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November/December 1999

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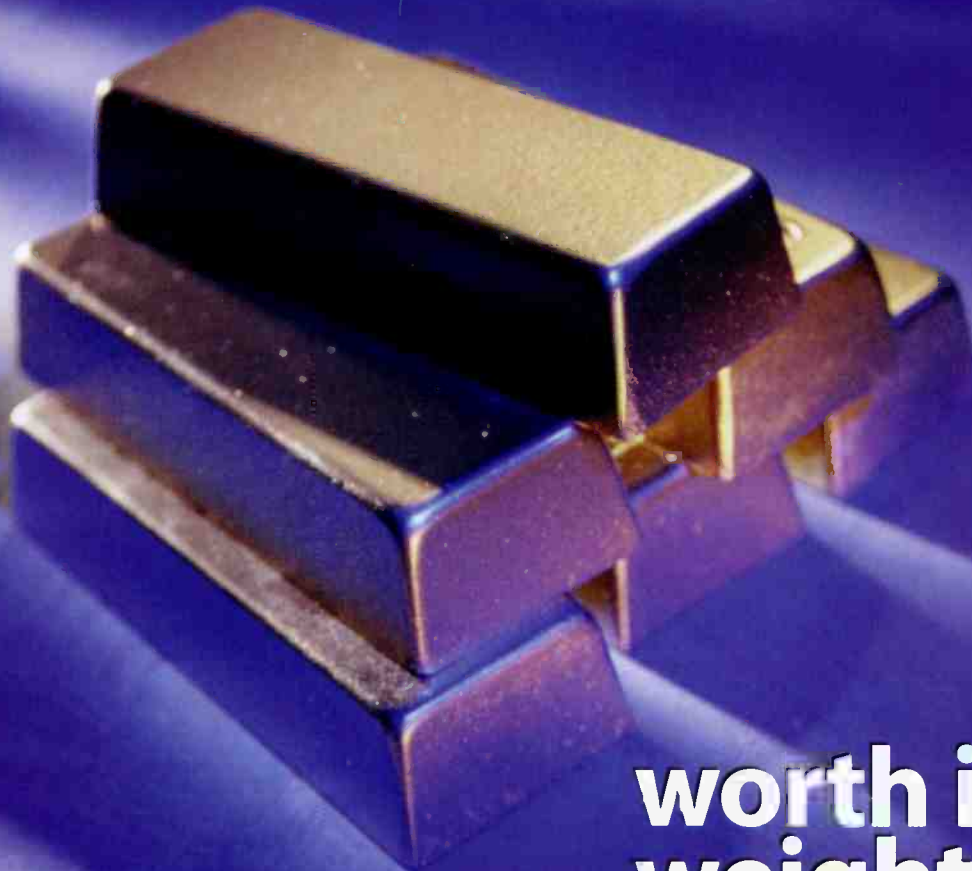
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*Mark Williams, Production Director, WPOC, Clear Channel - Baltimore, MD*



"I was completely impressed by the training offered by Prophet. Both the facilities and the course itself were absolutely first rate. I was able to return to the station and immediately utilize what I had learned. We are in a transition now with the AudioWizard™ handling 100% on the AM side, and about 50% on our FM - and PSi has been with us every step of the way. Even the PSi people regularly go through the in-depth training, to constantly stay on top of the latest features and functions. I really appreciated the attention to detail they put into the class, our comfort and the depth of the knowledge they imparted. It also enabled me to connect names and faces with customer service and tech support there in Nebraska - so now when I call, I know who I'm talking to - and they know me."

*Ken Lovejoy, On-Air Personality, WIKX - Clear Channel - Punta Gorda, FL*

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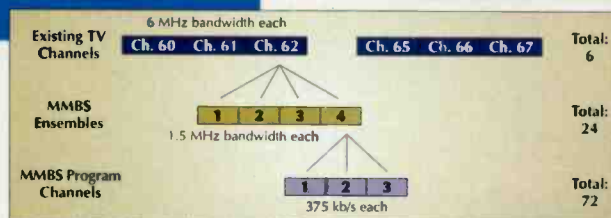
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## Past and present

It's always interesting when another year ends. This year's end is accompanied by all the hype of a new century and a new millennium. Of course when January 1 is here, you'll still have to hear about the coming new millennium, because the marketing world will realize that the 21<sup>st</sup> century actually starts in 2001. Those who have wares to peddle will certainly capitalize on this and continue their efforts for yet another year.

Just like these past few months, radio's overall past is a series of successes won with tried-and-true methods. Radio has been king for many decades and, though competition has stepped up during the last few years, it still has a strong future. The key to radio's future is the same one that has served it so well in its past: It is reliable, portable entertainment.



DAB (whether IBOC or Eureka) continues this tradition. It promises an improvement on audio quality as well as additional services and features. While these will add to the listening experience, radio is and always will be based on audio. Radio

with still pictures or low-resolution video is not enhanced radio; it is poor television.

Radio stations have always controlled both their content

and distribution method. This is one of the IBOC's appeals. A station always has direct control of its transmitter, and since the laws of physics remain constant, the medium itself doesn't change. Internet broadcasting (bitcasting, webcasting, netcasting or whatever you like to call it) changes this model somewhat. Although you still have control of the Web server, the rest of the Internet is out of your control. This is a new situation for broadcasters. Until IP multicast is common and as long as the available bandwidth has limitations, Internet broadcasting will suffer. When it comes to be a reliable, high-quality, stereo (at least) medium, it will be a true competing medium.

Another possibility for the future comes from the wireless industry. Every day, more people are using mobile phones. A recent study shows that, while the number of people listening to the radio in their cars has remained constant, the time spent listening to the radio in general has decreased. In contrast, the time spent on mobile phones has increased. There is a point of convergence here.

The wireless industry is exploring getting into mass distribution. There are already some limited wireless Internet applications available. (How's that for an STL: wired to the Internet backbone and transmitted over PCS.) Ericsson is also working on audio distribution over a wireless network.

It's possible that this is the future of radio: We'll control the audio stream until it leaves the building, then ISPs and wireless carriers will take over the transmission facilities. As we begin Y2K, we'll continue to be the content leaders. We'll just leave the transmission to someone else and prepare for the new millennium.

A handwritten signature in cursive that reads "Chris Scherer".

Chriss Scherer, editor

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# COMREX

## Shielding and grounding

By Ron Bartlebaugh

Shielding and grounding are perhaps the most common design components of any facility. Their science of dealing with power levels varying from megavolts to nanovolts is also perhaps one of the least understood by many broadcast engineers. Properly designed, installed and maintained grounding systems can protect the valuable assets of a facility and are well worth the initial investment. Consistently low-noise figures can almost be guaranteed by employing proper grounding and shielding techniques. However, many of the common practices used in our industry in the past are now either obsolete or need to be modified because of the application of digital technologies in today's broadcast equipment.

### Proper shielding

Careful attention must be given to the quality of shielded cables within a facility. Electrostatic noise may be generated by sparks at the armatures of motors or generators, by gas-discharge lighting (neon or fluores-

low-level audio cables by means of inductive coupling, and the typical electrostatic shield offers no protection at all from these noises. Instead, solid conduit (iron or steel), or simply a substantial physical distance is required to minimize induced electromagnetic noise.

The use of balanced lines should be mandatory for circuits to be properly protected from stray electrostatic noise sources. Any unbalanced line utilizes its shield as one of the primary conductors, thus any noise fields striking the shield will be imposed onto the low-level signals, causing unwanted noise and distortion. Balanced lines always see any noise interference on both of its inputs as a common-mode voltage. The balanced input uses a differential receiving device, either an amplifier or a transformer, which inherently responds only to the difference in voltage between its inputs. By definition, such an input will reject common-mode voltages, since they are identical at both inputs.

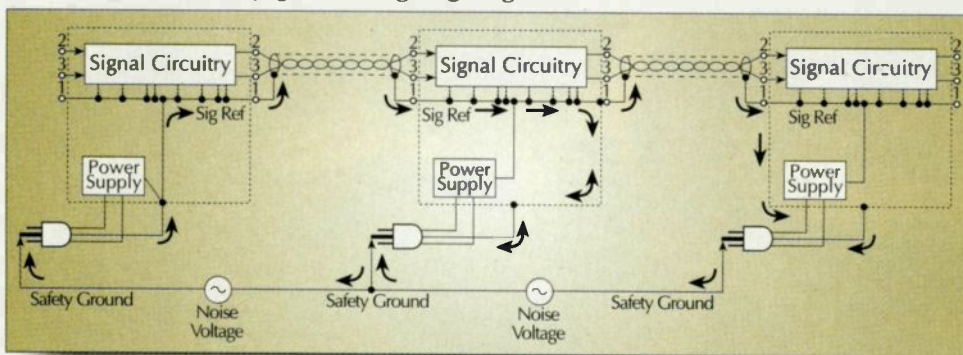


Figure 1. Producing the pin 1 problem. Notice the flow of current through the ground system.

cent), a power cord close to a low-level audio cable, and other sources. Such noise can invade low-level audio cables and components by means of capacitive coupling. Cable shielding such as a metallic braided jacket, a spiral wrapped jacket or a foil tape jacket can reduce electrostatic noise, provided the shield offers a low resistance to ground. Proper cable selection is important.

This electrostatic shielding provides protection against the noise that would otherwise be induced by electrostatic coupling. The effectiveness of the shield depends upon the percentage of coverage of the shield surrounding the low-level audio conductors. Not all cables are created equal; thus engineers would be well-advised to do their homework before selecting cable for use in their facilities.

Alternately, electromagnetic noise may be generated by many sources around the facility. Such noises can invade

infamous pin one problem. Many manufacturers use the equipment chassis as signal ground, shield ground and power supply electrical ground. Figure 1 shows typical examples of this configuration and how noise voltage can travel into the signal path. Figure 2 indicates examples of equipment with proper internal grounding, thus eliminating the pin one problem. Engineers often are unaware of this problem, and end up chasing hum and noise problems that may never otherwise be eliminated. There are safe resolutions for the pin one problem, including the use of high-quality input/output isolation transformers. Under no circumstances should the equipment's electrical safety ground be removed when attempting to eliminate ground loop hum problems.

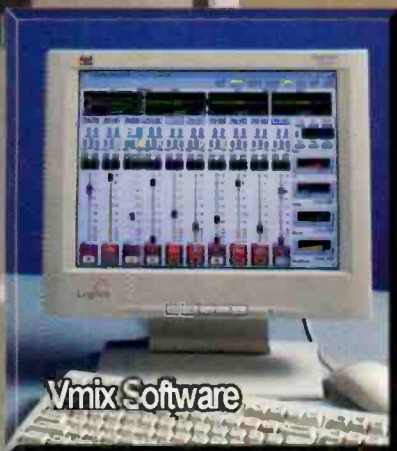
With the operating frequency range of today's digital equipment, the engineer now must pay close attention

### On the ground

Ground loops represent another means by which noise can enter audio circuits. A ground loop is simply a duplicate path to ground from a given component in a system. These ground loops are often generated within equipment designed with what the industry has termed the *pin one problem*. More than half of all audio equipment in the marketplace is believed to have the



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## Contract Engineering

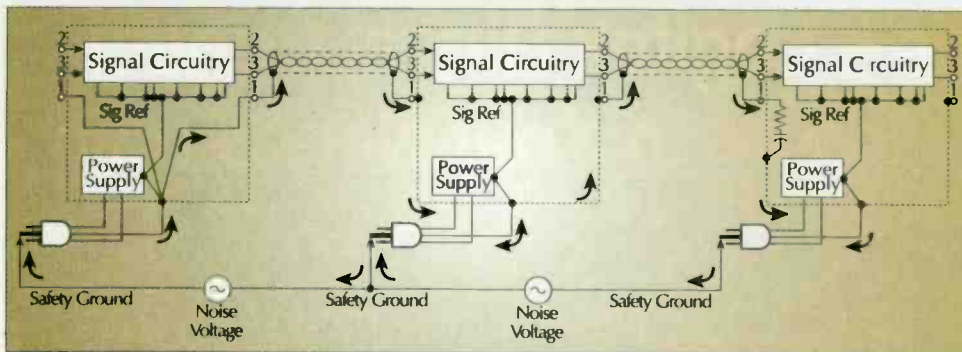


Figure 2. A similar equipment configuration with proper attention given to the flow of current in the ground system.

to the bandwidth of a facility grounding system. An all-digital facility installation typically may employ a signal reference grid (SRG) ground system. The SRG involves the use of a cellular raised floor (computer room-style flooring) under which the SRG, electrical power and signal wiring can be routed. Materials used generally involve AWG 6 bare copper wire or a copper strap of about 0.1 inch thick and 2 inches in width. The crossover points where the junctions are made are typically at 2 feet by 2 feet. SRG designs of this type are typically effective from DC to approximately 25MHz to 30MHz. This is good broadband grounding effective across the entire frequency range needed for analog and digital logic-based equipment.

