 years of experience who just happens to climb. There are only a few of us, at least in Tennessee. My tower maintenance philosophy has been to treat service requests as I did two-way radio repeater outages – namely, as emergencies. This approach led to the following experiance.

THE CALL

Late one Sunday afternoon, I had just returned from a shopping trip with my wife. I had changed into my sweat pants and Homer Simpson slippers in anticipation of another Simpson's episode on Fox, and was about to settle in onto the couch when the phone rang. The panicked engineer on the other end needed help.

It was supposed to be a relaxing afternoon.

His main revenue producing station had gone off the air and he suspected it was an STL (Studio-Transmitter Link) receive antenna failure at the transmitting tower. The tower had collected considerable ice and he felt a piece must have hit the antenna. He asked if I could climb – that night – and re-aim an unused STL antenna. With an internal groan I thought about the hour drive that lay ahead and said, "Sure." Good-bye Homer; the jeans went back on and I got into my truck.

The trip was smooth, but naturally it was after dark when I arrived at the studio. As I got into my climbing attire, the two engineers prepared some equipment to cob together a "McGivered" STL using Marti equipment. At 7:00 PM we began our trek to the tower on roads that were still ice choked from a storm that had hit the area a few days previously.

REPRIEVE FROM A NIGHT CLIMB

As I followed the chief, my cell phone rang; the station had magically come back to life. There seemed to be no point in driving the twenty miles to the tower site that night, so I decided on a hotel.

After a great night's sleep, a complementary breakfast and a freebie toothbrush, the engineers and I once again began our drive to the transmitter, which had gone off the air again. Once we arrived, I prepared to climb to the first STL dish and see what I could do.

DODGING ICE BULLETS

The only potential hazards I noticed before starting the climb were the large chunks of ice being shed by the tower. However, as there was very little ice inside the tower (the bad stuff was on the exterior of the structure), I decided that climbing on the inside would present little danger.

The ice was falling, but at least it was "out there."

During the ascent, a couple of marble sized chunks "pinged" off my hard hat but the big pieces stayed outside of the tower structure. Every so often toaster sized pieces or bigger would make their way to the ground, but would always fall six to twenty feet away from the tower.

Finally I arrived at the first dish, which was not polarized to receive the signal. To get the station back on the air faster, I decided to rotate the feed assembly only, re-aim, and see if a usable signal was produced. Not only did they get signal; they had plenty of signal and the station was on the air, and stable.

GOING THE EXTRA HUNDRED FEET

Now it was time to take a look at the main STL dish, a six-foot diameter "Mark" at about the six hundred foot level. I really did not need to do this; the trip to the main STL could have waited for another day. Even the station's engineer suggested I postpone dealing with it. But I did not want to leave without knowing what needed to be done.

Besides it was only another one hundred feet or so to the problem antenna. What could go wrong?

Arriving at six hundred feet, I noticed the driven element on the dish's feed assemby was bent slightly. The plain aluminum elements are often bent, but I suspected a driven element, with its Teflon covering, would be the cause of the intermittent receive problem. Therefore, I decided to remove the feed assembly and take it to the ground.

Ice contined to fall, but with little affect. I began the task of cutting off the frozen weatherproofing from the connector.

In order to achieve a better work position I stuck my right arm outside and around the leg of the tower. This allowed me to achieve better leverage for the razor knife I was using. I worked this way for about twenty minutes, taking a couple of breaks during that time. I seemed to be getting nowhere cutting through the frozen mass but continued to work.

PAINFUL MOMENT

After about twenty-five minutes of cutting frozen mastic, a chunk of ice I never saw slammed into my exposed right arm about three inches above the elbow. That hurt!

I let the pain die down and decided, "well, that's not likely to happen again." I stuck my arm back out of the tower and set back to work. Two minutes later a second, heavier piece slammed into the same spot. Now I was really hurting and wondered if the bone was broken.

Falling ice can be worse than loose bolts.

As I tried to collect myself, something happened that I had always heard about but had never experienced: I actually became nauseated. I knew it was time to get back on the ground while I still could, but I just could not move for a short period of time.

CAUTIOUS DESCENT

I do not know exactly how long I lingered inside the tower but it could not have been too long. Finally I was able to start the long climb down with a very sore right arm.

The climb down was not as bad as it might have been. My right arm strength was normal, when pressing up or directly away from my body, but hanging from that arm was painful. My speed down the tower was almost normal, with a stop at the lower STL to add some weatherproofing to the connector. At the lower antenna I took the time to attempt to evaluate my injury.

Through my jacket and sweater I could feel a soft swollen place on my right biceps. Probing the swelling did not hurt and there did not seem to be any deformation of the bone. I surmised I had probably received a deep bruise.

MEDIC!

Back on the ground I was able to take jacket and shirt off, and take a good look at the injured area. The swollen spot was about the size of half a tennis ball. One of the engineers asked permission to take a picture of the arm.

Ouch!

During the two-hour drive back to my home, the swelling decreased by half. The next morning the swelling had decreased by another half. The swelling persisted for about a week and then went completely away. I never had any discoloration around the area and at three weeks from the injury the swelling is completely gone.

I was clearly lucky beyond my deserving; my injury could have been much worse. If the ice had struck three inches to the left, it would have nailed the elbow. If I had to get hit twice, it happened at the best place possible. Quite late, I realized that there was absolutely nothing but two hundred feet of unobstructed free space between the bottom bay of the main transmitting antenna and the upper STL antenna; the lower STL antenna had plenty of obstructions above it to break it up any falling ice.

NO LOVE TAP

A true engineer, or someone who paid attention in high school physics class could probably figure the amount of force that would be generated by a two-pound chunk of ice falling unhindered two hundred feet. The piece might have been heavier, but I will go with two pounds. However, I can say it felt like someone had hit my arm with a baseball bat – twice!

I considered taking it easy for a couple reasons, other than the injury. For one thing, I celebrate the completion of my sixtieth year at the end of January. However, time, a lack of employees and circumstance has kept me climbing tall towers continuously since the injury; a week later I was back, climbing 1,120 feet at night, tuning a wave-guide. The arm is still a bit sore but still works about as well as it ever did.

The author in his main office.

In the aftermath, the client decided the station needed ice shields for both STL antennas; three days later we had fabricated, delivered and installed those ice breakers.

It could be that the god of my understanding was trying to get my attention by giving me a gentle tap on the arm. The problem is that he "taps" very hard. It is now quite clear to me that when I did not get the message the first time, he tried a little harder. Another way to look at this experience could be to consider the words of the famous philosopher, Friedrich Nietzsche. Nietzsche is known for the line, "What doesn't kill us makes us stronger."

Of course Freddy only lived to be 56, and to my understanding, he never climbed towers.

Photos by Matt Aaron

John Hettish is the owner of Middle Tennessee Two-Way, in Shelbyville, TN. You can email John at jhettish@mt2w.com

Digital Ready. Value Conscious.

1kW AM Broadcast Transmitter

Nautel Jazz J1000

HD Radio Pure Digital. Clear Radio.

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Save Money

A value priced, high quality transmitter with traditional Nautel reliability.

High operating efficiency reduces power bills.

Compact design reduces shipping costs.

Save Time

Next business day shipment from factory.

6 preset RF power levels can be programmed to automatically meet your power allocations throughout the day, 12 months of the year.

Critical parameters can be conveniently set and queried using the graphic user interface.

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Maintenance Guide

by Gary A. Minker

Line Sweeping

Part 2 – Why it is Important

*Last spring (**Radio Guide**, May 2004), Gary Minker briefly explained the concept of line sweeping, and what it can reveal. This month, he returns with a discussion of why a line sweep should be a part of a station's regular maintenance schedule.*

[LAKE WORTH, Florida] If you are truly the curious type and on top of your game, you realize there are many basic questions associated with the great unknowns of the *quality* of your transmission system. Some of them should be gnawing away at your very core on a daily basis.

The reason is simple: No transmission system, no station; no station, no paychecks.

WHAT YOU SHOULD KNOW

When you break it down, the issues are really pretty simple. Most stations have no earthly idea just how good their system is electrically – certainly as far as the Return Loss is concerned – other than the generally poor excuse for a Wattmeter that comes with most transmission systems.

An important starting point is to realize that virtually every wattmeter on the planet has an accuracy of only 20 dB. This means that if you are stuffing 20,000 watts of power up that shiny copper pipe (or aluminum rectangle, for some TV folks), you will be given the gift of a reflected power slug that says "2,000 Watts" on it. In terms of accuracy, it could be likened to measuring seconds with only an hour hand on your watch.

For those of you who never learned to solder big pipes, you should realize that just one or two hundred watts of power, combined in the wrong place with the existing 20,000 watts going the opposite direction, can give you a hot spot that has nothing to do with your laptop logging on to the Internet.

The resulting damage can consume a lot of money, not to mention the potential for lost airtime.

BASE LINE DATA

Why should you perform Line Sweeping at least on an annual or semi-annual basis? The answer should be self-evident. Just like the photographer at the wedding, your last line sweeping certified that the system is healthy *at that point in time.*

You regularly should take a full set of meter readings on the transmitter, and a full set of readings on your wattmeters, noting these readings in the log. That way you have a "base line" record of the readings "when installed" (or last tested), and these readings equal such and such of a Return Loss (which is mathematically calculable to VSWR) and that the system is performing properly.

Any changes in your system performance that deviate from this complicated set of corroborative readings can – and usually do – spell trouble. Defining that trouble is the tricky part, as I found in Atlanta last year at a SBE meeting demonstration test. The host station's backup antenna, which was our demonstration antenna, had iced over and the station had no idea. The return loss was fantastic 1-1/2 channels away, but on-frequency, the transmitter had no prayer of operating without tripping off.

KNOWING WHEN THINGS CHANGE

Most changes in your reflected power are not good. In order to help you diagnose an impending problem more quickly and accurately, I wholeheartedly recommend you discard that 2,000-watt slug and order yourself a pair of 200-watt slugs.

Sure, the Wattmeter Company will pitch a fit and tell you that those slugs are not calibrated, they are not going to be accurate and they will not make you look prettier. But what the manufacturer will not tell you is that the readings will be close and the actual number delivered for reflected power is totally irrelevant!

The fact is they really are a calibrated and matched pair. You should alternate using them at least once per month, if not more often, and when you come to the transmitter to take your daily readings and find the reflected power is different from the day before, you simply put in the alternate slug. If they are *both* elevated, your next phone call should be to your favorite factory or your favorite line sweeper to schedule an overnight outage before it becomes a show-stopping event.

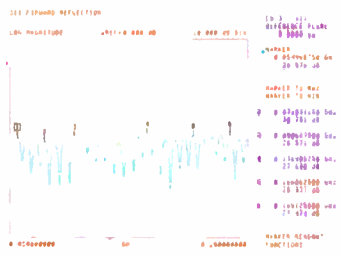

Figure 1: Healthy Return Loss

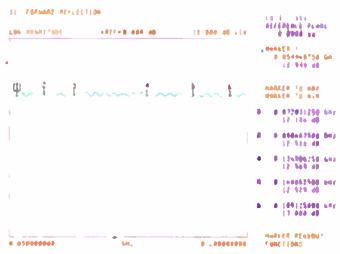

Figure 2: Poor Return Loss

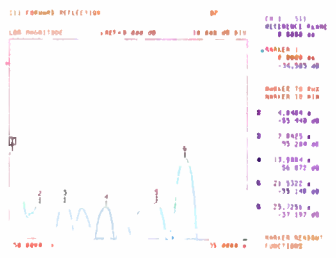

Figure 3: Healthy TDR/FDR

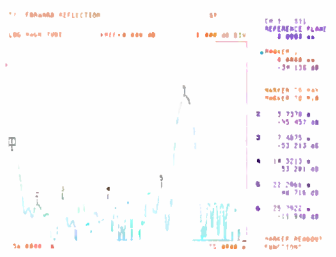

Figure 4: Damaged TDR/FDR

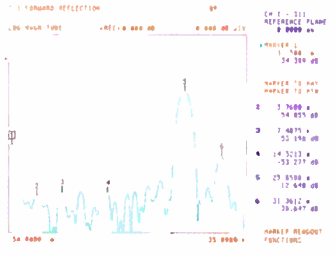

Figure 5: Line Problem Anomaly

COMPARING THE DATA

In order to have a good grasp on the results of your next planned line sweeping, you should have the report generated by the previous line sweeper on hand. This data is critical to performing an accurate comparison of the system back then and now.

Thinking back to those wedding pictures, perhaps you recall that after the photographer left the party the bride's maids started a food fight. That is just what happened to your transmission system; it was healthy and now it needs some help.

The report data generated during the previous inspection should have a number of critical components in it. This report should be accompanied by the installation drawings of the system and it should be kept at the transmitter site, with a copy kept in the Engineering office.

Let us take a look at these documents. It is easier than maintaining your public file.

ENGINEERING FILES

Installation Drawings: This document should have a complete parts list for your system. The parts list should contain the total number of every piece of apparatus installed in your system from spring hangers to line segments to elbows and possibly most importantly, where any slugged sections or components are located.

The drawings should give a complete and obviously accurate stick-type drawing of the system from the output of the transmitter to the tippy top of the antenna.

The components for every foot, the distances to them, and the line section parts count, and if there are cut or custom fabricated pieces involved, the line-section parts count should be included. With this drawing and data sheet grouping from the installation of the system, your line sweeper can make informed decisions about the results of the tests that he is about to perform.

The Line Sweep: The two basic trace tests that you will need are the Return Loss graph taken in Log Mag, and the system TDR or Time Domain Reflectometer test. The Log Mag graph (or if you are more comfortable, you can also print this graph out in VSWR) tells you about the absolute electrical health of the system.

While TDR is the common vernacular, it is more accurately a frequency-driven test developed numerically by the analyzer as a result of looking at the swept frequency applied to the system within prescribed bandwidth parameters, and analyzed in the time mode to ascertain the location in linear distance of each component in the system and how each of these components reacts to the frequencies applied to them.

Sometimes this test will be called FDR. In a down and dirty system test, the TDR or FDR could consist of only one trace that encompasses the entire system from input to the top of the antenna. But this is not sufficient.

You should be presented with a full system trace and "zoomed-in views" of the specific areas of interest such as the input complex connections and switches, suspect anomalies located in the testing, upper area complexes, confirmation of slugged component locations and any other points of interest.

I like to see these points developed by shooting the system in TDR/FDR in 50-meter segments. Fifty meters is a good slice to bring out the system components, without taking a chance of missing some small hidden item such as a dent or that chance drywall screw.

Hopefully when your line sweeping event is completed, you will have a report that makes sense and agrees with the one done previously. If there are discrepancies of any kind, an attempt to replicate that previous testing set up should be made to insure there was no procedural or special circumstance that gave the differing results.

SAMPLE TRACES AND ANALYSIS

Some examples of before and after traces are shown here. In **Figure 1** there is a Return Loss graph in Log Mag that shows a healthy system. **Figure 2** shows a failure of the system as evidenced by the poor Return Loss.

Figure 3 is the TDR/FDR trace of the healthy system and **Figure 4** shows the TDR/FDR graph of the damaged system. In this example, the failure was in the antenna itself. The contrast is shown by the good return loss at the end of the TDR/FDR graph (in **Figure 3**) and the poor return loss at the end of the graph in **Figure 4**.

Now, let us contrast this antenna failure with a line failure. **Figure 1** is used again and shows the healthy graph in Log Mag and **Figure 2** once again shows the poor Return Loss of the damaged system. The difference is shown by comparing the TDR/FDR of the healthy system in **Figure 3** with the one from **Figure 5**, which clearly shows the anomaly of the problem in the line itself.

As you can see with these five traces, you can have the *same* poor return loss result generated by two *different* types of failures.

UNDERSTANDING THE SYSTEM

This is where interpretive skills are greatly aided by having the complete installation drawings available for your line sweeper. With these drawings he can determine if that nifty spike in your line is a point of suspicion or a slugged component. It is a waste of time, money and embarrassment to have a crew go up the tower, only to find that the spike in the system is just a slugged line section, installed while no one was looking, to try to solve some other problem in the installation.

Please remember that your line sweeper put his crystal ball in the shop about the same time you did, and neither of you is going to get it back any time soon. Your help can dramatically assist your line sweeper in providing you a quick and accurate diagnosis of a system problem, or – we hope – more pleasantly, a very clean bill of health.

Gary Minker is the Owner of Radio Works R.F. Consulting in Lake Worth, FL. He can be contacted at gary@radioworksrfconsulting.com

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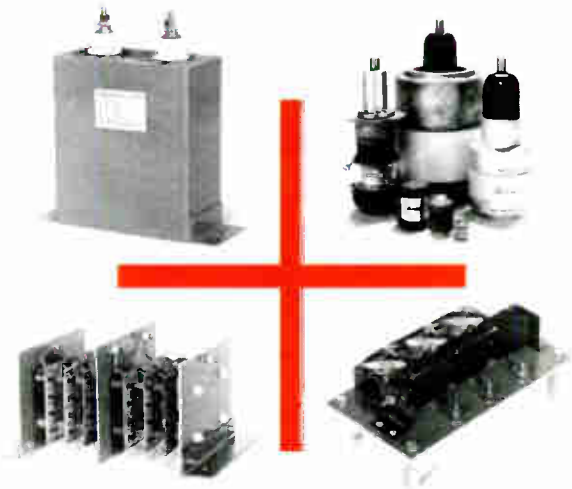

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A Non-Comm View

by John Devecka

Bringing the Remote Broadcast Back Home

[BALTIMORE, Maryland] Remote broadcasts can be as close as just outside the studio windows, across campus, or as far away as an airplane can take you. Close in, costs usually can be contained. The further out you go, well, that is another story.

MORE DISTANCE, MORE MONEY

The further the remote is from the studio, the deeper you may need to dig into your wallet. Key to making it work are the wireless options, which are typically, higher in cost and more complex technologies. Thankfully, there are so many folks who came before you that the complexity is mostly hidden inside the box, rather than placed in your lap.

Unlicensed wireless systems in the 900 MHz, 2.4 GHz, and 5.8 GHz ranges are available in many electronics shops. Some of these can reach out to a range of one-half mile – but not guaranteed. Retail shops like Radio Shack carry video links designed to let you hop your downstairs VCR to your upstairs TV.

Many of these are made by RF Link Technology (http://www.araneusa.com/) in several frequency ranges. They are lower cost and do not require a license. They may be a good solution for short-range coverage on a campus, but probably not for larger schools.

Line-of-sight and height are the critical performance issues with these systems. If you have a couple of easy rooftop locations, it might be worth experimenting to find a good cross-campus hop location that you can then leave wired up permanently, and return the audio to the studio from there.

As a more complex, slightly higher cost option, there are several companies offering 5.8 GHz parabolic antennas that can be fine-tuned to your transmitter point and jump coverage range to as much as 4 miles (*their* claim, not mine!). Try searching the many spy devices websites for compact transmission units and long distance receiving options.

Speaking of cross-campus wireless, you already *may* have wireless networks running on campus. If so, you could use those, or even your hardwired intranet, to stream audio back to the studio. While this presents a fresh set of issues including latency, buffering and dropouts, it is not unreasonable to consider – even for live events.

If you have followed my advice and made friends with your IT people, it is possible that they could make this even easier.

IT ASSISTANCE

Your IT folks can probably set you up with a locked IP address at either end of a path, and allocate enough bandwidth to that path to increase the chance of a clean, reliable connection. I am trying to keep this simple, and you can talk to them about the details, but they *can* make that happen in many cases.