References: Bill Whitlock-Jensen Transformers Inc., Advanced Grounding & Interfacing, CEDIA 1999.

Martin Glasband, "Lifting" the Grounding Enigma, Mix Magazine, November 1994.

Canare Corporation of America, Evaluating Microphone Cable Performance and Specifications.

Journal of The Audio Engineering Society, Volume 43, Number 6, June 1995.

Figures are courtesy of Bill Whitlock, Jensen Transformers Inc.

Ron Bartlebaugh is director of engineering for the WKSU Stations, Kent, OH, and president of Audio and Broadcast Specialists, Akron, OH.

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## Tomorrow's technical staff

By Barry Thomas, CSRE

**T**he other day, I listened to a program director lament the lack of young, fresh morning-show talent, specifically the non-blue variety.

This PD's situation has been occurring in broadcast engineering for almost 20 years. In the interest of automation, consolidation and efficiency, we have successfully eliminated any entry path into the business for new talent. Now it's not just engineering that is struggling but programming as well.

### Getting started

When many of us started in the broadcast industry, there were entry-level positions available. We may have started by cleaning the AP wire and tape heads (as was the case for me), assisting the chief engineer, working at a smaller

transmitter systems have reduced the apparent need for many RF skills. Studio systems, at least standard broadcast varieties, are being replaced with digital production tools. Production studios resemble recording studios more so than broadcast studios. The next generation of broadcast engineers will excel at handling an even wider range of tasks than we can currently imagine.

### Needed skills

Beyond possessing technical skills, station engineers must act as an integral part of the organization and work in concert with the promotional, programming and revenue goals of the station(s). Broadcast engineers will need to understand the way other departments work to keep from being blind-sided with demands.

The lengthy, gradual education process is no longer as practical as it was for our generation. Yet a place to develop new talent who show technical promise or aptitude is needed. Changes in the industry are clues to finding people to fill your technical needs. The key is investing the time to find these people. If you manage a station or market and have to fill some technical gaps, the time is well-spent finding and developing these sources of talent.

*Computer skills.* New engineers who have computer skills are swallowed up by other industries. But should we simply concede defeat on this?

Local computer-user groups can be a resource for technical people with computer skills. Many involved in such groups are in search of new opportunities or contract customers. These organizations can provide a supply of contract MIS people if not potential station technicians. Notices, list servers and ads posted at computer fairs will give you an idea of how to connect with a group like this. The added benefit of developing ties to this type of group is that you'll have an avenue for furthering your knowledge of computers. These groups can make for excellent SBE programs, thus providing



Assisting on special projects is one way to gain additional experience for both seasoned and new technical talent.

station to reach the elevated position of chief engineer. The experiences we gained were part of the process of earning a position of leadership. The rewards may not have been monetary, but often the successful execution of the job was reward enough. The knowledge we gained on the job as apprentices to chief engineers was at least as valuable as our school or military education.

So what now? Many small stations are combined with large stations and are automated. Multiple facilities are managed by the chief engineer with little or no staff. Where will we find future chief engineers and engineering managers, and will they need to know?

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**Audio skills.** Local weekly magazines are filled with ads for music stores, guitar shops and repair specialists. You probably have a relationship with a couple of these outlets for fast, local access pro-audio gear for your studios. These stores are a source for people who are good with technology and need a career to finance their bands.

**Remote broadcast.** New ISDN and

POTS technologies have allowed stations to get out on the streets like never before. Even automated stations have remotes because they provide an easy way to generate non-spot revenue. Remotes also allow the station to promote itself less expensively. Finding people to do take on remotes, however, can be daunting. Remote broadcasts take an unusual level of resourcefulness and flexibility. Finding someone who is up to the challenge may seem difficult, but

there are resources here, as well.

Promotions usually provides a flow of people working for the station, even some who can carry out remotes. But be careful. Promotions often has the highest employee turnover, and many times the staffer is merely doing the work until the PD gives him/her a weekend shift. This isn't a negative, per se. It's simply a warning to be prepared to do a little selling to keep the person interested.

**RF.** In a recent SBE meeting, one member risked heresy by suggesting that the current LPFM proposal could provide the influx of new technical talent. Despite the LPFM debates, the point is valid. The industry could be turning full circle in that the new, low-power service (legal or otherwise) could provide RF-experienced people. The pirate FM stations on the air today are run by people with a technical aptitude who have been infected with the broadcasting virus. Can we harness these people?

Manufacturers have always offered training programs. These programs are getting more comprehensive in response to the types of engineers who attend them. They should be used as much as possible to update your skill or those of your staff, and to fill the gaps in training that day-to-day operation no longer provides.

In contrast, RF may not be the concern it once was. Transmitter designers are successfully simplifying the operation and reliability of RF systems such that weekly visits and adjustments are not necessary. Once an RF system is installed, it can often be counted on to run for a long time without *any* attention. Transmitters are being built so that repairs are reduced to module replacements. Bench troubleshooting is becoming impractical.

Demand for skilled technical people is increasing, even in this age of consolidation. The jobs are changing drastically, however, and will require new skills and talented people to manage technical facilities. A new breed of engineers is the future and the hope for our increased value.

Barry Thomas is technical director for KCMG-FM, Los Angeles, CA.

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10:27:36



Time	Cart	Title	Artist	Length	Intro	End	Type
16:32:43							
16:32:48	DALIVE	Longo's		03:00			COM
16:36:46	M17	Autism		00:11			VIX
16:36:59	M12	Autism	Daf Leppard	06:58	22		MUS
16:41:53	V001	Young Track 1		00:05			VIX
16:41:58	M17	Party Town	Glenn Fry	02:48	06		MUS
16:44:46	J001	Today's Best Music		00:00			JIN
16:44:54	M05	Listen To Heart	Tom Petty	02:48	11		MUS
16:47:42	DALIVE			03:00			COM
16:58:42				00:05			JIN
16:58:48	M04	Dance You Night	Van Halen	02:47	13		MUS
16:53:35	V005	Young Track 5		00:05			VIX

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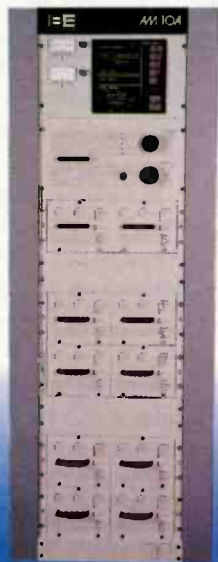
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## Tower inspections

By John Battison, P.E., technical editor, RF

**T**he FCC requires regular tower inspections. Apart from keeping the radio inspector happy if he comes, it is important to maintain a safe and legal tower. Basically, there are three major divisions of tower inspection: *cosmetic*, *mechanical* and *electrical*.

### Cosmetic

The first thing that comes to mind and eye is the tower paint job. Despite its high cost, tower paint doesn't last forever, and it is necessary to maintain the FAA's aeronautical orange (which looks more red) paint hue. Use a *paint chip* card for comparison purposes. White can also become dingy and fail to pass the FCC's eagle eyes. Be certain both shades are compliant.



Tower paint condition is only one item in a tower inspection checklist.

The top and bottom color bands on a tower *must* be red. If you should use a local painter, be sure that he knows and follows the FCC/FAA requirements as laid down in your license or CP.

An unpainted tower with high-intensity lighting will also require regular inspection to check the condition of its plating to protect against rust deterioration.

The FCC frowns on vegetation around a tower base, especially in the case of a DA. Excessive vegetation can affect the base impedance by effectively changing the distance between the tower base and ground.

Check the fence for serviceability and soundness.

Locks and hinges need to be lubricated and paint applied as necessary. Radiation warning signs should be inspected and replaced or repaired as necessary.

There is uncertainty as to exactly where the commission wants the tower registration data displayed. It is best to label each tower with its number on its base fence. Where a circumferential fence is used, it is best to put the number and other data on the fence by the entrance in addition to the towers themselves. This allows an inspector to see the numbers without requiring field glasses. Some licensees also add a telephone number for emergency use.

### Mechanical

It is easy to become accustomed to a slight warp in a tower. For AM, this is not quite as important as for FM, especially when a multibay, high-gain FM antenna is used. A small amount of FM beam tilt can deprive an important area of good service. It is worthwhile to have your tower surveyed for vertical correctness, especially if you have received complaints of poor service from a particular area. In an FM DA, a small warp can disturb a carefully adjusted pattern and cause many headaches.

Rust can develop in towers with tubular members. It can also develop at welded and mechanically secured unions using bolts and nuts. Look for fatigue cracks in a tower that has been battered by strong winds. Strong winds tend to make towers vibrate or sway. A warp or bend in a tower could signify guy wires badly in need of adjustment or it could be caused by tower or guy anchor settlement.

Even the best concrete can deteriorate and break up. Footings should be examined below the immediate surface. Guy anchors can rust and turnbuckles can sometimes unscrew when locking wires rust and fall away.

Guys should be checked with a *tensiometer* and guy insulators examined with field glasses. It seems to me that guys are not greased as often as they used to be, but it's a good practice to keep them free from gathering rust. (By the way, watching a man slide down a guy in bosun's chair is quite a sight.)

For AM towers, there are additional concerns. A series-fed tower requires a large base insulator. Check this carefully for cracks and be sure that the weep holes are clear. Replacing a base insulator is by no means an easy task. Grounded folded unipoles need to be checked for guy insulator failure and mechanical damage to skirt wires. If possible, have a man go up the tower to inspect all the shorting stubs from drop wire to tower. Intermittent and corroded connections can cause unexpected antenna changes.

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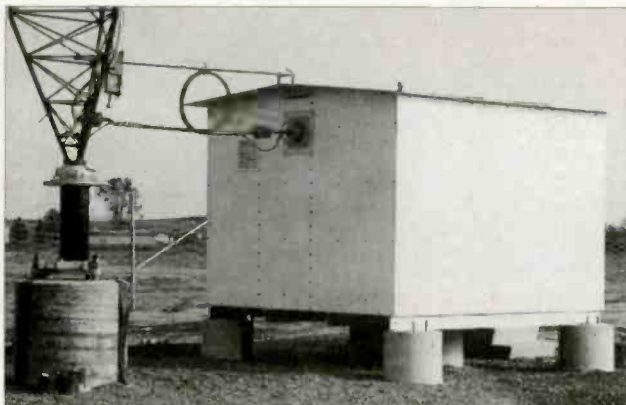
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Inspect the one- or two-loop copper tubing that forms the RF drive connection from the ATU to the tower. If it is bent out of shape or is no longer a good round loop, replace it. Be sure the tower-end connection is clean and free from corrosion and rust. If the lighting power is taken through this tube, check for frayed and failing insulation. Measure the lightning ball spacing and reset if needed.

Check the tower lights at night for proper beacon operation. Check the electric-eye in daylight for proper operation. A clamp-on ammeter is useful here. Follow the manufacturer's manual for maintenance of high-intensity lights, and be sure to examine all cables from the control box.

While you have the ammeter handy, clamp it on the FM antenna heater line and check for open heating units. You should be able to read the rated power for each unit.



For AM tower bases, check the base insulator, spark gap and all the electrical connections. Photo by Tracey Liston.

A good tower installation practice is to bond all tower sections for electrical continuity. Unfortunately, not all owners are willing to pay the extra cost of brazing or welding. If this practice has been followed, these continuity jumpers should be checked for continued function.

A frequently neglected item is the tower-mounted DA sampling loop. The coax connection should be cleaned and reinstalled and the loop mounting tightened. It is vital not to disturb the placement of these loops. If their orientation is changed the antenna monitor will no longer read correctly.

Examine the isocouplers or quarter-wave isolating stub to be sure all connections are sound. Include any audio lines in this inspection.