This option does involve a need for a couple of computers, probably a laptop for the sending end, so it is not necessarily cheap, but it might be easy. If you have spare computers around campus (I bet your IT folks do!) that can be stripped to do nothing but this function, it would also increase reliability.

Lots of free programs can do the encoding for you as well. Consider a variety of them since your link will be closed and all that matters is that *you* can get the connections to work. On-the-fly encoding is needed, so you do want a reasonably quick machine.

Encoders such as Streaming Audio Manager (SAM) (http://www.spacialaudio.com/products/winamp/) or Shoutcast, (http://www.shoutcast.com/download/) work just fine and are some of the *many* options available. If you can survive delaying the broadcast, you could simply encode to MP3 or .wav and email the files over to the station for replay (either in chunks or upon completion).

POTS OPTIONS AND BEYOND

POTS (Plain Old Telephone Service – everything has an acronym) line codecs are the most common option used by stations. Many different vendors offer this in many configurations. Some are simply hybrids that allow you to connect a phone at either end, and some offer bandwidth shifting and expansion through digital codecs.

As with everything, the more fancy features the lighter they will leave your budget.

Many companies making these systems will let you demo them at your station (Comrex, JK Audio, Telos, Tieline, and others). And if you cannot get the manufacturer to provide a demo unit, try your preferred equipment vendor, they will probably help out. If you do not know another local station that uses one, get a loaner and try several models from different companies before you settle.

JK Audio Remotemix Sport

Try them on several different lines (both on and off campus) because every line is different. Do not assume all the lines on your campus are the same vintage, path or quality – check them. Likewise, if you have a cross-town sports rival that will be a regular broadcast point, see if you can test at their facility and send signal back with each unit.

CELLULAR CONNECTION

Cellular wireless solutions are more expensive and more complicated, but also give you flexibility to get off the campus. Wireless packages are available for use with (and even including) cellular phones for their interface. This would be used in place of a direct line connection to the studio.

The advantage is that the phone is unlicensed, and more flexible than some line-of-sight solutions for wireless, and it is very portable. The disadvantage is cost. However, you may be able to work a deal with a local cellular provider for some exchange of underwriting (or ads if you are not licensed) to cover the costs.

Also check with various people on campus to see if you already have a bulk deal for cell phones available. Many different options exist for these types of systems: Marti Electronics makes the Cellcast unit with the cellular system completely integrated (http://www.martielectronics.com/products/rbs_400_.html) while Comrex, JK Audio, Telos and Tieline offer interfaces that can handle connections to cell, analog, and PBX lines.

With cellular options, it is also critical that you determine if the particular service you want to use is available in the towns where you want to do your remotes! Most cellular services offer coverage maps, but you should verify with the service provider (and possibly someone at the other schools) that you *can* get reliable service in their location.

ISDN

ISDN remote systems are the height of telephone-based remote broadcasting (for now). They offer the highest quality audio paths and, in theory, the most robust service.

They require an ISDN (Integrated Services Digital Network) connection at *both* ends of the signal path, which means you need to make arrangements with the phone company first. Some of them will run on standard POTS lines as well. This would allow you the most flexibility for remote operation and typically sound better than most other options. But, like anything good, they cost a lot of money; these systems can easily clear $7,000.

Comrex Envoy

They pay for themselves in terms of flexibility and clarity, but you must ensure ISDN connections are available at the remote site – something that is not always easy! If most of your broadcasts will be from larger schools, contact their athletic departments or radio stations, and see if ISDN is available there. If most of them say yes, consider this as your high-end solution with the least headaches.

ISDN converts your analog universe to a high quality digital one and sends it home. As long as you can arrange and afford ISDN connections in the locations you want, this is a great solution.

However, you had better add to the list of friends, someone at the regional phone company, as ISDN is still a "black art" among most commercial phone companies. There is usually a "guru" or two in a regional company, and you will get nothing but offers to sell you DSL service and drooling stares until you find those people. Once you do, get their cell phone number and guard it with your life!

RPU OPTIONS

Remote Pickup Units (RPU) are a great way to get long range (up to 10 or 20 miles, or so) coverage for your remote broadcasts without a phone connection.

These start around $5,000, however, and require a license for operation and permanent antenna locations for receiving. You may be able to find them used; if you have the budget they are worth considering. RPU systems require a high antenna location for the studio side and a pretty clear shot back from the transmitter antenna. So, when considering cost, do not forget to factor in the towers/poles to mount the antennas, cabling, licensing and installation costs.

An important note: *before* you even bother looking at RPU systems, be sure to contact your local Frequency Coordinator to see if there are any reliable frequencies in your region.

Your local Coordinator is likely an SBE member; check www.sbe.org for the local chapter. If none exist, contact the Chief Engineer at one of the bigger local stations and ask whom to call. In some cases you may be referred to a commercial company, or coordination may be a "Wild West" affair. Make sure you know what you are getting into before committing to a licensed system.

As you see, there are a lot of options. You need to find out which one really fits you best *and then* worry about the cost. Voice events, like play-by-play, are going to have very different issues than live concerts, so some options may self-eliminate quickly, and some new ones may come up over coffee with the IT or Telecom folks. You will remember to have that coffee right? Trust me, it will save you more money and hassle than you can ever imagine.

John Devecka is the Operations Manager for WLOY at Loyola College in Maryland. He still thinks he has friends in IT and Telecom, although they do not always return his calls. For more advice on butt-kissing on campus email wloy@loyola.edu

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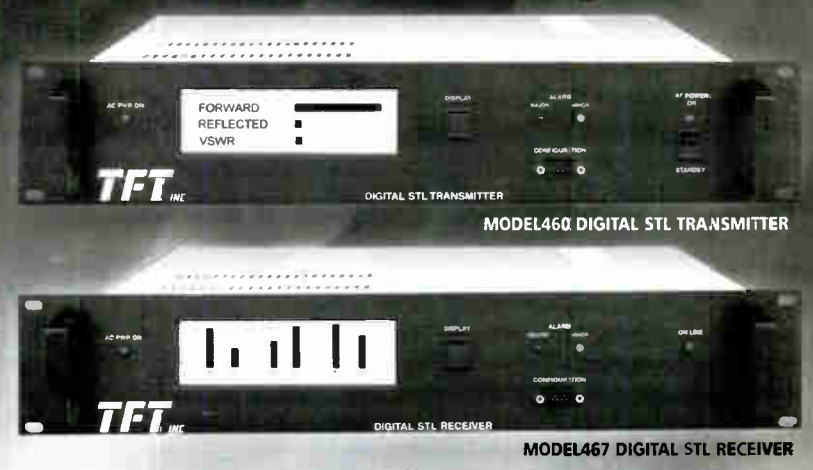

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Field Guide

by Jay Crawford

Dialight LED Beacons and Marker Lights

[CINCINNATI, Ohio] During the summer of 2003, we started erecting a new 499-foot tower. We chose to use what was for us a new style of tower lighting: LED beacons and markers. The beacons are Dialight D864-A11-001.

We had used the old style incandescent L-864 beacons and sidelights on several of our towers. We also had tried strobes – both day/night and red light strobes – in the past. Due to the unreliable operation of the strobes, we had removed them from the towers where we had tried them.

Of course, with any electronic equipment there will be failures. Therefore, we try to choose equipment to keep these failures to a minimum, particularly where safety is the main issue.

INSTALLATION

We put the first lights on the new tower during November of 2003, when we got the tower to a height that needed lighting. Due to a severe health problem with our tower installer, the tower was not topped out, but only reached the 440-foot height before winter. This meant that the tower wiring was completed to approximately the 400-foot level, which supplied both levels of side markers and the two beacons at the 250-foot level.

LED Beacon, side-mounted.

The "top beacon" was temporarily hung on the side of the tower as near the top as possible, and wired in with SO cable. (The beacon could not be easily installed on the top of the tower, because there was no "mounting plate" at that level.) The lights were connected to the controller for the old tower, which was still in use. The extra load of three beacons and the six sidelights was well within the limits of the old controller. It all worked well until the summer of 2004 when the tower was completed.

LED beacon re-installed at the 499' (top) level.

When the tower was finally complete, the top LED beacon was moved to the mounting plate and the conduit and wiring was installed to the top of the tower.

Shortly after that – within a few weeks – the top beacon failed. We contacted Dialight to get replacement parts for the beacon. We were sent two "light modules" to install in our beacon. Unfortunately, that was when our problems began.

A SLIGHT PROBLEM

Servicing anything 500 feet off the ground is always a challenge. You are a long way from the bench and toolbox, and all it takes is dropping a small fuse to kill a day's work.

Our first problem was that, at 44 pounds, the two modules were much too heavy for a climber to carry up the tower without rigging. One of our engineers does some climbing, but only for small projects. (We do not have rigging equipment to do the larger projects.)

Beacon opened to show the dual elements.

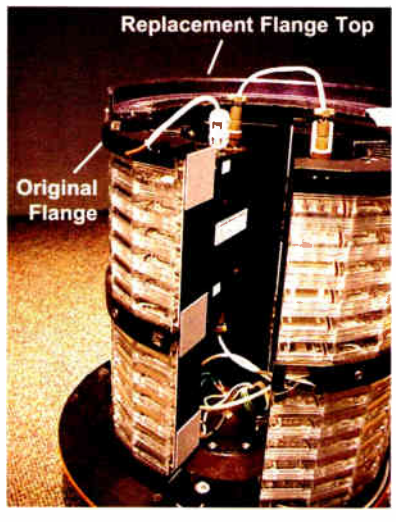
Up on the tower, our engineer tested the two original modules, and found that one side was not functioning.

This meant we had to wait for our normal installer rather than getting the beacon repaired quickly. In the meantime, we had a lot of "fun" with the FAA, eventually filing four NOTAMs. Then, when the tower crew got the replacement modules to the top of the tower, they found several more problems.