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## The other DAB

By Skip Pizzi, executive editor

In July 1999, the Consumer Electronics Manufacturing Association proposed to the FCC a new broadcast service that is essentially DAB by another name. Called the *Mobile Multimedia Broadcast Service* (MMBS), CEMA filed the proposal in response to an NPRM on the reallocation of some soon-to-be-reclaimed UHF-TV spectrum (Docket 99-168). The action covers spectrum currently occupied by TV channels 60-62 (746-764MHz) and channels 65-67 (776-794MHz).

CEMA envisions a service that includes multichannel digital audio (5.1 channels) plus auxiliary data, with robust coding and modulation suitable for mobile reception. The auxiliary data could carry *program-associated data* (PAD, content associated with the audio program) or *non-program associated data* (NPAD, independent content).

### A variation on Eureka 147

A strawman format CEMA has proposed mirrors the Eureka 147 DAB format in that it uses COFDM coding, DPQSK modulation and a 1.5MHz channel bandwidth. Unlike Eureka 147, however, MMBS includes only three (rather than Eu-147's usual set of five) program services

no market can use all channels because of the need for adjacent-channel protection in neighboring markets. CEMA's proposed frequency-reuse plans that accommodate such protection might reduce the number of MMBS program channels in a major market to as few as 12. Some observers feel 30 channels is a more probable lower limit.

Very long guard intervals are employed in the COFDM format suggested, allowing F(90, 90) coverage at up to 120km/hr speeds. The trade-off is a substantial penalty in program capacity, however. Whereas the same 6MHz channel can carry approximately 18Mb/s in the TV flavor of COFDM (the DVB format), the longer guard interval in the MMBS proposal would only allow a total of 4.5Mb/s to be transmitted. This is the price paid for reliable broadband mobile reception from a terrestrial source — the most difficult of all transmission channels.

The format is also optimized for transmission at 770MHz, which has advantages over L-band (1500MHz) or S-band (2300MHz), where other COFDM-based mobile audio services for North America have been proposed (Eureka 147 in Canada and S-DARS in the U.S., respectively). MMBS also assumes the use of multiple, low-power transmitters, fed either by synchronized links for single-

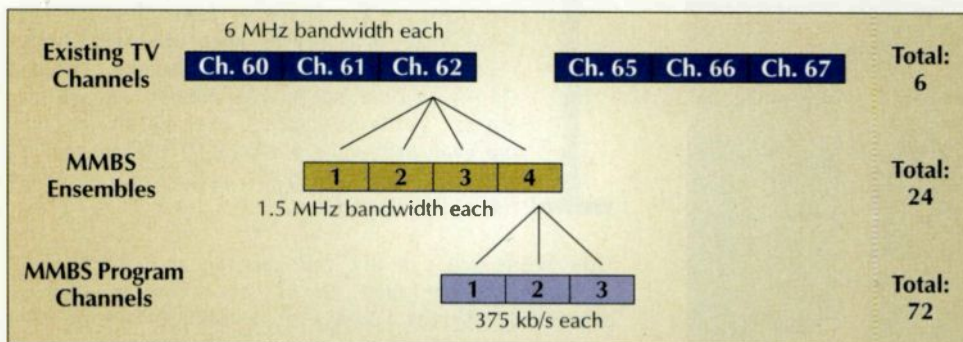


Figure 1. Proposed MMBS channel allocation (for clarity, only a single TV channel is detailed). Each MMBS program channel provides a 5.1-channel digital audio signal plus 64kb/s of auxiliary data.

per RF channel (or *ensemble*), each of which runs at 375kb/s. This data is assigned as follows: 288kb/s for multichannel audio, 64kb/s for PAD/NPAD and 23kb/s for forward error correction. Three such channels are multiplexed into a 1125kb/s bitstream, which is robustly channel coded at 0.75b/s/Hz into the 1.5MHz ensemble.

At this channel bandwidth, each UHF-TV channel (6MHz) could accommodate four MMBS ensembles. The entire band of six UHF channels therefore allows 24 such ensembles, carrying 72 audio/data program channels (see Figure 1). Like any local broadcast service band, however,

frequency networks (SFN) or simple off-air repeater operation. In either case, much lower total power (and, in most cases, lower antenna heights) can be used to provide equal or better coverage than a single high-powered transmitter. Either type of multiple-transmitter design also allows for greater spectrum reuse due to tighter pattern control.

The advantage of SFN over off-air repeating is the allowance of greater distance between transmitters (~50 km), roughly double the spacing possible with simple off-air repeaters (~25 km). The dedicated links used in an SFN instance allow discrete control of the relative timing between transmitters, which expands the usable service area between transmitters at a given guard interval. Its downside is the additional cost and complexity of multiple STLs, which the off-air repeater approach does not require. The obvious downsides of either multiple-transmitter method are the requirement for space rental at numerous individual locations and distributed maintenance duties.



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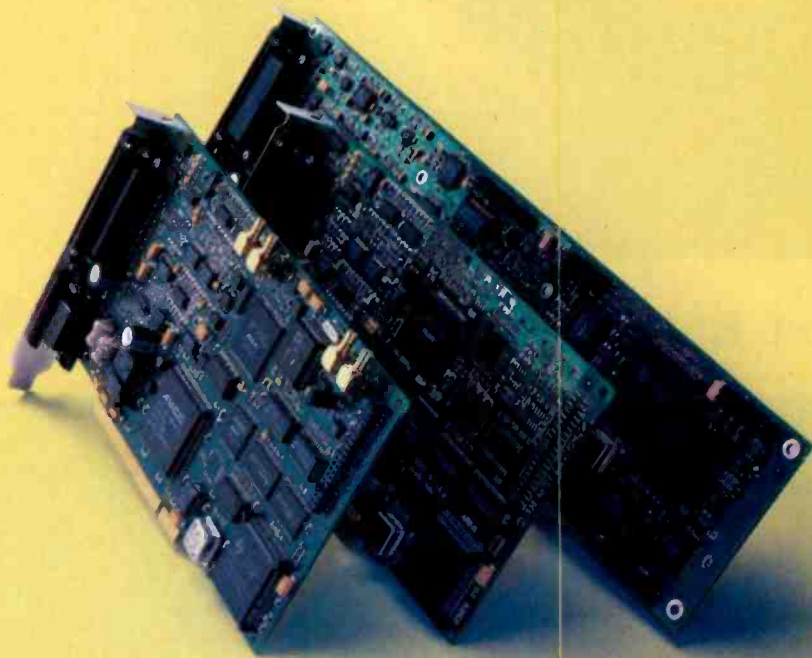
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## Next Wave

### An uncertain future

It was initially believed that this spectrum would be auctioned after January 1, 2001, for availability in 2006. Congress has since ordered that this spectrum be auctioned prior to September 30, 2000, so the proceeds can be collected during FY2000 to be applied to the current fiscal year.

Even before this acceleration, insiders felt MMBS would have an uphill battle, given the current FCC's proclivity toward more flexible, open-market, wireless telecom-oriented applications of such reclaimed spectrum. CEMA's MMBS proposal would have called for the FCC to take a more proactive stand and mandate that the entire reallocation be assigned to create a new local, terrestrial, nationwide broadcast band, including a single technical transmission standard. Had the format been approved, Congressional requirement for auctioning of the spectrum would have opened the door to competing interests with deep pockets, leaving many broadcasters out of the game.

Meanwhile, the NAB has expressed its displeasure over the MMBS proposal, citing the new service's threat to existing radio broadcasters, who already face other emerging competition. NAB is also concerned about the potential for interference to existing analog UHF TV broadcasters in and adjacent to the proposed MMBS band.

Finally, CEMA wants MMBS to be a free service. But the speculative, high entry-cost nature of auctioned spectrum does not fit well with the free broadcast business model.

The MMBS proposal CEMA has presented is elegant and well-crafted technically, but a compelling business case is hard to identify in the auctioned spectrum context. In an environment more favorable to broadcast interests, however, it could become the basis of an ideal DAB solution. Unlike S-DARS, MMBS is a local, terrestrial service. It could serve fixed and portable devices equally well, without the need for large, complex antennas. If nothing else, CEMA's work here might have value as initial R&D for some other new-band DAB that the FCC now seems open to considering.

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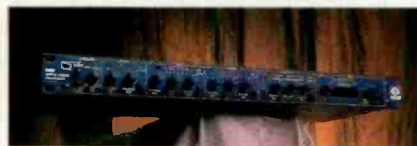


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## Old CPs given new life

By Harry Martin

**T**he commission has added a year to the construction period of permits outstanding as of February 16, 1999. This will allow more time for construction of those stations that have less than a year left under their construction permits when the FCC changed the standard from 18 months to three years.

A number of parties filed petitions seeking reconsideration of the FCC's decision to apply the new three-year construction period to old construction permits. Some parties argued that the application of the new rule to such permits was impermissibly retroactive or insufficient notice had been provided.

The commission rejected both arguments in the reconsideration order. Nevertheless, the FCC will provide relief to permittees who held a valid initial authorization or extension as of February 16, 1999, the effective date of the initial streamlining order. For these permittees, the authorizations will now be automatically forfeit either one year from the effective date of the reconsideration order or on the existing expiration date, whichever is later. The commission also stated that, in appropriate circumstances, its *tolling* provisions could be applied to the one-year extension period.

In the initial streamlining order, the commission determined that it would no longer extend construction periods but that it would allow for tolling of those periods under certain extraordinary circumstances. On reconsideration, the commission affirmed its conclusion that zoning difficulties generally would not be considered as a circumstance justifying tolling of the construction period. The only exception would be judicial review of a zoning decision. The commission reasoned that diligent permittees would find a way to surmount zoning difficulties by either securing an alternate site or finding a way to obtain the necessary approvals. Tolling also will apply where there is a failure to meet a commission-imposed condition prior to commencing operation. For example, in some cases in which a station seeks to change its channel, and that channel change requires a change in another station, the permit issued to the first party will include a condition that the second station commence operations on its new channel prior to program tests for the first station. Likewise, when a station has completed construction and commenced operation pursuant to Special Temporary Authority but cannot file a license application because of special circumstances, the construction permit will not be considered forfeited.

Otherwise, the events that justify tolling are "acts of

God," such as natural disasters, which prevent construction and judicial or administrative review of the grant of the permit itself.

### Fines issued for broadcasting phone calls

The FCC has fined three separate radio stations for recording or broadcasting telephone conversations. Radio stations in Georgia, Illinois and California must each pay \$4,000 for their violations of The FCC Rules, which requires a licensee to notify all parties of a telephone call that the call will be broadcast prior to recording or broadcasting it. An exception exists for callers to call-in shows.

The FCC stated that a station couldn't delegate the responsibility of notifying a party that a conversation will be broadcast. The Illinois station broadcast a segment in which a listener and the on-air personalities phoned a listener's relative. The station had a policy requiring the listener to place a presegment call to the relative to advise the relative that the station would call, and that the call would be recorded and broadcast. The FCC still found the station to be in violation of the FCC Rules, which require stations to directly notify participants that a call will be broadcast or recorded.

In the other cases, the stations admitted on-air personalities had broadcast telephone conversations without first notifying the call recipients that they were being broadcast. Two stations advised the FCC that their on-air personalities were reprimanded, and all other staff were reminded of the FCC Rule. One station formally apologized to the person called; the other station apologized and gave the person called dinner for two at a local restaurant. None of these circumstances mitigated the violation: Each received the standard fine.

All station staff should be aware of the restrictions on broadcast of telephone conversations and should know that only station personnel may notify persons who are called of the intended broadcast of a call.

*Harry Martin is an attorney with Fletcher, Heald & Hildreth, PLC., Arlington, VA. E-mail martin@fhh-telcomlaw.com.*

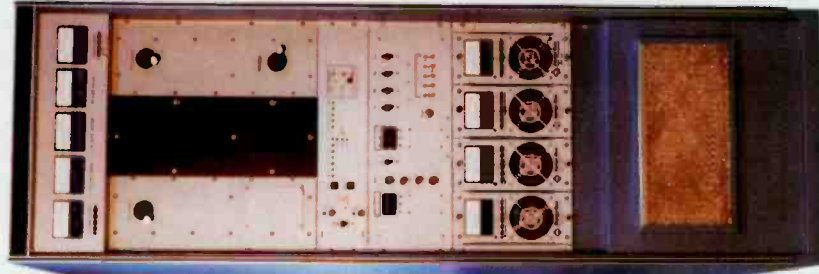
## Dateline

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# NAVIGATING THE TECHNOLOGY MAZE

By Chriss Scherer, editor

*A look back at the year's technological progress.*

**A**s an engineer, understanding and keeping up with technology is a crucial part of your job. If you have a problem in one of your studios, or if you need to design a new facility, you will be entrusted to know all the choices available and to select the best ones for your stations.

Every month, *BE Radio* helps keep you informed by bringing you coverage of the latest radio-industry technology. Developments are increasingly occurring in the digital realm.

Digital audio is no stranger to most facilities. Although some stations are

still supporting a completely analog infrastructure, others have fully immersed themselves in digital audio chains. Chances are, your facility falls somewhere in between. Over the coming months, you will probably add more digital audio capability.

The first rule in handling digital audio is to treat it more like RF and less like DC. Wire and cable must be properly selected to carry the signal. Routing and distribution must also be considered. Multiple taps on an AES3 signal are not allowed. Any signal

splitting must preserve the signal level and impedance.

The first digital audio device in your control room was probably a CD player. You used the analog outputs, but it was potentially a digital source. Other equipment has trickled in that also takes advantage of digital signals. Unless you have built a new facility from the ground up, the conversion to digital has most likely been slow and gradual.

One piece of equipment whose analog roots have stayed firmly planted is the console. The first digital



consoles were introduced a few years ago. Not many stations jumped on-board right away. Because the console is at the heart of the control room, taking the first leap of faith is difficult. Digital consoles are finding more acceptance as they prove their metal.

## Two ways to go

Most digital consoles available today fall into one of two basic types. The first is a direct equivalent to the analog predecessor. Like an analog console, all the connections are made directly to one input or output. A single source must be connected directly to each input location where it will be used. All of the connections are made directly to the console. For analog sources, a bridging input impedance will allow some flexibility in more than one connection. For digital sources, a digital audio splitter will be needed. This style of console is along the lines of traditional radio consoles; it allows a facility to install a digital console into an existing environment without many additional changes.

The other type of digital console has a different personality and adds the enhanced features typically found in audio routers. One of the primary functions of any console is to route audio signals. This level of routing is not complex and usually consists of assigning a source to an output with some degree of level control. Building a console around a router further integrates the functions of the two.

Inputs and outputs for this style of console are usually accommodated through a controller or audio engine.

This component can typically be placed quite a distance from the console control surface, which communicates with the controller via a communications bus.

Both console styles can usually be configured on the fly as well. As program shifts change, so can the console's configuration. Sometimes, a series of presets can be saved, much like scenes on a lighting controller. The routing style models can also remap their inputs.

Channel labels are displayed on readouts. As the source is changed from one device to another, the readout will reflect the change. Some console manufacturers are taking this one step further to communicate with the on-air delivery system, so that song, artist or spot information is displayed as each event is played. Instead of adjusting the console level on automation system output three with a label such as *AUTO3*, the user could instead adjust *Vivaldi* or *Matchbox 20*. The AES18 standard (see sidebar p. 32) allows for some user data to accompany a digital audio stream.

## On-air playback

A considerable number of systems are available for on-air audio playback. These systems have matured since their introduction. Their features range from direct cart replacement to feature-heavy, highly redundant, multistation systems. Windows 9x and NT are common operating systems. Some systems run on DOS and Macintosh. Some manu-

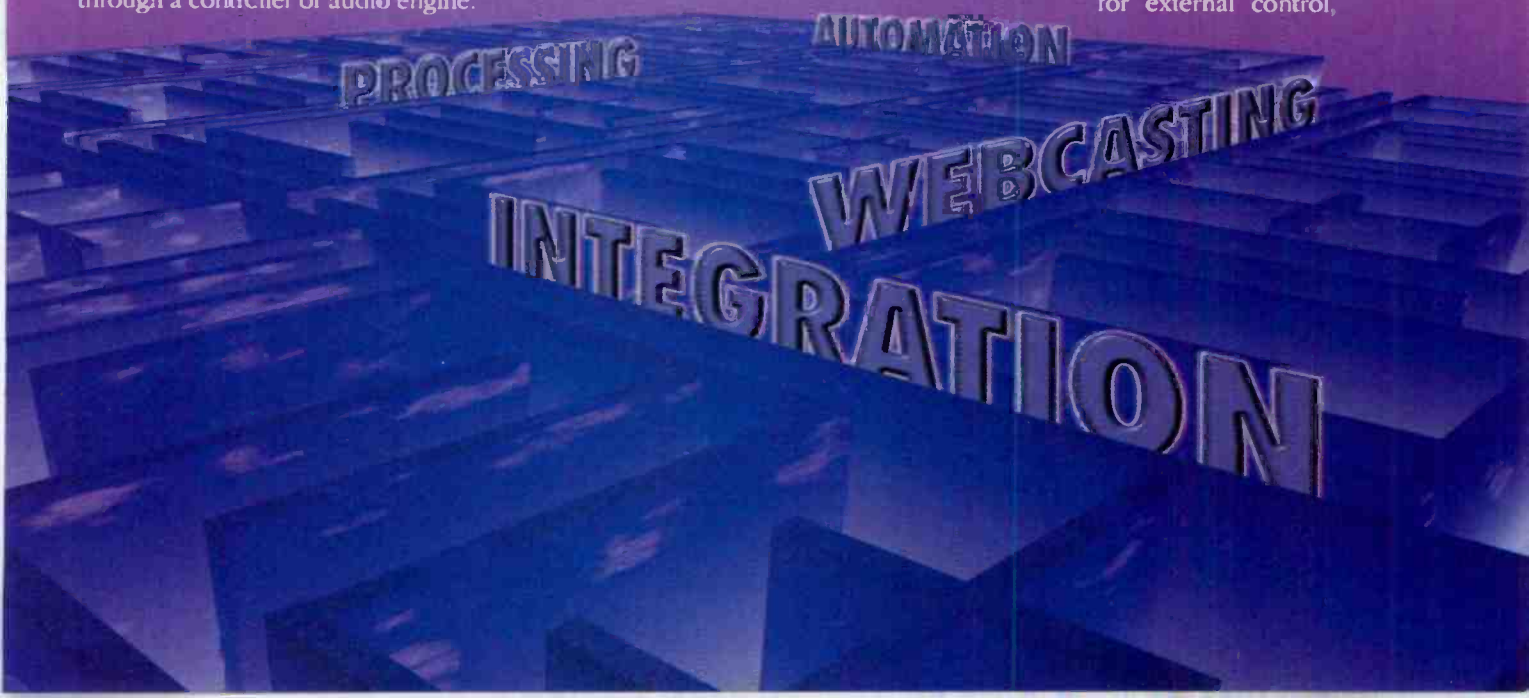
facturers are looking at Linux as an OS. A few such examples were represented at the NAB99 convention.

Cross-manufacturer communication between different systems is a concern some stations have faced with consolidation. Existing files and audio archives will need to be made available to another system. Communication with digital audio workstations (DAWs) is also common. (For more on DAWs, see page 34.)

Most computers in use around stations are already connected to a network. While there may be (and if there is not, there probably should be) separate networks for on-air and office functions, a bridge can be installed to allow cross communication. The most common links are to the music scheduling and commercial-traffic databases. Other links may be needed, depending on the facility.

Computer networks have also grown to include the DAWs. Once stand-alone islands, facilities with more than one DAW can network their units for greater flexibility and file sharing. Even systems from different manufacturers may be able to share common files. If one producer prefers a system for music editing and another favors a different system for commercial production, the same files can be created and shared between the two.

Networking has moved to equipment that is not always considered a computer. Microprocessor control and/or DSP are common in much of the equipment in a facility. Most of these devices also have the capability for external control,



typically by a serial port. If data can be sent and received externally to a device, that device can also be made accessible through a network. A serial to IP interface can be used to make a device available almost anywhere. Some equipment takes this a step further, adding a network interface card (NIC) or other built-in means to make it available as an IP address. Remote access to equipment is a valuable tool for routine checks or trouble analysis.

## Transmission

An early stage of the transmission facilities is a station's audio processing. Processing is one area where DSP and microprocessor control have made significant advances. Remote access to audio processing is also a valuable tool. The ability to recall settings or even copy them to another processor can aid processing setup, modify processing for dayparts and establish baseline parameters for a new installation.

Processing an on-air signal is nothing new. Processing an online signal is. Although webcasting does not yet offer the financial benefits of broadcasting, more stations are using the Web for audio streaming. This content may simply be a simulcast of the air signal, or it may offer a separate program feed. Just as audio processing is used to maximize the RF broadcast signal, it can also be used to maximize the Web signal.

## Getting from here to there

By Bob Leighton

Reconsidering the way you have thought about satellite-delivered audio is the key to streamlining the process. Treat satellite programming as data and you will greatly simplify the process of routing the programming stream to its destination. This approach will also provide opportunities for minimizing your maintenance requirements and eliminating excess hardware.

### Infrastructure issues

One challenge many stations face is that their existing audio routing infrastructure is built around satellite requirements that are far less demanding than current needs. It is designed around an analog paradigm in which things happen sequentially. Specialized audio switchers and distribution amplifiers feed material throughout the facility on dedicated audio cabling. Timing must be precise. Delays and missed cues are inevitable as the audio is transported from point to point in the station. In this system, additional switchers and DAs do not alter the speed of data transfer or improve its flow. When idle, these devices are an investment your station is not making the most of.

An alternative involves computer technology and high-speed networks. This approach requires us to stop treating the incoming satellite feed as audio. We must concede that it is digital data, which can be moved much more quickly than analog data.

### A change in the picture

You probably treat audio as data in one sense, with your station's digital audio management system. If your system is centralized, it coexists with your routing infrastructure (see Figure A). In this example, there is a significant duplication of hardware. Each studio is equipped with a PC (the blue elements) and a switcher for satellite material (the red elements). Each hardware network also has its own wiring between locations: dedicated audio cable for the switchers and a standard CAT5 cable for the PCs.

Audio as data, however, is flexible enough to be conveyed along the PC cable. This means that, if a method can be created for capturing satellite material directly into the PC-based digital audio system, the parallel distribution structure of switchers and DAs becomes completely redundant.

Figure B illustrates one such approach, using a PC designated for network capture as the portal for audio from the satellite receivers to enter the digital audio system. Depending on the audio card configuration used, this single PC might handle up to eight separate satellite feeds, delivering them directly to the system in real time.

Because the network stores the audio as it is received, many playback scenarios are possible. When the need is immediate, the satellite material can be streamed directly to the control room, where it is aired as well as played into the system for later use. If a voice call or music cut has run over by several seconds, the feed can be fractionally delayed. When playback hours or even days later is needed, the material can be stored in the system for later access. At this point, it becomes much like any other cart in terms of how it's handled

in the schedule. The material can be edited into separate segments, voice-tracked or used simultaneously by multiple stations on the system. This simplifies matters for the operator. Instead of switching in material from secondary sources, everything appears on screen in a familiar, easily managed format.

### Nuts and bytes

Apart from the operational advantages this approach presents, there are significant gains in budgetary and maintenance terms. Several pieces of equipment are eliminated and replaced with PCs, which either are already in the station's possession or will almost certainly be more affordable than dedicated black boxes. Workspace in the studio is freed. Maintenance time, stocking of spare components and potential factory service are reduced. Expansion and improved performance become a matter simply of adding memory or audio cards or recycling the PC hardware to another area of the station in favor of a recent, faster model.

More than ever before, the PC is a fixture in any radio station operation; it probably already performs tasks that might at one time have required racks of gear to accomplish. By applying its power to distribution of your satellite programming, you enable this part of your operation to move smoothly into the fast lane, and you take a step closer to an all-digital facility.

Bob Leighton is programming manager at CBS/Custom Business Systems Inc., Reedsport, OR.