SEEKING SOLUTIONS

First, they found that the modules were not identical to the originals. The replacement modules had a top plate with a "lip," somewhat like using a piece of aluminum angle instead of a flat plate. It turned out that this was from an earlier model.

This plate prevented the top of the light from closing properly. We tried to swap the top plates (they are attached by three screws). However, the original modules had the wiring folded over the top of the module; the replacements had a hole drilled horizontally through the top plate and wires placed through it.



The replacement top plate (flanged), sitting on top of the original top plate.

At this point, the only option we had was to bring the modules back down the tower and disassemble them enough to disconnect the wiring, take it out of the "hole," and then fold it across the top like our original modules.

Top plate closeup.

During the process of talking with Dialight about the D-864 beacon and its repair, our engineer was told that we had "an older style light" and that future repair parts were likely to be difficult to get. In the short time we have had the unit, Dialight began producing a newer beacon, shorter and using a totally different design. We have asked what will happen if we have further problems with our lights, but so far have not received an answer from Dialight.

SHIPPING UNCOVERS PROBLEM

Dialight did ship us one of the "old style" beacons, like the ones we had installed. This light arrived severely damaged by the shipper. We discovered that the whole light assembly is attached at the bottom of the electronics area with six 3/4-inch 8-32 screws into the base. The base is made up of a cast mounting plate with what appears to be a portion of the casting about four inches in diameter sticking up.

Six of these tiny screws are all that holds the beacon to the tower.

In the unit we received, these screws were ripped right out of the casting, and the outer Lexan cover with its metal top plate was cracked. We found that the screws were much too short; at best, they only threaded one-eighth of an inch into the casting!

We replaced these with longer screws, which thread about a half-inch into the casting. We are still waiting for a replacement for the outer Lexan cover.

ISSUES TO RESOLVE

If our experiences thus far are any indication, the Dialight LED beacons and side markers themselves are very reliable, although we do seem to have received one light with an "infant mortality" problem. However, our greatest concerns are the less than rugged construction (if a shipper can rip screws out of a mount what can a large chunk of ice being blown by a 75 mile per hour wind do?) and the fact we may not have factory service in the future.

I realize that those who build our equipment routinely improve designs, but should we be expected to pay for a tower crew to swap out an entire beacon just because the manufacturer decides to supply a "new model" rather than stock and supply parts for a light discontinued only one year after being purchased?

There is another issue to keep in mind if you are replacing fixtures on an existing tower rather than installing an all-new system like we did. The efficiency of the LED lights can actually be a slight "problem," as they draw approximately one tenth of the current of standard incandescent bulbs.

If you do visual light inspections this will not matter. But if you have one of those fancy controllers with current sampling to confirm proper operation you may well have trouble getting the current sensing circuits to work properly. There are readily available "sensing modules" which work well, but be aware you will need to replace your controller or rebuild your old controller using the more sensitive sampling modules.

Photos by Jeff Johnson

Jay Crawford is Chief Engineer of WVXU, Cincinnati, and the X-Star Radio Network. His email address is jcrawford@wvxu.com

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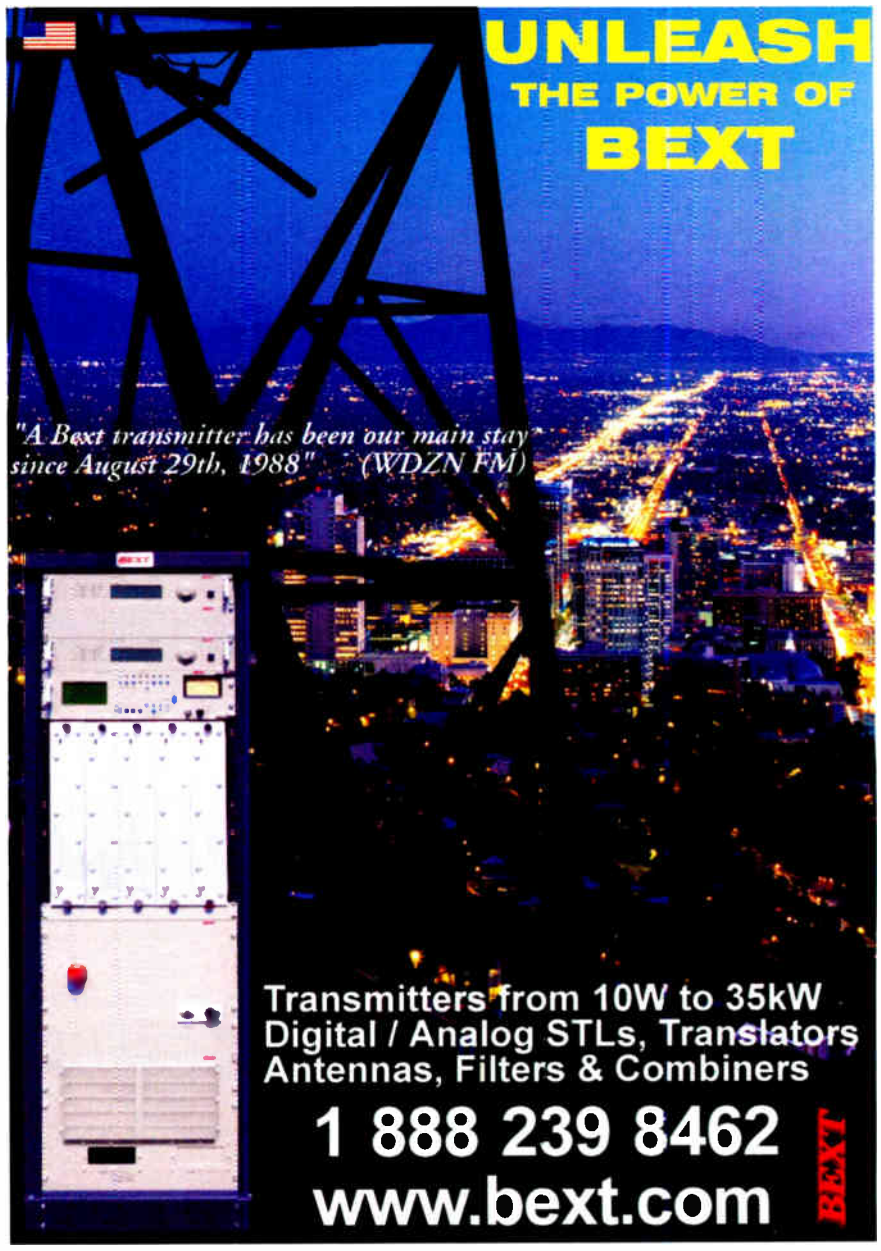

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Tech Tips

by Stanley Swanson

Using the Right Fence

[YUMA, Arizona] The FCC says that antenna towers having radio frequency potential at the base must be enclosed with an effective locked fence.

WHAT IT TAKES TO BE SECURE

The FCC does not define what is meant by an effective locked fence. They will probably accept any type of fence three feet high with a locked gate. Although a three foot high fence will keep out chickens and small children, it really cannot do much against thieves and vandals.

A lot has been said recently regarding security, and this usually includes the subject of fences. While I was at KBNL(FM) in Laredo, Texas, we had the opportunity to construct a new antenna site. The previous site had had one break-in and one attempted break-in (a hole in the plywood roof). The site had a concrete block wall partially around the tower base, with the concrete block building serving as the remainder of the wall.

This time we built a transmitter building with poured reinforced concrete walls and roof, and a single metal door. From previous experience I had learned that the door should swing out, not in, so that it could not be forced. We also needed a fence to enclose the building and the tower.

AN EFFECTIVE FENCE

If you are not thinking of a concrete block wall, you are probably considering a chain link fence. Chain link fence comes in heights of between three feet and twelve feet. Residential chain link fence is commonly 11 or 11-1/2 gauge wire, with about a two inch mesh. (Mesh is the distance between parallel wires; some refer to it as a diamond.)

This type of fence can easily be cut or climbed, and is of little value for real security. Barbed wire at the top does little to discourage unwanted visitors, and can be successfully climbed over. Razor ribbon is more effective, but I would not be surprised if someone takes you to court for damages after he tries to climb it!

Typical 11-1/2 gauge wire.

The best approach is to start with a fence that is difficult to either cut or climb. I suspect that many people do not know that there are various varieties of chain link fence. Chain link fence for security purposes should be of at least nine gauge wire (smaller numbers indicate heavier wire). Mesh sizes such as 1-1/4 inches, 1 inch, 5/8 inch, 1/2 inch and 3/8 inch are available. A good fence should have a mesh size of 1 inch or less.

This nine gauge fence provides more security.

The larger gauge and smaller mesh make it very difficult to cut the wire, as well as being more difficult to climb. Look for samples at your fence dealer before deciding on the fence material. If you choose a good fence material with a height of six feet or more, you may decide that barbed wire or razor ribbon are not needed.

USE THE RIGHT POSTS AND GATES TOO

Your fence dealer will also be able to tell you what diameter posts and top rails are suitable for the fence material you choose. An important note: since the posts will probably be set in concrete, they may not make a good ground connection; one or more ground rods can be used for safety from lightning or other causes.

The easiest point of entry will be the gate. Make sure you have a kind of closer that cannot be forced. You will probably want to use a heavy chain to secure the gate. I once had to cut a chain with a hacksaw because someone had left our lock out of the loop. I can tell you that it was not easy!

Stanley Swanson is the Chief Engineer of KYRM, Yuma, AZ. He can be emailed at: sswanson@hcjb.org

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Radio History

by Ken Benner, NCE

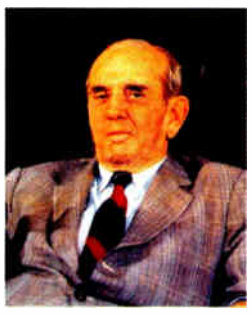
KSTP Celebrates Its 80th Anniversary

[TUCSON, Arizona] One of the most fascinating stories in the history of American Broadcasting began eighty years ago this month.