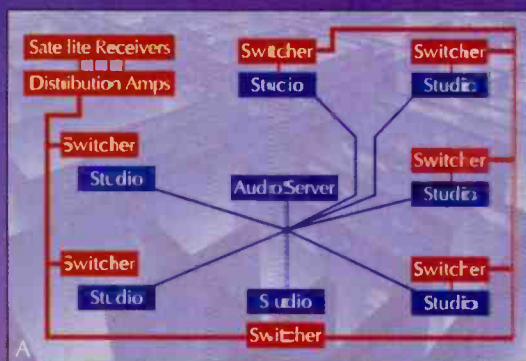
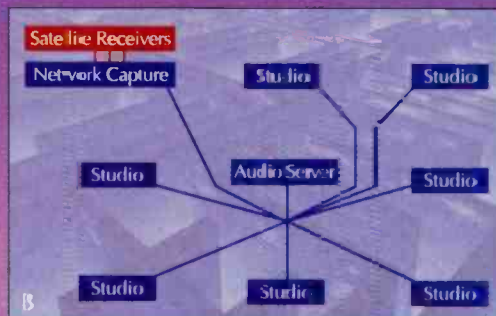


Figure A shows series distribution for switchers and DAs. Figure B shows the same studios with parallel structure distribution.



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# THE TECHNOLOGY MAZE

The biggest difference between processing for on-air as opposed to processing for online is that webcasts do not have pre-emphasis/de-emphasis curves to follow. It is important to understand and

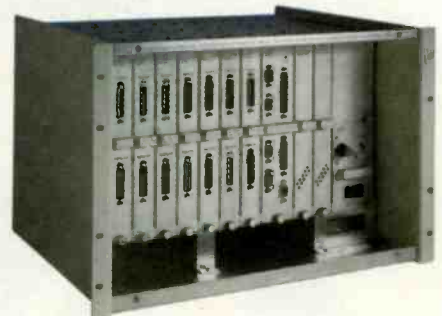


work with the high-frequency boost used for the broadcast medium. This is not a consideration for the Web.

**Process online audio streams with the same care and attention you give the station's broadcast signal.**

The signal source for webcasts ranges from a radio receiver to a dedicated, linear audio path from the station to the ISP. For stations that do have a dedicated feed, the decision may be made to use an old audio processor for the webcast processor. This solution may provide satisfactory results for some. If you go this route, be sure to eliminate any pre-emphasis/de-emphasis networks that may be in place.

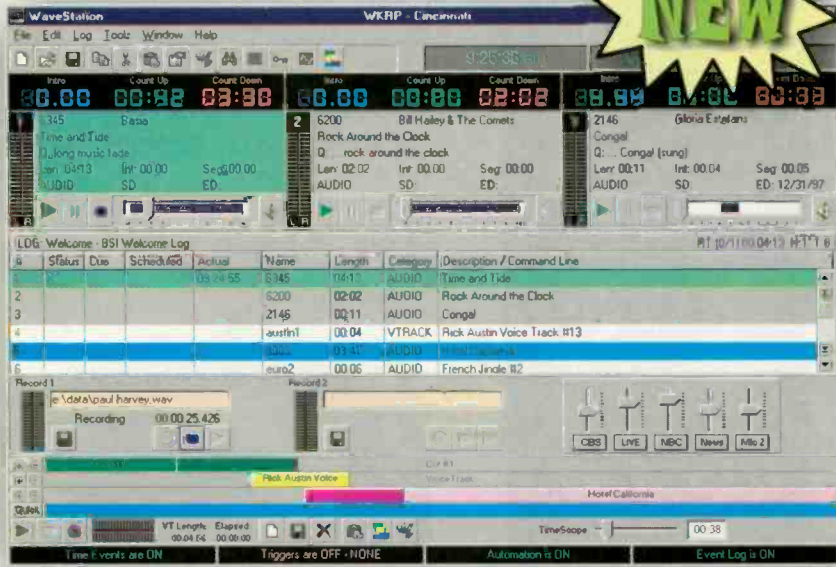
Advances in media streaming have also occurred. New coding algorithms and enhancements to those that already exist allow improved performance with more robust signals and a reduction in required bandwidth. Webcasting will continue to grow in popularity and practicality as algorithms become more robust and adequate bandwidth is consistently available.



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### The RF side

For many stations, upgrading the STL to digital has provided substantial improvements. It is common to find an STL path that has significantly degraded over time, but the effect has not been noticed because the change occurred gradually. Both wired and wireless STLs provide a cleaner path to the transmitter and usually provide additional communication paths.

STLs over T1 circuits offer a return path that can be used for remote control, remote audio feeds, data and

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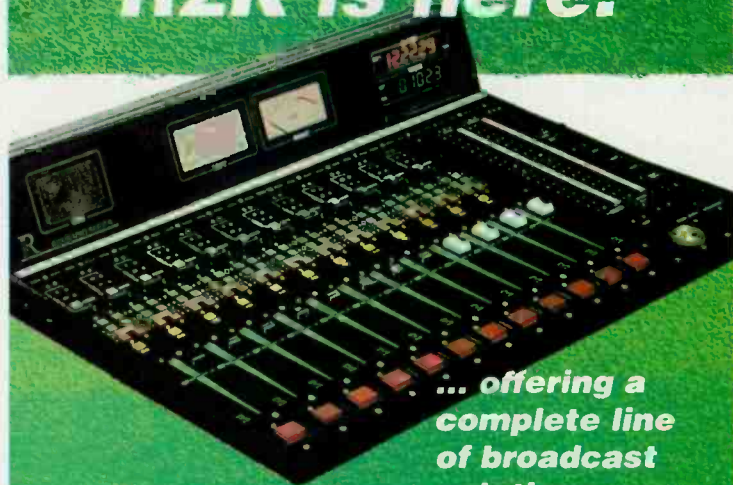
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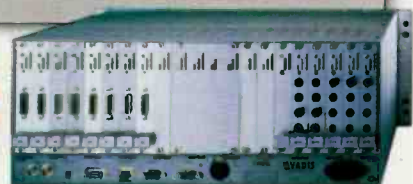
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## THE TECHNOLOGY MAZE

other functions. Digital RF STLs allow you to transmit data and sometimes even additional program channels. Both have excellent audio specifications, but care must be given to their maintenance. Unlike analog units, they do not fail gracefully. If neglected, a signal can degrade over time until the error correction can no longer compensate for the



Centrally locating a console audio engine can reduce facility cabling requirements.



loss. Once the digital cliff is reached, you're off the air.

Solid-state transmitters have also made it on their own. Increased power handling per device has brought down size and operating requirements to make them the perfect choice for some installations. Solid-state transmitters also offer broader bandwidth and better linearity, which affords a potentially extended life-span in an IBOC future.

### AES-18

#### Passing the data

Distribution of digital audio signals in one of the two AES3 formats is common today. Most stations and engineers are comfortable with digital audio routing needs within a facility. Because digital audio is a data stream, routing it is more like computer network routing and less like its analog predecessor.

One variation to the AES3 standard has useful applications for radio. The standard, called AES18-1996, outlines the application of and guidelines for user data that can be imbedded within the audio stream. The user data may comprise any data that fits into the specified format.

Transmitting additional data along with the audio is part of the design of RBDS. Many stations have implemented RBDS on their carriers to transmit only clock and station ID data. Getting the artist and song title information to the RBDS encoder has often been an obstacle.

AES18 offers an ideal solution. Many stations are playing audio from a central storage system for on-air playback and the song title and artist name is already attached to the audio file. Keeping this text information with the audio information is exactly what AES18 was designed to do. As a song plays from the file server and the AES3 audio is routed throughout the facility, the title information goes with it.

One drawback to this idea is that equipment that can pass AES3 digital audio may not be able to pass the AES18 data intact. Also, the source equipment must be able to deliver the program data. It is possible to add the program data into an existing AES3 signal, transmit it through the facility, and then extract the data at the transmitter.

Look for this technology to gain popularity and acceptance over the next year. Another application to the AES18 standard is DAB, which inherently has an imbedded data stream.



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# DIGITAL

By Kevin McNamara, CNE

*Deciding which type of DAW to buy can be a daunting task, but the decision becomes easier once you determine your current and future needs.*



A DAW's flexibility and speed can lead to greater creativity.

# AUDIO

The days of constructing a studio facility are history. Concerns have shifted to integrating the facility so all the new digital audio-based devices will seamlessly work together. Okay, maybe not exactly seamlessly, but we're getting much closer.

Wondering what console or CD player to buy has been replaced by concerns about architecture and protocol. Even after these and other critical infrastructure issues have been addressed, you still have to make what is perhaps the most stressful decision: what equipment to buy.

This decision is complicated by the harsh reality that digital-based audio equipment

has firmly planted roots in some form of PC-based technology.

Moore's Law speculates that the speed of these devices doubles every 18 to 24 months. This is a major concern for anyone responsible for purchasing technology these days. Using the same logic, it's reasonable to expect that each generation of a particular device will have improved audio and noise specifications, will interface better with other equipment, will provide a more comprehensive menu of features and will be easier to use than earlier versions because of similar

improvements in *Digital Signal Processor (DSP)* technology.

## Form and function

Digital audio workstations (DAWs) come in two general forms:

1. PC- or Mac-based systems with associated software. These systems typically use high-quality digital audio cards and, in some cases, external control surfaces and/or output devices. They range from a built-from-scratch approach — a PC customized with the appropriate hardware running your favorite audio editing software — to systems with completely configured packages.

2. Stand-alone systems that incorporate the processor, disk drives and

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# DIGITAL AUDIO WORKSTATIONS

DAW



Originally released only for Macintosh, ProTools from Digidesign is now available for Windows.

audio interfaces in a single chassis. These units generally feature an external control surface.

The type you choose may, on the surface, be determined by your budget as well as the experience, capabilities and preferences of those using it. The technology behind the particular system, however, should be the determining factor in the final selection.

When planning the deployment of digital audio workstations in your

facility, you need to consider the following questions:

1. How will files transfer to/from the DAW?
2. Is there a common file format used in your facility?
3. By what means do audio files currently travel through your facility (i.e., network, AES/EBU, analog)?
4. If audio files are transferred on a network, which protocol(s) are required (i.e., TCP/IP, IPX/SPX, NetBEUI)?
5. Do the files need to be linked to other systems, such as traffic and music scheduling?

6. Is there a requirement for the DAW to interact with any other systems that are in place or planned?
7. Are the primary users of the DAW comfortable with the system, and can they make full use of the technology?

8. In the case of networked facilities, is a trained network person responsible for the infrastructure?

9. Are these requirements likely to materially change in the next 12 to 18 months?

The term *integration* has taken on new importance in many current studio designs. The tapeless facility is now largely a reality. Whether the audio product is produced from a DAW, satellite, an electronic newsroom or digitally at another location, it all needs to end up on a common database that can be accessed to provide on-air content. The Internet has proved to be a

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# D A W DIGITAL AUDIO WORKSTATIONS

powerful marketing tool for newspapers and broadcasters. A few vendors offer products that can produce events on your website that are closely linked to material that is broadcast in real time. An example of webcasting would be the ability to add text and audio news clips from a newscast while the newscast is in progress.

Another issue to consider is the ability of the DAW to embed certain auxiliary information with the audio

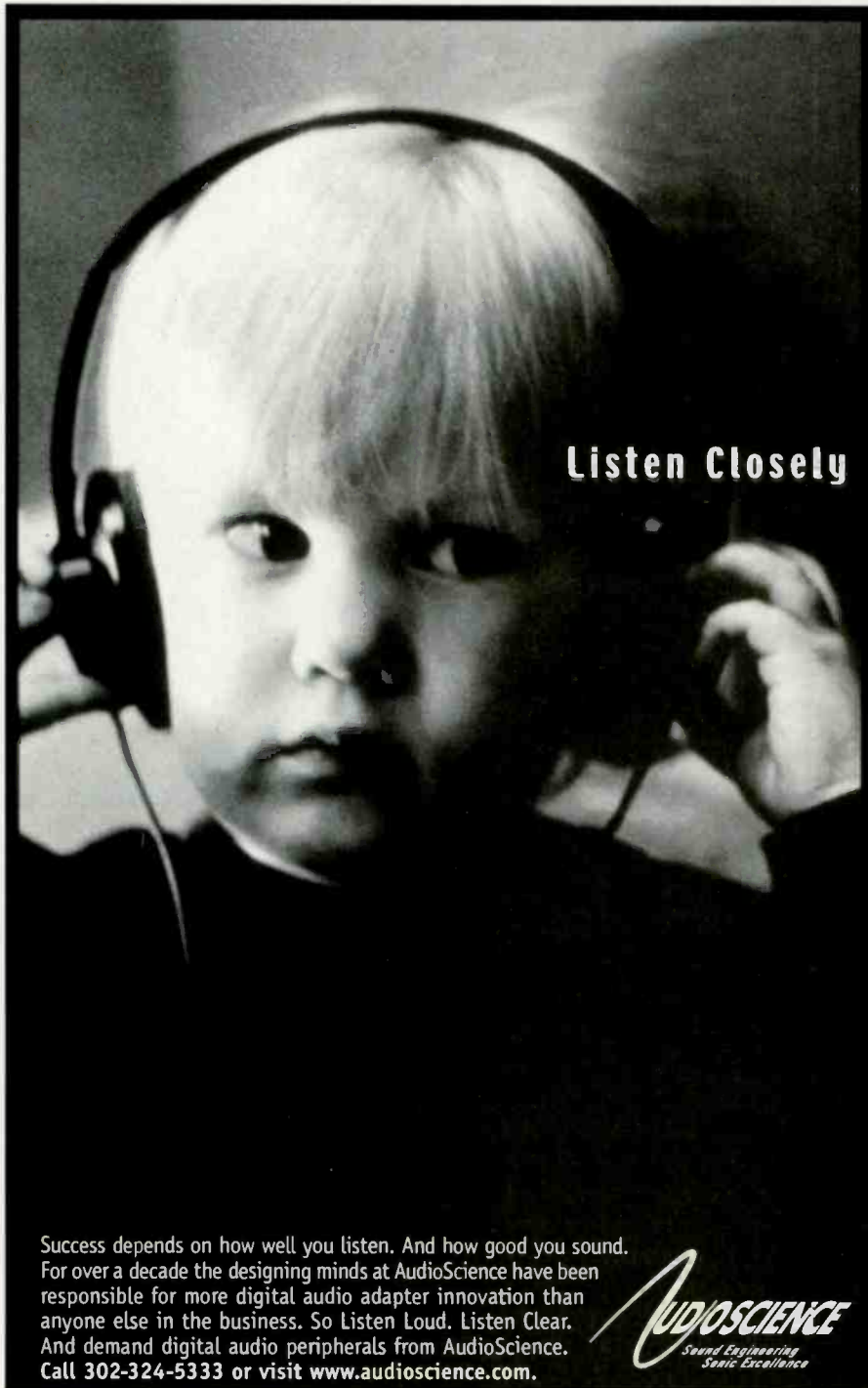
data that is sent across the network. This auxiliary information can be used to update a website or provide information to a traffic or music system. Integrating your facility to this level may not be in your immediate plans, but you should be aware of where the technology is heading.

## Operational features

DAWs combine all the features of a multitrack console and tape machine with a rack of processing equipment.

Features vary, but even the lowest-cost systems in the right hands can arguably produce higher-quality work than that which can be attained with a studio full of equipment. Furthermore, the DAW produces such results in a much shorter time.

All DAWs provide some level of digital mixing. More advanced systems feature the ability to record multiple tracks simultaneously. The recorded material can be subsequently mixed down to other internal tracks or to as many as 128 virtual tracks. Control surfaces combine the features of a console and a tape controller. These control surfaces offer the ability to control audio using slide faders, manipulate recorded audio with a scrub



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**DAWs combine all the features of a multitrack console and tape machine with a rack of processing equipment.**

---

wheel and switch assigned audio tracks. They also provide tape-machine control buttons and other custom features.

DAWs can deliver a variety of effects, including audio equalization, reverb, delay and SPX processing. Some systems include a time-compression and expansion function that gives the user some control over the specific length of the audio material without changing its quality. For many systems, libraries of software-based special effects plug-ins can be purchased or downloaded free from the Internet. Plug-ins allow the DAW to emulate the specific sound characteristics of certain equipment, such as a particular tube-type compressor or spring reverb. Over time, software that will accept plug-ins may prove to be a much better value.

If the heart of the DAW is software, then its soul lies within the associated

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# D A W DIGITAL AUDIO WORKSTATION

audio card. Most PC systems today have audio cards with specs that can produce decent-quality audio material. You can purchase software that can turn a PC into a mini DAW. High-end DAW products use sound cards that dwarf the common PC audio system in terms of power and performance. The current hot processor in the digital signal processing world is the Motorola 56002. Sound cards used in professional PC-based DAWs use at least one of these processors operating at approximately 80MHz. Standalone DAWs may also be based on the 56002 or a similar proprietary DSP.

## I/O options and file systems

As with most digital audio-based professional equipment, the options for getting digital audio in and out of a DAW are pretty standard. Typically, analog, AES/EBU and S/PDIF (coaxial and optical) digital inputs and outputs are available. The digital inputs usually have automatic sample rate conversion to 32kHz,



Some editors are designed as stand-alone devices and do not require a separate computer for operation.

44.1kHz or 48kHz. The sample rate of digital outputs can be adjusted similarly. Connections for interfacing with MIDI devices, external drives and remote control connections may also be provided.

Producing audio content from a DAW without the ability to share it with other systems is both time consuming and unnecessary. Fortunately, most manufacturers have moved away from using proprietary file formats. Those that do provide a file conversion utility. Once again, this is an unnecessary extra step that

should be avoided. Typical supported file formats include WAV, MPEG Layer II, BWF and cart chunk.

Multimedia-based file formats are considered either self-describing or headerless. As the name implies, self-describing file formats contain information about themselves. This information can be used to support multiple formats and transport additional non-audio data to a destination. Self-describing file formats tend to work across different platforms (i.e., PC, Macintosh, SGD), which is



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# D A W DIGITAL AUDIO WORKSTATIONS

important in a mixed environment. Headerless file formats can only be used for encoding and decoding single data formats.

The most common self-describing formats are supported under Microsoft's *Resource Interchange File Format* (RIFF) specification as a means of storing digital audio information. Files in the WAV format can support non-compressed or compressed formats, such as MPEG or ADPCM. The RIFF simply acts as a structured framework that contains multiple nested data structures. These structures are known as *chunks*. Each chunk contains specific information about the data stream, such as the contents, or possibly even another chunk called a *sub-chunk*.

The *Broadcast Wave Format* (BWF) or, as originally proposed by the European Broadcast Union, the *Broadcast Extension Wave Format* (EBU/BEXT) maintains many of the characteristics of the original WAV format but allows for additional chunks that provide certain informa-

tion. Some of the additional elements include description of the sequence, name of the originator of the file, additional reference field, date and time of creation, time-code information, version information, type of encoding used (PCM or MPEG), mono or stereo, sample rates, bit rates and more.

In the case of MPEG coded data being carried by the BWF, two additional chunks are used that define sound information, frame size, ancillary data length and ancillary data definitions.

Manufacturers can still maintain proprietary file information within a dedicated chunk within a BWF while keeping the basic audio file format readable. Applications written specifically to decode RIFF formats will ignore unrecognized chunks.

Currently, a proposal is in progress to create yet another RIFF wave-data type called *cart chunk* or the *CART/audio delivery extension*. Essentially, the cart chunk format expands on the BWF with the addition of traffic,

scheduling and continuity data. The information in the cart extension chunk includes the title, artist name, cut number, category, out cue, start date and time, end date and time, timer information, user definition, meter system calibration information, version, and

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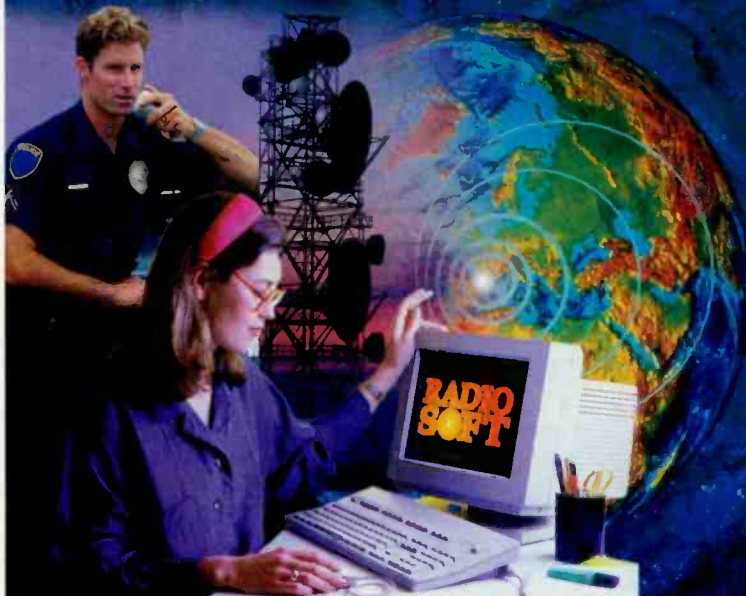
**Essentially,  
the cart chunk  
format expands  
on the BWF with  
the addition of  
traffic, scheduling  
and continuity  
data.**

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tag text. For more on the cart chunk concept, see the August issue of *BE Radio*, p. 41.

MPEG file formats can also be contained within the RIFF. MPEG has become a popular file format within the broadcast industry because of its

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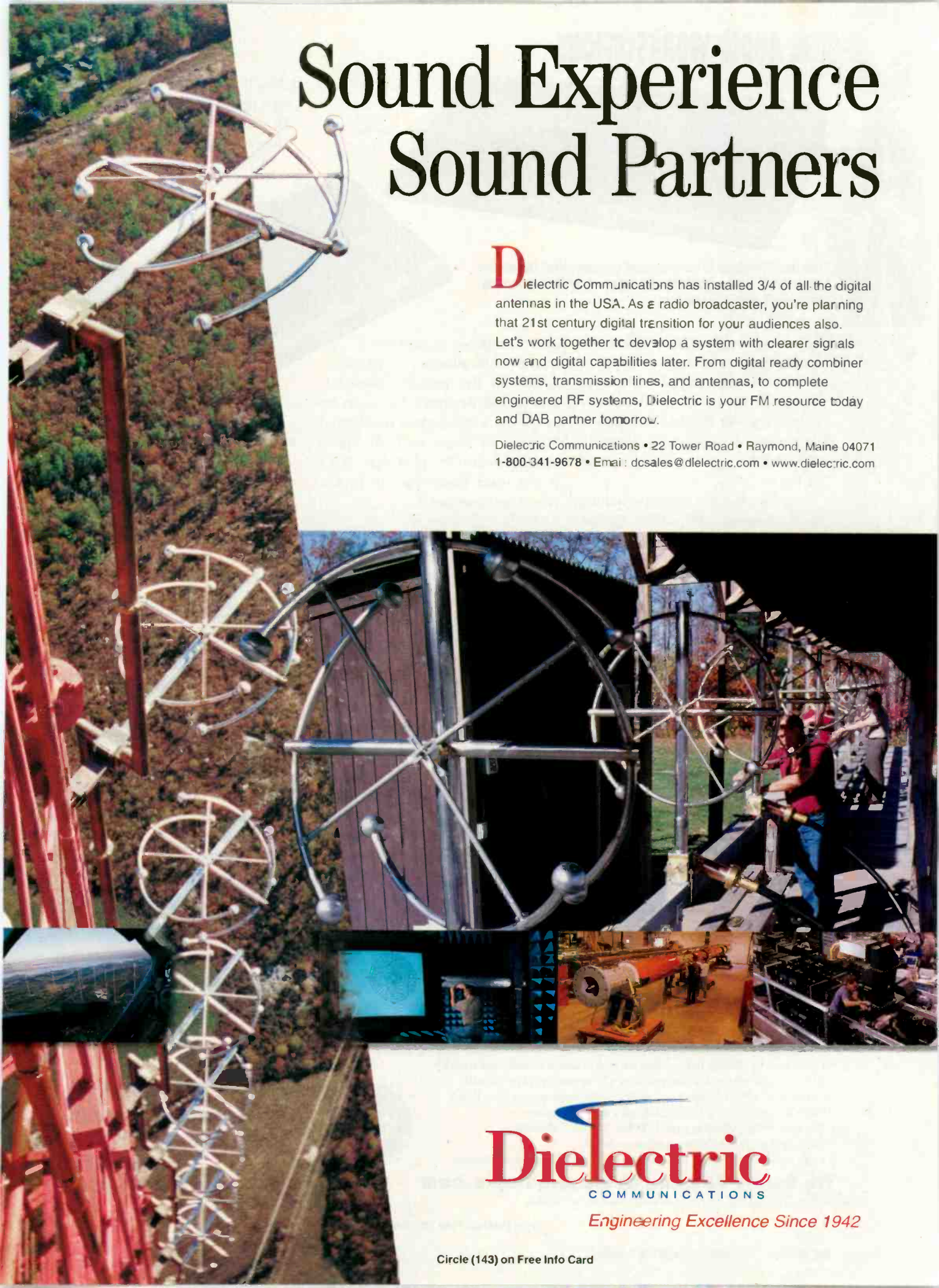
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# DIGITAL AUDIO WORKSTATIONS

DAW



The user interface is an important consideration in selecting a DAW. Some systems offer several options including additional control surfaces.

ability to provide high-quality audio at relatively low bit rates.