A few weeks prior to the Grand Opening, engineer M.G. Goldberg put the finishing touches on the 500 Watt transmitter, and its long wire antenna tuned to 1230 atop the Marigold Gardens Dance Pavilion at Nicollet and Grant in downtown Minneapolis was ready to broadcast live dance music five nights a week.

READY, SET, BEGIN!

One of Broadcasting's most interesting and successful entrepreneurs, Stanley E. Hubbard had applied to the Radio Division of the Bureau of Navigation, Department of Commerce for the license WAMD, "Where All America Dances." The date was February 13, 1925 when the bicyclist from Western Union delivered the telegram advising the "authorization" had been granted – almost immediately, that same day, the little station was on the air.



Stanley E. Hubbard

Mr. Hubbard, a prominent aviator who operated the station, soon moved the station studio and transmitting plant to the top of the Radisson Hotel. The antenna consisted of two poles 50 feet high and 75 feet apart supporting an inverted "L" type antenna.

This was an interesting period for radio. On July 12, 1926 the station simply changed frequency from 1230 to 1020 – without authority. Ten days later, they were back on 1230. It was during this period that radio regulation collapsed. In fact, a US District Court had ruled The Radio Act of 1912 rendered the government incapable of regulating stations' frequency or power, and for a period stations governed themselves.

STAR POWER AND MORE

WAMD was no exception as it vied for a more favorable frequency and power. Even though few realized at the time the lower end of the AM band was the more favorable, Hubbard understood what was put on the air was also very important.

Hubbard established a rapport with major national talent of that era and several performed their radio debuts on his station: for example Eddie Cantor, the Marx Brothers, Eddie Albert, Edgar Bergan and Charlie McCarthy. Meanwhile, in March of 1928 the station began operation as KSTP, and in November was awarded 1460 kHz with 10 kilowatts.

Fast-forwarding to November 1938, a construction permit was granted to Hubbard Broadcasting to raise daytime power to 50 kW with approval to install a three-tower directional antenna. Shortly after, the station was operating 50 kW day and night using two patterns.

FURTHER IMPROVEMENTS TO SERVICE

The KSTP research efforts by Professor of Electrical Engineering, Hector Skifter and his colleagues Fred Clarke and Lynne Smeby did much to encourage the expansion of AM directionals in order to provide "...an important contribution to the broadcasting industry and bring new radio services to millions of Americans." The transmitter designed by Skifter operated for almost 20 years as the main and for an additional 10 years as a back-up from the KSTP site.

One of the most awesome pieces of electronic equipment this writer has ever seen was the 50 kW "Black Beauty" transmitter with its 500-gallon copper distilled water tank to water-cool the plates of its six final amplifier tubes. The leakage current to ground was carefully measured in microamps.

Still, the transmitter ate approximately 150 kW for 50 kW output and had to be fired up and shut down in three stages. During its waning years as a backup for the station's 50kW RCA Ampliphase, it was never allowed more than ten minutes on the air, so as to minimize the effect on the "power demand meter" which would result in a very significant increase in the monthly power bill.

Yours truly shut that transmitter down for the last time in 1964, ending a most extraordinary era in American Broadcasting technology. Today the station uses a far more efficient MW-50 solid-state transmitter pulse-width-modulated transmitter into a vertical half-wave "Franklin" daytime and at night into its original three-tower directional.

SUPPORTING THE INDUSTRY

Indeed, the Hubbard family has played a very important role in the rich history of American Broadcasting. Founder of Hubbard Broadcasting, Inc., Stanley E. Hubbard and his son Stanley S. Hubbard are both Charter Hall of Fame members of the Museum of Broadcasting Hall of Fame. Among KSTP alumni are numerous others, including several prominent network reporters, who have been inducted into the Broadcasters' Hall of Fame.

Much of the KSTP history is on display at the Pavek Museum of Broadcasting. Visitors see a variety of KSTP artifacts, including a pair of vintage RCA 77DX microphones, photos from the popular, pre-television "Sunset Valley Barn Dance" program and more.

Today, KSTP-AM "The Talk Station" holds top billing in the Minneapolis-St. Paul market. It remains in the Hubbard Family as one of fewer than ten stations in the nation under the original family ownership.

Extraordinary marketing research efforts on behalf of its advertisers have developed a loyal sponsorship. Combined with the professional dedication from a talented staff which is given the freedom to think and create with pride, KSTP provides a high standard of broadcasting excellence rarely seen in this age of the bean-counters.

Happy 80th to Hubbard Broadcasting from all of us at **Radio Guide**!

Ken Benner, an alternate FCC inspector, is based in Tucson. His email address is: bennerassociates@aol.com

Studio Guide

by Mark Shander

A Mobile Talk Studio – On the Fly

Got a remote coming up, but no easy way to get the audio back to the studio? Mark Shander has some ideas on how to quickly set up a remote "studio."

[PHOENIX, Arizona] One of the most exciting programming elements on the radio is a live remote broadcast. Live broadcasts are also a great potential revenue source, and account executives frequently sell a live remote or include it as a bonus to a heavy advertiser.

Until recently, setting up a live broadcast meant anything from a formal RPU configuration to a call-in over a wireless phone. If you were shooting for a high-quality feed from the field, you were talking about an investment in mixers or mixers that work with mobile phones or audio feeds over POTS or RF. Those are excellent and very reliable solutions. There is another method to consider that is a lot of fun for those involved, as well as those listening.

LOOK MA, NO WIRES!

Imagine what you could do with the ability to do a live remote wherever there was a Wi-Fi hotspot, or wherever quality wireless data services are available to you. Imagine being able to send video via Webcam with your remote broadcast, too. It is easier than many people think.

Reliability at a remote broadcast site is always a concern. Using a more current laptop and a more robust version of Windows will really pay off, although many laptops running Windows 98 should work just fine at lower qualities. Another challenge to consider when contemplating the use of existing, older equipment goes beyond reliability – older equipment may not have the horsepower needed for encoding. That is why I recommend using a more powerful laptop running Windows XP or Windows 2000.

The free Windows Media Encoder 9 can be downloaded from www.microsoft.com. Install it on the laptop. An important reminder before going on site: be sure any equipment you would like to use has been hooked up to the laptop and tested to make sure they work together. Sometimes it is useful to add a Webcam and/or Wi-Fi card first, and make sure any necessary drivers are installed before running the encoder.

THE REMOTE "PACKAGE"

At this point, you should lay out the elements you would expect to use with alternate audio delivery methods – a battery-operated mixer (music stores have a whole new line of these, some of which are under a hundred bucks!), a dynamic microphone or two like an EV-635A, Shure SM-58 or Sennheiser e835 and a wireless phone recorder interface modified to send audio from the headset output of the phone to an input on the mixer.

This 8-input, 2 bus Behringer mixer features two high-quality balanced mic preamps and lists for under 60 bucks. Would you believe it even supplies optional 48v phantom power?

Leave the headset microphone plugged in so the caller can hear you through the headset. (It is not a hybrid, but it works well enough, and only costs about $75).

You can monitor audio through the laptop's headphone jack, or plug in speakers or a headphone amplifier. You can even connect to a house audio system from the mixer or the computer output (which also lets you play spots on site).

While running Windows Media Encoder, select "Push To Server" rather than allowing others to connect to your machine. Send a signal directly to your main studio or to a Windows Media Server for distribution. The results are usually very good. Be sure to *Save* your Windows Media Encoder profile to the desktop, so the encoder can be used over and over again – just starting it with a single click.

CONNECTING OUTWARD

Connectivity is another important issue when preparing a live remote of this type. Many coffee shops offer free or low-cost Wi-Fi service, as do hotel chains and even some donut shops.

A common challenge with Wi-Fi and traditional Windows Media encoding is that secured free or commercial Wi-Fi means you are broadcasting from behind a firewall that you do not control. No one can connect to you, because the Wi-Fi network is designed to give you a non-routable IP address.

By selecting "Push To Server," the problem is solved. A one-way communication stream is established from behind the firewall and a connection to a client or server that will rebroadcast the live remote is made. Another solution is a wireless data laptop card from a wireless carrier – it turns whole cities into hotspots.

Now you have everything you need to send a live remote, and even take guests over a phone remotely. How do you stay in touch with the studio during the remote? Of course, there is excellent quality software available for communicating over data that is specifically designed for remote broadcasts, but with a Wi-Fi system, you can also use AOL Instant Messenger (AIM), Yahoo Messenger, MSN or any common Instant Messaging software. No kidding.

Mark Shander specializes in "new media" solutions. His email address is mark@shander.com

Radio Guide Tech Initiative

As announced at the NAB 2004 Radio Show, **Radio Guide** magazine has embarked on a **Tech Initiative** to encourage the sharing of technical knowledge and experience among the engineering community.