MPEG supports three layers: Layer I: 32 to 448 kb/s at a target bit rate of 192 kb/s; Layer II: 32 to 384 kb/s at a target bit rate of 128 kb/s; Layer III: 32 to 320 kb/s at a target bit rate of 64 kb/s.

Other supported formats include the following: *AIFF*, *AIFC*, *Quicktime Movie Audio* and *Sound Resource files* (.SND). *AIFF* and *AIFC* files are native to Apple and Silicon Graphics platforms. They are similar to *RIFF* files in some respects. *AIFC* are simply *AIFF* files that permit data compression. *Quicktime Movie Audio* is another multimedia

data compression scheme that permits files to be passed across all the popular platforms. The *Sound Resource* file is an example of a headerless file format. This file is native to both Apple/Macintosh and PC platforms, but it is not used extensively in professional environments.

## Platforms

In a radio broadcast environment, the platform of choice will typically be a PC or an Apple/Macintosh. Stand-alone systems generally operate with custom hardware and software and are designed specifically to handle the tasks associated with a

DAW. If you plan to configure your own hardware platform for a DAW, be sure to build it with as much power as your budget will allow.

Check with the software manufacturer to determine the minimum CPU, bus speed, RAM, disk drive, disk drive



interface, sound card, networking

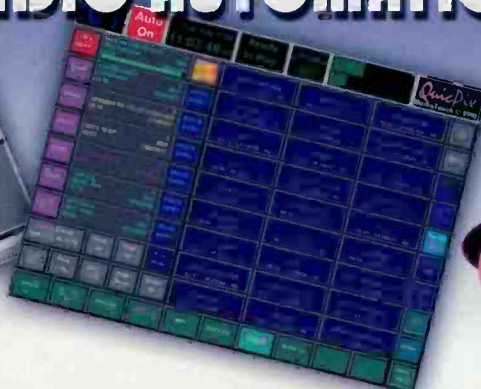
and monitor requirements.

Don't skimp on the disk drive system; the process of recording streaming data to a drive is speed-intensive. Ideally, a fast-SCSI interface should be used, along with multimedia-rated disk drives that spin at 10,000 RPM. The size of the drives will be determined by the type, length and compression of your audio files. Plan on using about 7.5MB/minute for each channel of audio sampled at 24 bit and 44.1kHz.

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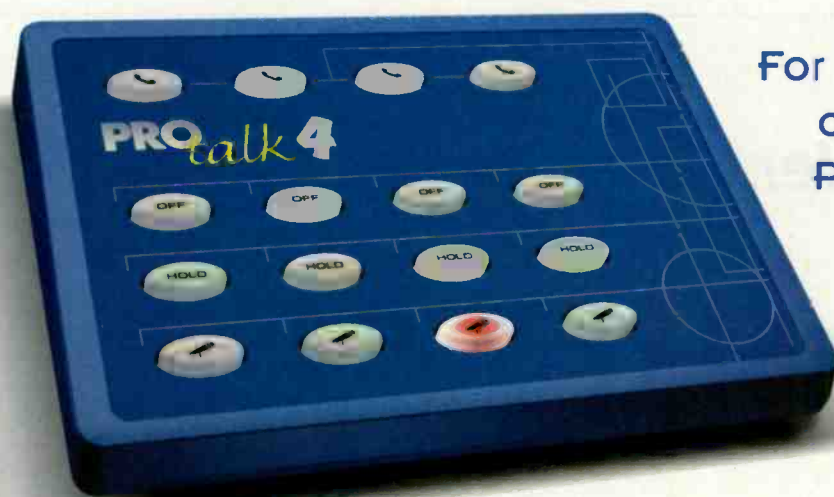
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# DIGITAL AUDIO WORKSTATIONS

## Networking protocols

PC- and Mac-based platforms give you the added flexibility to attach your DAW conveniently to a network by adding a Network Interface Card (NIC) and loading the appropriate network client software. Make sure your software supports the various networking protocols.

The most popular protocols used in broadcast applications currently include the following:

**TCP/IP.** As the backbone technology behind the Internet, Transmission Control Protocol/Internet Protocol is perhaps the most universal and flexible protocol. TCP/IP can deliver information across a wide variety of platforms, including PC, Mac, Unix, Linux and Sun, and management of the net-

work is dramatically simplified. Using the TCP/IP protocol also allows you to transfer files remotely over the Internet or any dedicated data transport method.

**IPX/SPX.** Internet Packet Exchange/Sequential Packet Exchange is a protocol native to Novell network operating systems. IPX/SPX is still widely used and largely supported by other network platforms. There is an industry trend to move away from this protocol in new installations in favor of TCP/IP.

**NetBEUI or NetBIOS.** *Extended User Interface* is an updated extension of the earlier network *protocol-NetBIOS*. It was originally developed by IBM and subsequently adopted by Microsoft for the Windows NT plat-

form. NetBEUI does not support the routing of messages to other networks; however it was considered an optimum choice for single local area networks. The format can be adapted to communicate with other networks, but not as easily as IPX/SPX.

The good news is that you have several choices. After evaluating the myriad of features available and considering operational constraints, such as how comfortable the primary user will be with the technology and whether it fits your budget, your final choice should be based on how the DAW will integrate with the rest of your facility.

*Kevin McNamara is president of Applied Wireless Inc., New Market, MD.*

**Stand-alone systems generally operate with custom hardware and software and are designed specifically to handle the tasks associated with a DAW.**

**For more on the cart chunk proposal, see the article titled "Production," in the August issue of BE Radio, p. 41.**

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# Antenna Testing and Compliance

By John Battison, P.E., technical editor, RF

*Once the hardware is in place it must be tested and maintained.*

**T**his month's article on antenna maintenance and testing concludes our yearlong series on broadcast antennas. We will outline the methods and equipment needed for making major tests regularly used with AM and FM antennas, and we will refer to mandatory FCC materials.

### Nondirectional AMs

Upon completion of a new construction permit or a change in a licensed non-DA AM station, the FCC requires that a new antenna impedance measurement be made. This

ATU on the antenna side of the base current ammeter. Be absolutely sure that the two ground strap connections from the OIB are securely connected to ground. An OIB can handle up to 5kW, and a hot, ungrounded OIB can produce bad burns and cause damage to equipment. If the ATU has a jack for a plug-in ammeter, the bridge can be connected there and the shorting plug removed when measuring.

With the bridge set for minimum sensitivity, set the transmitter at very low power and increase sensitivity until a midscale reading is obtained.

Adjust the R and X dials for deepest dip; R is usually more sensitive than X.

Increase sensitivity until the sharpest null is found, using the extra R and X pads as necessary. Remember, to avoid damage to the meter, turn off the transmitter or reduce sensitivity before disconnecting any equipment.

### Setting up networks

Often it is necessary to set up an ATU network from scratch. This in-

volves adjusting each leg to the calculated reactance and verifying the overall impedance. Refer to Figure 2 for the proper connections. First connect the receiver/generator (R/G) to the OIB input and the OIB output to point 1. The ground output lead is connected to point 2, and points 2 and 4 are shorted to ground. L1 is then set to the required reactance.

Move the OIB output lead to point 3 and adjust L2 to obtain desired reactance (i.e.,  $X_c - X_i$ ). Now connect the OIB output lead to point 2 (removing the temporary ground connection there) and the ground to point 4. Adjust L3 to produce the desired negative reactance in the same manner as for L2.

The network is now set to the calculated impedance. There will probably be a very slight change when the coax and antenna are connected, but this should be minimal.

License Application Form 302 requires the day and night base operating impedances and the associated base RF currents to be provided. In addition, the final amplifier voltage and current are required.

At this point, it is advisable to check the power output by Ohm's Law. The product of the base impedance times

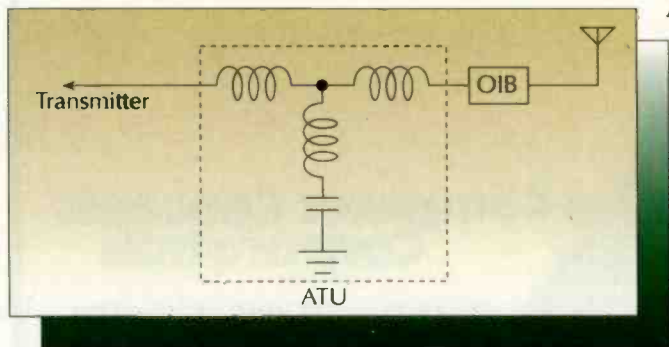


Figure 1. Using the OIB to make a hot impedance measurement.

measurement can be made in several ways. The easiest is to use the transmitter and an inline bridge and make a "hot" measurement, as shown in Figure 1. The OIB is inserted at the



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## ANTENNAS

the square of the base current equals the RF power in antenna ( $I_{base}^2 \times R_{base} = W$ ). Check efficiency by multiplying plate current by plate voltage, dividing this value into the RF power out and multiplying this result by 100 to convert it to a percentage. This should agree with the transmitter manufacturer's manual.

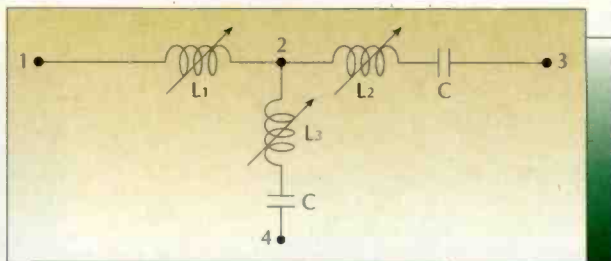


Figure 2. Setting the reactances within the TEE network.

If a transmitter is not available, you will have to make the measurement using an OIB and R/G (see Figure 3). The generator part of the R/G drives the OIB, the antenna is connected as in Figure 1, and the detector output of the R/G is fed back into the R/G input.

If a frequency counter is not available, the transmitter's oscillator output should be sufficient to beat against the RF generator and obtain zero beat to check generator calibration. Generator power is then increased as required and the measurement completed. Sensitivity is much higher when using the R/G as a driver and detector. This zero-beat technique may be followed when making the FCC's required  $\pm 25$ kHz common point reactance sweep on a directional antenna. Often it is possible to use other station's close-in frequency as zero beat check points.

The most difficult measuring situation is faced when a transmitter or a receiver generator is not available. Then the impedance measurement is made "cold" (i.e., without the transmitter). This is how we did it before the OIB and R/G were developed. A suitable oscillator, such as an old

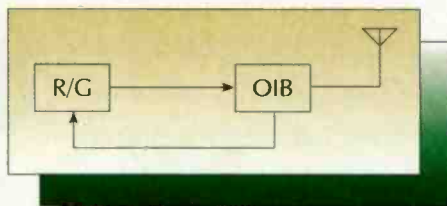


Figure 3. Using an OIB and R/G to measure impedance.

Signal Corps BC221, a GR RF bridge and a suitable detector were connected as shown in Figure 4.

The impedance measurement was made with very low RF power. Sometimes, higher power, hot measurements made with an OIB show ATU or antenna problems that would be missed with "flea" power oscillators driving the bridge. The main problems with the older method were mating cables and connections, the possibility of excessive radiation that interfered with accurate measurements, and general inconvenience.