As part of this outreach to encourage information sharing, a number of manufacturers have already contributed over $15,000 of gear, to be awarded to the best submissions. Some of the items include:

- **Broadcast Warehouse DSP-X Digital Processor**
- **Comrex DH-20 Digital Phone Hybrid**
- **Audion Labs Voxpro Digital Audio Editor**
- **Henry Engineering Studio Drive Mixer**
- **Orban Optimod 1100 Processor Card**
- **rfSoftware rfInvestigator (full package).**

What we are asking is for you to share your Tech Tips, User Reports and War Stories as well as longer articles on topics that interest you, from studio construction or renovation, to transmitter site maintenance. Please address any questions or submissions to: **Editor@radio-guide.com**

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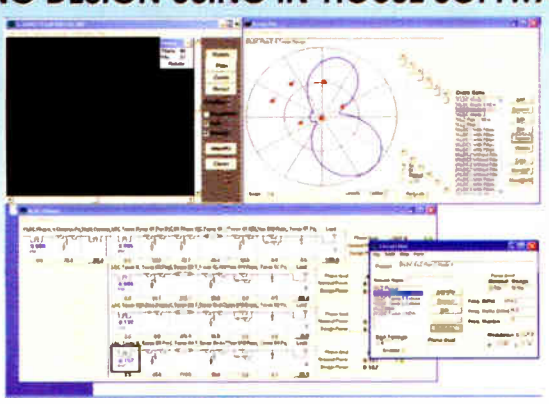

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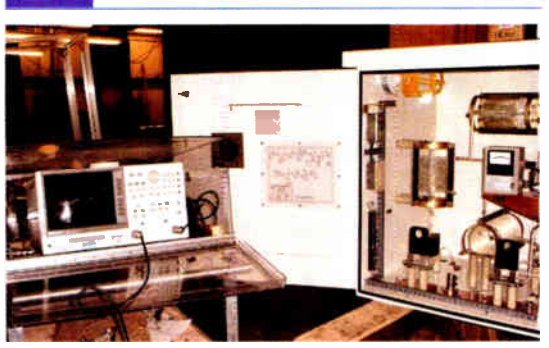

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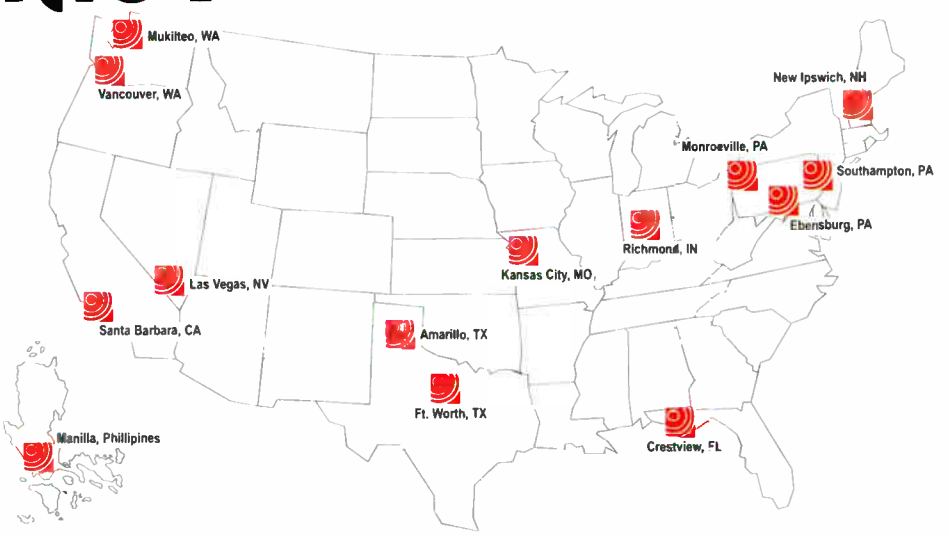

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Tool Guide

From the Radio Guide Tool Box

ML1 Minilyzer

NTI ML1 Minilyzer – Analog Audio Analyzer

A familiar tool which keeps evolving is the Minilyzer from NTI. This is the company which formerly was the test equipment division of Neutrik, and many users are familiar with their whole series of handheld Minstruments under the old Neutrik name. All of the products are now available directly, along with some new additions.

The ML1 Minilyzer is one of the most familiar – a powerful and complete audio analyzer in a palm-sized format. Not only does the ML1 offer traditional audio analyzer measurements, such as Level, Frequency and THD+N, but it also includes a 1/3 octave analyzer which can also be used as an acoustics sound pressure level meter and RTA when an optional measurement microphone is added.

Another popular monitoring function is the inclusion of an auto-ranging headphone monitor together with a PPM/VU screen mode, which turns the whole tester into a walk-around audio signal tracer.

About the time you discover that the Minilyzer also has Polarity Testing for either electronic signal paths or monitor speakers, as well as built in cable testing, you realize why this under one pound device is so popular.

But even more measurements are possible, including graphs of frequency response from an external sine sweep; and newer firmware versions also include individual harmonic distortion analysis.

Other useful modes are the ability to measure level over time, with time sweeps (think intermittent audio faults!) and a built in scope mode for viewing a signal. The scope function will never replace your trusty Tektronix but is completely auto-ranging and does show what the waveform looks like – for instance if clipping may be occurring.

The Minilyzer also can also become a Windows PC-based instrument with the addition of NTI's MiniLINK USB interface and Windows-based software. This package may be added by the user to any Minilyzer. It adds many things, including the ability to store dozens of test results on the instrument, then later download them (screen shots or the full test data) to the PC when connected.

The instrument may also be remote controlled via USB from the PC, and while connected the Minilyzer takes its power from the USB interface to save battery life!

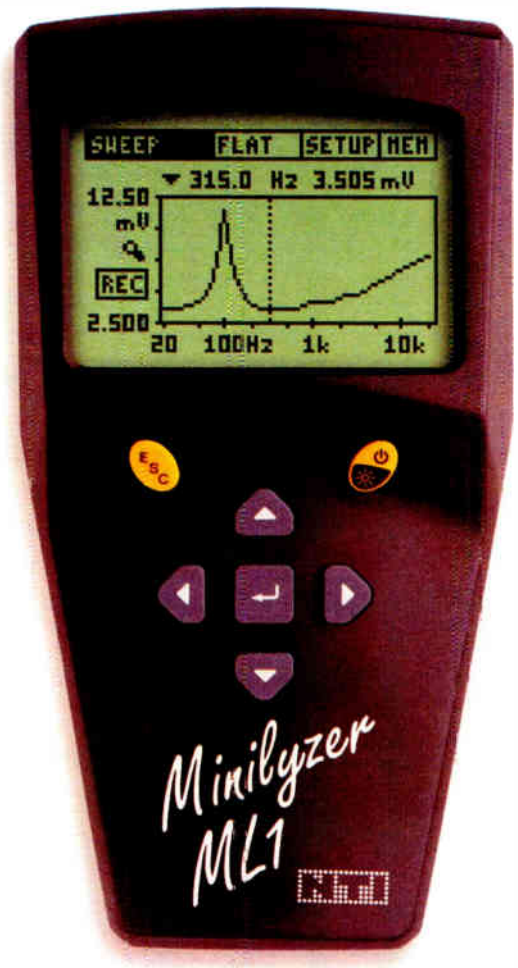
The final function of the PC interface is to access online firmware updates for the instrument. Over time, NTI adds features and improvements which may be downloaded from their web site via the MiniLINK system. For owners of older Minilyzers this option is a good investment as the benefits include not only all the data storage and remote control functions, but free updating of your older instrument to include the newer features.

Finally, for those interested in even more measurements, NTI also offers the DL1 Digilyzer for digital audio measurements for HD Radio; and the MR1 Minirator, the analog generator companion to the Minilyzer.

The instruments are sold through a network of distributors in the U.S. See the NTI web site or call NTI Americas Inc. at 503-684-7050 for assistance.

List Prices:

- ML1 Minilyzer $579
- MiniLINK USB interface and Windows software $325
- MiniSPL Measurement microphone $349
- MR1 Minirator analog sine, square, noise generator $215
- DL1 Digilyzer Digital Audio Analyzer $1499
- AL1 Acoustilyzer Acoustics Analyzer $904



The Minilyzer ML1 Analyzer

NTI Americas Inc.
PO Box 231027, Tigard, Oregon 97281
Phone: 503-684-7050
Website: www.nt-instruments.com

Consultant Guide

Radio Consulting Engineers

PHASETEK INC.

Quality

PHASETEK'S manufacturing facility and components expertise are available to design and fabricate any type of inductor or special RF component.

Our engineering and production staff's years of experience and commitment to quality are available to fill any special requirements.

Dependable

RELIABLE & DEPENDABLE RF COMPONENTS & PARTS

Variable & Fixed Inductors
Variable & Fixed Vacuum Capacitors
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Transmission Line Terminations
Ribbon Clips and Tubing Clamps
Horn Gaps
Toroidal Current Transformers
And More!

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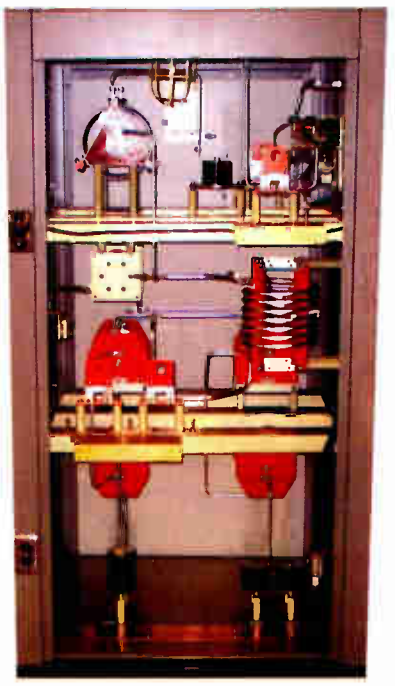
Quakertown, PA 18951
Phone: 800-742-7383 215-536-6648
Fax: 215-536-7180 Email: kgpti@epix.net
Website: www.phasetekinc.com



Custom Phasing Systems

Custom Manufactured

Antenna Phasing Systems
Control Systems
AM/MF Antenna Tuning Units
Diplexers (NDA/DA and expanded band)
Triplexers
Transmitter Combiners
Dummy Loads (with matching networks)
Tower Detuning Units/Skirts
Broadband Matching Networks
Tunable Skirt Assemblies (TSA's)
Isolation Transformers

Experience

Phasetek's experienced staff of engineers and production personnel are dedicated to provide the broadcast industry the highest quality, custom designed phasing equipment.

Value

OTHER SERVICES AVAILABLE:

Phasing System Design
Engineering & Technical Field Support
AM & FM Installations.

Model RFC-1/B Remote Facilites Controller
- control transmiter from any telephone
- 8-64 channels of telemetry and control
- programmable control by date and time
- optional printer and modem adapters
- programmable telemetry alarms
- integrated rack panel

Model RAK-1 Intelligent Rack Adapter
- parallel printer interface
- internal modem for data transfer
- front panel status indicators
- battery backed power supply
- rack mountable chassis
- accessory package for RFC-1/B

Model DAI-2 Dialup Audio Interface
- perform unattended remote broadcasts
- fully programmable output on any key press
- momentary and/or maintained relay outputs
- four logic inputs with programmable output
- balanced audio input and output wth ALC
- seven DPDT relays and one 4PDT relay

Model AFS-3 Audio Failsafe
- contact closure or status voltage on alarm
- adjustable delay period from 30 sec to 5 min
- positive delay adjustment via rotary switch
- internal audible alert--continuous or pulsing
- front panel status indicators and bypass
- dual, balanced audio inputs

Sine Systems inc

615.228.3500
www.sinesystems.com

Digital and Analog Transmitter Audio Switching Solutions, Analog to IBOC!

The AES-302 Digital Audio Switcher/DA/D to A Converter

The CDS-300 Composite Audio Switcher/DA

The CDS-302 Automatic Composite Audio Switcher/DA

Introducing the next generation **transmitter audio switchers** from BDI. Now you can have complete confidence in your signal path with this series of switcher/DA systems. We have **composite** and **digital** solutions for your routing and distribution requirements. If you system is all digital, choose the AES-302 to automatically switch, distribute and monitor your transmitter audio feeds. Still running an analog STL or stereo generator? Use either the CDS-300 or 302 to switch and distribute your baseband audio signals. Select one of the optional modules for the CDS series and convert your analog signal path into an AES digital output suitable for digital exciters and IBOC implementations. Visit our web site and download complete information about these problem solver products.

Broadcast Devices, Inc.
Tel. (914) 737-5032 Fax. (914) 736-6916
Website: www.Broadcast-Devices.com

bdi

Gear Guide: Telephone Audio and Control

Remote Telephone Audio Gear

AEQ

The **Eagle** is a dual-channel Audiocodec that connects to any ISDN line worldwide. It provides a X21/V35 interface for a point-to-point connection. Many radio stations use this feature as a cost-effective STL.

It has Digital and Analog Inputs and Outputs. The two channels can be multiplexed to allow the callers on both lines to interact live On-Air. The talkback intercom uses the microphone/headphones and the Aux-TelSet connection in the front panel. The Eagle can be remotely controlled via the E@sy Software.

It works with the following encoding formats: G.711, G.722, MPEG L II, MPEG LIII and AEQ LD-2, also operates as high-performance hybrid and is compatible with AEQ Hybrid with frequency extender. It is compatible with practically all Codecs available.

AEQ
Phone: 866-817-9745
Website: www.aeqbroadcast.com

ATA Audio

The **Scoop E-Z** can be used with POTS, ISDN, wireless and Inmarsat connections. It includes a two-channel audio mixer with phantom power, a selectable

compressor/limiter, and auto answer and configuration of incoming call type (ISDN/POTS).

At 9" x 6" x 3" it weighs less than 4 lbs. The unit is now available for use with GSM networks by inserting a SIM card into the unit. The Scoop Studio is a 1RU version of the Scoop E-Z without battery backup and mixer functions.

ATA Audio
Phone: 973-659-0555
Website: www.ataaudio.com

Audio Processing Technology

WorldNet Milano is a full duplex, low delay, stereo audio codec designed for Studio to Transmitter Links and Studio-to-Studio networking. The primary X.21 / V.35 data interface is automatically backed up via a single ISDN line for "Mission Critical" applications.

Additional features of the WorldNet Ohio for Broadcasters are Silence Detect, Simultaneous Digital and Analog Outputs, RS232, Contact Closure and Alarm Ports.

The core compression algorithm is Enhanced apt-X™, which ensures an end-to-end delay from Station to Transmitter of under 5 milliseconds. The Enhanced apt-X™ algorithm is in daily use throughout the world delivering superior audio quality over countless networks and is the defacto standard across the professional audio industry.

Audio Processing Technology (APT)
Phone: 323-463-2963
Website: www.aptx.com

Broadcast Devices

The **HSA-100** Headphone Amplifier from Broadcast Devices, Inc. features a balanced, stereo input that accepts -10, 0, +4 and +8 dBm nominal inputs. There are two 1/4" phone jack outputs on the front panel and one on the rear for auxiliary output.

All outputs are controlled by the front panel level control. The unit comes complete with chassis and power pack. The HSA-100 features a rugged discrete transistor output with short circuit protection.

They are ideal for talent station installation or for remote broadcast use. The auxiliary output can even drive a small set of speakers for remote or talent monitor applications.

The HSA-100 is also available in a P.C. board only version for custom installations.

Broadcast Devices
Phone: 914-737-5032
Website: www.broadcast-devices.com

Broadcast Electronics

If you can get a cellular connection, you can do a remote broadcast – just grab your **Digital Cellcast** and go! Operational on most cellular networks worldwide, this portable broadcast studio eliminates the need to have line of sight with the studio to do a remote. Digital Cellcast features a high-quality, four-channel mixer with separate controls for microphones and headphones.

Also included are a line-level input and line-level output; 20 number speed-dial; battery and AC operation; and program audio VU metering. Battery and magnetic antenna are included.

And because it is from Marti, you know that Digital Cellcast is easy to use and rugged enough for your roughest remote requirements.

Broadcast Electronics
Phone: 217-224-9600
Website: www.bdcast.com

Broadcast Tools

The tiny TOOLS™ **TT-1** is more than just an ordinary telephone line coupler. The TT-1 is a compact telephone line powered auto-answer and auto-disconnect hybrid. The TT-1 utilizes dual-hybrid transformers providing full duplex audio at a plain old coupler price.

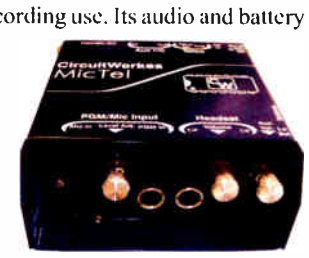
TT-1 features include: Front panel Line Seize button; call Drop button; Auto-answer/TAP switch; Audio mute switch; Off-Hook and Ring indicators.

The rear panel has an RJ-11 jack for the telephone line and a second loop-thru RJ-11 configureable to disconnect devices when the TT-1 goes off-hook. Screw terminals are provided for transformer balanced send and caller audio; remote optically isolated seize and drop functions and one SPDT off-hook dry relay contacts.

Broadcast Tools
Phone: 360-854-9559
Website: www.broadcasttools.com

CircuitWerkes

The **MicTel** is a portable audio interface for both telephone and field recording use. Its audio and battery specifications provide long life and "Broadcast Quality" audio production. For telephone operations, the MicTel replaces the phone's handset to provide high-quality audio for feeding and receiving audio.



The MicTel includes defeatable audio limiters in both the send & receive channels that prevent output distortion or overdriving the telephone line.

Its balanced, studio-quality mic or line level inputs and line level outputs make it an excellent audio interface device for all kinds of remote or in-studio work. The aux. audio channel drives the headphones giving you a portable mic amplifier with an IFB feed.

CircuitWerkes
Phone: 352-335-6555
Website: www.circuitwerkes.com

Comrex

The new **Studio Telephone Access Center (STAC)** from Comrex puts you in control of your talk shows, call-ins and phoners with great sound, ease of operation and scalable configuration.

STAC incorporates a Comrex high-performance dual digital hybrid with automatic level control. A compact, rack-mounting mainframe houses the hybrids, the multiline controller and all telephone and audio connections. STAC is available in either six-line or 12-line configurations.

The attractive, ergonomic control surfaces offer two operational modes for either Studio/Producer operation or a Screener Mode which simplifies the task of screening and queuing callers. The STAC will accommodate use of up to four control surfaces per mainframe.

Comrex
Phone: 978-784-1776
Website: www.comrex.com

Comrex

The Comrex **Matrix** provides a complete remote broadcast system. The 1U Rackmount Matrix is the perfect studio-side "hub" accommodating POTS, ISDN and Wireless GSM connectivity to remote units in the field.

The modular design of the Matrix Portable makes it uniquely adaptable to conditions in the field as well as future technological advances. By itself, it's a high-quality POTS codec providing up to 15 kHz full duplex audio on a standard analog phone line.

The Matrix ISDN Module adds G.722 and MPEG Layer III compatibility. The GSM Module provides up to 7 kHz full duplex audio and doesn't require any additional hardware when used with the Matrix Rackmount.

Comrex
Phone: 978-784-1776
Website: www.comrex.com

Gear Guide: Telephone Audio and Control

Remote Telephone Audio Gear

Conex

The new **DT-90** is the latest in a series of telephone remote control devices from Conex Electro-Systems. The DT-90 provides DTMF control of four magnetic latching SPDT relays, and a four channel audio switcher. Useful in a wide range of broadcast applications, the device allows bi-directional transmission of audio over a dial-up phone line, and features balanced audio inputs and outputs.

The compact unit includes a security access code, and many parameters which may be remotely programmed, including number of rings, and relay operation (interlocking, momentary, follow audio, and independent latching). Connections are made with convenient plug-in terminal strips. A separate audio switcher provides for selection of the audio source to be monitored from the telephone, including an internal mic.

Conex
Phone: 360-734-4323
Website: www.conex-electro.com

Henry Engineering

Henry Engineering's **Audio OnLine** is a multi-message, multi-caller Listener Information System for broadcasters. It uses standard phones lines to efficiently provide listeners with the information they need.

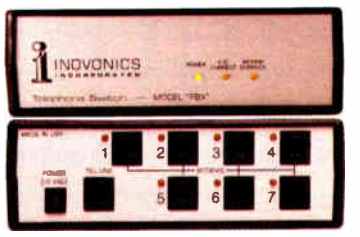
The system is PC-based, and can store up to 999 messages of almost any length. The system is menu-driven and caller-interactive. Callers can select the information they want from a menu, eg. "Press 1 for concert info, press 2 for school closings, etc."

Audio OnLine then plays the recorded message, and tabulates the number of times each message has played. Up to 16 calls can be independently answered by the system. Recording messages can be changed or updated remotely, via telephone, with password protection.

Henry Engineering
Phone: 626-355-3656
Website: www.henryeng.ocm

Inovonics

Say you have a remote transmitter site served by a single dial-up Telco line, but you've got several boxes that need dial-up access: an alarm on the door, a phone on the wall, backup for your remote control, and a modem to adjust processing or to update your RDS.



Inovonics makes a small, inexpensive box they call the **PBX**. It connects to the incoming Telco pair and has seven RJ-11 station jacks for equipment. Outgoing, the first off-hook grabs the line, although one station can be assigned priority to bump others off. Incoming, when you dial the site the PBX will answer, unlock with a 3-digit security code, and put ringing voltage to the station you select.

Inovonics
Phone: 831-458-0552
Website: www.inovon.com

JK Audio

Innkeeper PBX allows you to send mic and line level signals into your PBX telephone system while maintaining excellent separation between your voice and the caller. Simply connect Innkeeper PBX between the handset and base of any telephone system.

The DSP based echo canceller removes your transmit signal from the caller's voice, leaving a clean, talk show quality broadcast signal. The stereo output jack on the back of the unit provides your voice on one channel and the caller's voice on the other channel.

The balanced XLR output jack contains only the caller's voice. Innkeeper PBX provides connections for a microphone, headphones, mixer, and sound card.

Check out our complete line of analog and digital hybrids at www.jkaudio.com

JK Audio
Phone: 800-552-8346
Website: www.jkaudio.com

RAM Broadcast Systems

The **ITB 302** offers leading-edge solutions in all digital telephone broadcast, teleconferencing and communications applications, guaranteeing the highest levels of telephone quality and user friendly operation.

The ITB 302 is a dual line hybrid that features an indispensable mix-minus system. The quality derived from this hybrid is of particular benefit during multi-line conferences and ensures elimination of the Larsen effect, even with poor quality telephone lines.

The ITB 302 uses advanced DSP Technology, producing perfectly natural audio during telephone conversations; a sophisticated echo-canceling system ensures crystal clear audio output bringing to listeners the highest quality sound.

The ITB 302 automatically adapts to all types of telephone lines and eliminates, on each new call, any speakers voice modification or distortion.

RAM Broadcast Systems
Phone: 800-779-7575
Website: www.ramsyscom.com

Sine Systems

The Sine Systems **DAI-2** is designed primarily for unattended remote broadcasts but with the array of features included its uses are unlimited. The DAI-2 combines a telephone autocoupler, a DTMF tone operated controller, audio switching, logic sensing and output relays into an extraordinarily flexible system.

Telephone audio can be used as a source or the DAI-2 can backfeed an external source.

The integrated relay panel includes one 4PDT and seven DPDT relays with LED indicators and pluggable connectors. The optional DB-1 Delay Board can be used to eliminate the brief control tone bursts from reaching the air audio signal. And the CI-1 Composite Insertion module is available for installations were discrete audio is not available.

Sine Systems
Phone: 615-228-3500
Website: www.sinesystems.com

Sonifex

The Sonifex **HY-03** telephone hybrid can be used for any application where a clean telephone signal is required and the line is not subject to delay. This includes radio and TV station call-ins, entertainment venues, audio conferencing and dealing floors.

Features of the HY-03 include fully automatic operation adapting to varying line conditions with automatic signal limiting, local and remote line hold switching, integrated auto-answer after a pre-determined number of rings, a balanced mic/line input, low impedance balanced output with output gain adjustment, line limiter, bandpass filter and output noise gate with preset threshold providing low distortion crystal clear audio. You can also mix the caller output and mic/line input signals to record both sides of the telephone conversation.

Sonifex
Phone: 207-773-2424
Website: www.independentaudio.com

Telos Systems

With more than 10,000 Zephyr codecs in radio stations and production studios around the globe. **Zephyr Xstream** in your rack or remote kit gives you the satisfaction of knowing you've got the industry's number-one ISDN codec, assuring crystal-clear CD-quality connections to anywhere in the world.

In the field, Zephyr Xstream and **Zephyr Xport** are powerful remote tools, perfect for on-location broadcasts, news gathering, interviews and remote studio linkups. New Low-Delay MPEG AAC-LD coding lets you transmit Layer 3-quality audio while reducing transmission delay by up to 70 percent, enabling smooth, natural, high-quality two-way audio.

Zephyr models with built-in mixers and phantom power help reduce inventory and setup time; intuitive controls and simple user interfaces make operation easy.

Telos Systems
Phone: 216-241-7225
Website: www.telos-systems.com

Tieline

The new Tieline **i-Mix G3** codec/mixer features:

1. Your choice of POTS, ISDN and GSM codecs offering 15kHz mono/stereo over ISDN and POTS plus up to 15kHz over GSM.

2. A configurable 16 x 11 Cross Point Digital Matrix Audio Router (DMR).
3. Configurable communications facility for local and back-to-studio live communications.
4. A 7 input and 3 output configurable digital mixer including 5x mic/line, 1x auxiliary and an analog line input plus POTS, ISDN and GSM codec in/outs.
5. A telephone talkback interface for taking live callers in the field.
6. On-board relay and RS-232 control system for local and remote control of equipment plus control of your remote talent's audio input levels from the studio.

Tieline
Phone: 800-780-4750
Website: www.tieline.com

Service Guide: Radio Equipment Products and Services

Service Guide: Radio Equipment Products and Services

Final Stage

Send your information for publication to: **radio@rconnect.com**

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C.E. Position Needed at Morris Communications

Morris Communications Company, owner of Columbia River Media Group, based in Wenatchee, WA, has an immediate opening for a Radio Chief Engineer.

Candidate should have an SBE certification, with 5 years experience in radio broadcasting, with experience in FM, AM directional, hard disk automation, studio maintenance, FCC compliance, EAS, and computers, as well as a solid background in electronics troubleshooting. Candidate should be motivated, dedicated, and ready to play a key role as part of a winning team.

This is a great market, and Morris has outstanding benefits including medical, dental and 401(K). Morris is an EOE. Send resume to: Jay White, Corporate Director of Engineering, Morris Communications Company, LLC, 1321 North Gene Autry Trail, Palm Springs, CA 92262, fax (760) 322-5493 or e-mail, jay.white@morris.com.

Radio Guide Calendar

Email your information to: radio@broadcast.net

Great Lakes Broadcasting Expo & SBE-91
March 7-8 – Lansing, MI – www.michmab.com

IBS International College Radio Conference
March 11-13 – New York – www.collegeradio.tv

Oklahoma Assoc. of Broadcasters & SBE-56
April 1-2 – Tulsa, OK – www.www.oabok,org

SBE Certification Exam
April 19 – Las Vegas – March 1 App Deadline

NAB 2005 Spring Convention
April 16-21 – Las Vegas – www.nab.org

SBE Certification Exam
Jun. 3-13 – Local Chapters – Apr. 22 App Deadline

Northern New England Broadcasters & SBE-110
June 23 – Manchester, NH – bteffner@wcax.com

Texas Assoc. of Broadcasters (TAB)
Aug 3-5 – Austin, TX – www.tab.org

Nebraska Broadcasters Assoc. & SBE-74
Aug 10-12 – Lincoln, NE – www.ne-ba.org

IBC2005 Conference
Sep 8-12 – Amsterdam – www.ibc.org

2005 Fall Radio Show
September 21-23 – Philadelphia – www.nab.org

SBE Chapter 22
Sep 28 – Verona, NY – www.www.sbe22.org

Pittsburg Chapter 20 Regional SBE
Early Oct. – Pittsburgh – www.broadcast.net/~sbe20

Madison Broadcasters Clinic
Oct 11-13 – Madison, WI – www.wi-broadcasters.org

Boscon, Boston & SBE 11
Oct 25-26 – Marlborough, MA – www.bos-con.org

Arizona Broadcasters & SBE 9
Mid October – Phoenix, AZ – www.sbe9.org

SBE National and 2nd Annual Engineering Expo
Oct 10-20 – Grapvine, TX – sandytex@swbell.net

SBE Chapter 16 Regional Convention
October – Seattle – www.broadcast.net/~sbe16

Lightner Electronics Offers Spare Parts and Service for Auditronics Consoles

Lightner Electronics has purchased the service rights and all remaining spare parts for Auditronics console models manufactured at the original Auditronics plant in Memphis, Tennessee.

They are working with many of the original parts manufacturers to arrange for additional custom runs of switches, pots and other components for most of these consoles.

Lightner Electronics has also acquired all the original factory test and calibration equipment; allowing them to diagnose, repair and restore most Auditronics consoles back to factory specifications.

Their service manager, Dwayne Rosko, who has over 20 years experience repairing and refurbishing professional audio equipment, will be the primary contact person for parts and service.

Lightner Electronics inc.
Phone: 814-239-8323
Service@lightnerelectronics.com
www.LightnerElectronics.com

Orban/CRL Mobile Broadcast Laboratory Tour Dates

The following is the Orban/CRL Techmobile tour schedule through May 2005 (subject to change).

Techmobile #1

March 1-4	Dallas, Texas
March 15-18	Oklahoma City, Oklahoma
March 29-April 1	Memphis, Tennessee
April 5-8	New Orleans, Louisiana

Techmobile #2

March 15-18	Orlando, Florida
March 21-25	Miami, Florida

Orban/CRL Tour Bus & Suburban Trailer

April 18-21	NAB 2005 Las Vegas
May 16-20	Phoenix, Arizona

For more information, contact David Rusch at: 480-403-8300 or e-mail at: drusch@orban.com. Information is also available at both websites.

Orban/CRL
www.orban.com
www.crlsystems.com

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Radio Luncheon Keynote Speaker

April 19, 2005
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