Before licensing a new station, the frequency must be measured. Many stations use frequency-measuring services that make a monthly check. Today, stable and calibrated frequency counters are easily available and

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MP-4	4	800W	3.3	\$1,280
MP-2-4	4	2,000W	3.3	\$1,820
MP-3-5	5	3,000W	4.1	\$2,270
MP-3-6	6	3,000W	5.2	\$2,740

## LOW POWER CIRCULAR SERIES

Model	Bays	Power	Gain	Price
GP-1	1	2,000W	-3.1	\$350
GP-2	2	4,000W	0	\$1,350
GP-3	3	6,000W	1.5	\$1,900
GP-4	4	6,000W	3.4	\$2,600
GP-5	5	6,000W	4.3	\$3,150
GP-6	6	6,000W	5.5	\$3,700

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Model	Bays	Power	Gain	Price
SGP-1	1	4,000W	-3.3	\$690
SGP-2	2	8,000W	0	\$2,690
SGP-3	3	10,000W	1.4	\$3,595
SGP-4	4	10,000W	3.3	\$4,500
SGP-5	5	10,000W	4.1	\$5,300
SGP-6	6	10,000W	5.2	\$6,100

The antenna gain may vary with the frequency. For powers up to 20 KW please, make the request to provide the specific configuration.

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# ANTENNAS

stations can make their own checks. The commission has not required frequency monitors for many years, but there is still a fine for being off frequency.

Similarly, modulation monitors are no longer required, but you're in trouble if you over- or undermodulate. The wise engineer keeps a monitor for checking compliance. An oscilloscope can be used or a regular modulation monitor kept on hand; however it is advisable to be able to keep a constant check on your modulation.

## Measuring field strength

Normally, nondirectional stations do not have to make field intensity measurement to satisfy any FCC requirements unless there is a clause in their CP because of a dubious antenna or ground system. This is unfortunate. It is extremely helpful to have a yardstick against which past coverage can be measured when a GM or PD complains that the signal is down.

It is a good policy to make a series of field strength measurements in areas of high signal, low signal, business and residential areas as well as two or three clear spots in different azimuths as a reference signal to use when adjusting the system in later years. Identification of these points should be extremely specific for use at later dates and by different engineers. Because there are no FCC mandated azimuths or radials to observe, it should be possible to select measuring locations whose characteristics and address will be identifiable for many years to come.

These measurements should be recorded and filed carefully with documentation so that they can be repeated in the future. It is best to follow the record-keeping routine used in making FCC-required field intensity measurements.

## DA measurements

The procedure for setting up a directional antenna is much the same as for non-DA, except that the common point impedance has to be ad-

justed and measured. The individual tower operating impedances are measured in the same manner as non-DA towers. The overall impedance is produced by the combination of all the towers coming together and is

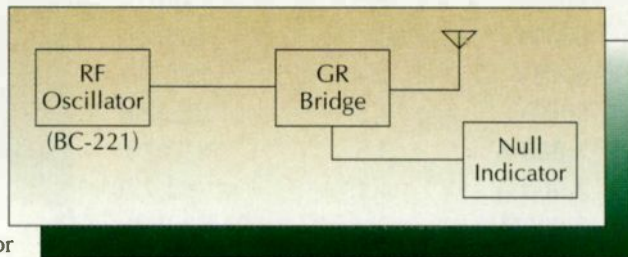


Figure 4. The "cold" impedance measurement method.

measured at the common point.

Figure 5 shows a skeleton phasor. The TEE enclosed by the dotted line matches the impedances of all the towers to the transmission and provides the load required by the transmitter. This TEE network is adjusted in the same manner as the networks in the ATUs, and the reactances are set to the calculated values.

The product of the current and resistance measured at this point should be the same as the FCC licensed value. Remember there is a small percentage of excess allowed, depending on the transmitter power, to cover losses in the phasor and lines.

The antenna monitor shows the current ratio and phase angle for each tower. The FCC-preferred method of driving this is by means of a coaxial toroidal transformer placed around the RF lead from the ATU network. For ease of adjustment, the stabilized coaxial cables from the ATUs should all be the same length. For critical arrays, the FCC requires it.

Multiplexed AM stations can reduce the number of antenna monitors by using a two-frequency antenna monitor.

The commission requires a full directional antenna proof of performance when a new DA system is constructed or major modifications are made to an existing system. As well as following good engineering procedures, excellent record-keeping is essential. It follows without saying that transmitter power is properly set and recorded prior to starting measurements and is maintained

throughout the measuring time.

From time to time, problems occur in coaxial cables. To locate a problem in a cable, a *time domain reflectometer* (TDR) can prove invaluable. Often, a TDR can be used where line damage is suspected but no clear indication is observed. A TDR can pinpoint the locations of cable irregularities, reflections and damage.

The TDR sends a pulse down the line and starts a time base line simultaneously. Any line irregularities produce a reflection whose location is found by measuring the time of the reflected pulse. TDRs are probably used more for FM antenna problems than for AM because of the isolated FM antenna and coaxial cable location up a tower. Nevertheless, many an AM engineer has found one to save hours of trial-and-error investigation.

In addition to performing antenna proof of performance measurements a DA station also has to make reg-



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ular monitor point measurements in accordance with its license terms. This requires use of a field intensity meter (FIM), possession of which is required of an AM DA licensee.

### FM measurements

Far fewer RF measurements are required by the average FM station. For one thing, field strength measurements are not required by the FCC, and the DA proof is performed by the antenna manufacturer prior to delivery. Coverage contours are based only on estimated (theoretical) coverage (73.313). Therefore, not many FM stations purchase FM FIMs. Sometimes erratic coverage problems make field strength measurements necessary, and equipment can usually be rented or borrowed to take care of this need. The FCC's Rules Part 73.314 specify the method of taking FM measurements, which is quite different from AM measurements. This is more inconvenient to do, is more trouble than for AM, and

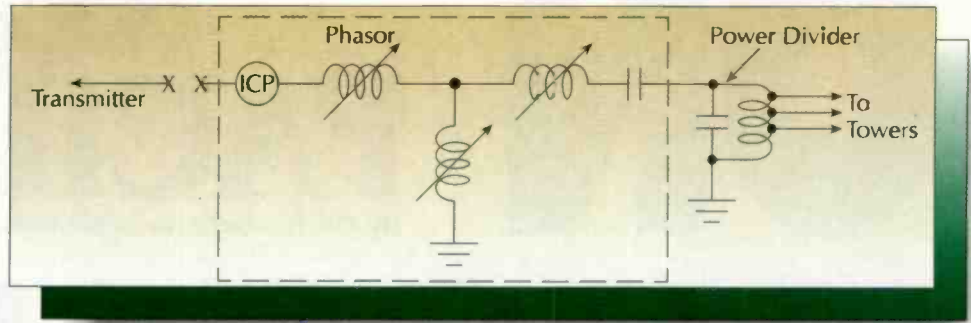


Figure 5. Measuring the common point impedance and setting the reactances.

possibly is not quite as finite. For one thing, antenna length and orientation are crucial.

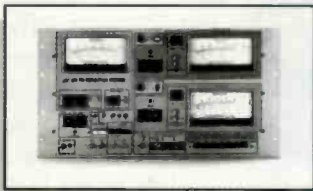
If a CATV field strength meter is used for comparative measurements, care must be taken to ensure that the obtained readings are correctly used and are accurate. The average CATV meter does not read signal strength in millivolts per meter unless care is taken to follow the instruction manual. Usually the readings are of voltage at the receiver (meter) input rather than in mV/m. These figures are fine for comparison between stations and locations but require manip-

ulation in accordance with the manual to use for contour determination. It is easy to become confused when using nonbroadcast equipment.

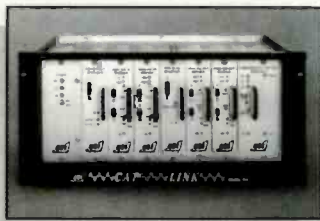
*This is the last part of a nine-part series on broadcast antennas. The series has appeared monthly in BE Radio throughout 1999. The series is available for purchase as a single document. For more information regarding bulk orders of this series in quantities of 500 or more, contact Jenny Eisele at 913-967-1966.*

E-mail John at: [batcom@bright.net](mailto:batcom@bright.net).

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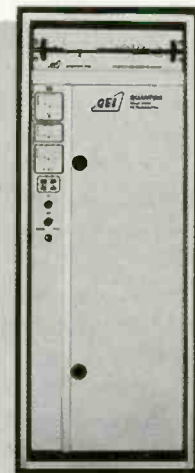


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# ON REMOTE FACILITIES LOCATION

By Chriss Scherer, editor and Dana Martin, associate editor

**R**adio remotes are carried out throughout the year, although most stations have a heavier remote schedule during the summer months. Some remotes tie into a local event such as a grand opening or a holiday celebration. Others are part of sales and marketing efforts. Sometimes the locations are exciting; other times they aren't.

Over the past year, *BE Radio* has featured several unique remote broadcasts. Some have centered on a specific event like the Baseball All-Star Game or the WGBH multichannel recording and broadcast. Events of this magnitude require a considerable amount of planning but still use many of the same tools as weekend car-dealer remotes.

This month, our On Location feature focuses not on the event but on the location itself. Specifically, we look at visiting station studios at theme parks and other public attractions. Broadcasting from such sites has one advantage: Most of the equipment is already in place. Remote engineers will certainly appreciate the lighter load.

The facilities covered here are only a small selection of the remote studios available around the U.S. All are self-contained studios. Though each was built to serve a variety of stations' needs, the staff at any of these attractions will likely be able to handle any special needs or requests you have.

## The Rock and Roll Hall of Fame and Museum • Cleveland, OH



The phrase "rock and roll" was first uttered by Alan Freed, who had his early radio success in Cleveland. With this in mind, the town was selected as the host site for the Rock and Roll Hall of Fame and Museum in 1986. Groundbreaking for the building began in 1993, and the doors

opened to the public in 1995. The opening ceremonies for the museum were held over Labor Day weekend, and radio and TV stations from all over the world were present to cover the historic event. One of the unique elements of the inauguration were the two rows of tents set up along the street as temporary housing for the visiting radio stations. In this *radio row*, representatives of legendary stations and air personalities sat side by side to cover the event.

The Rock and Roll Hall of Fame and Museum has a fully equipped studio on the fifth floor that has hosted more than 250 stations from all 50 states and 140 different countries. The studio has two large windows. One looks into a viewing area behind the jock position; the other allows the studio users to look out over the main hall of the museum and out the large front window to see the downtown skyline.

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The attractions at Disneyland are world famous. As you take a walk down main street, the Disney look and feel surrounds you. The open atmosphere is taken even further in the radio studio.



The radio studio at Disneyland is different than the other facilities in this showcase, because it is an open-air booth. Because of the (usually) agreeable Southern California weather, the radio studio is built in a metal-framed tent situated in the middle of the action. There are also facilities to broadcast from almost anywhere within the park, including from some of the attractions. The Instant Replay in the booth is preloaded with Disney songs and audio cuts.

### EQUIPMENT: PR&E

Stereomixer, Shure 267, Shure FP42, 360 Systems Instant Replay, JBL Control 1 monitors, Samson Q-5 headphone amp, Electro-Voice RE-20 mics, Sony MDR-7506 headphones, Telos Zephyr, Comrex Hotline

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## The Museum of Television and Radio New York City (Manhattan)

The Museum of Television and Radio was founded in 1975 by William S. Paley to collect, preserve and interpret TV and radio programming and to make these programs available to the public. The museum officially opened in 1976 as the Museum of Broadcasting. In 1991, the museum moved into its present location and changed to its current name.

The collection in the library covers more than 75 years of radio and TV history. The museum hosts special seminars and presentation throughout the year. The Ralph Guild Radio Studio, located on the



fifth floor, is typically used several times a week by local and visiting stations. The studio also has an interview table for guests. The studio adjoins a listening room in which visitors can watch a broadcast in progress. When no broadcasts are scheduled, the listening room is used for program presentations prepared by the museum.

**EQUIPMENT:** PR&E RadioMixer, Studer PR99 reel-to-reel, Tascam 122BMKIII cassette decks, ITC 99B cart recorder, Denon DN950FA CD players, Aphex Compellor, Tascam DA-30 DATs, Harmon Kardon tuner, Rane HC-6 headphone amp, Bryston 2BLTPBX power amp, Electro-Voice Sentry 100 monitors, Electro-Voice RE-27 host microphone, Electro-Voice RE-16 guest mics, Telos One telephone hybrids, Telos Zephyr

**CONTACT:** CRISTIN CALLAGHAN,  
PUBLICITY COORDINATOR  
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ccallaghan@mtr.org; www.mtr.org

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## Museum of Television and Radio Los Angeles (Beverly Hills)



The Los Angeles location for the Museum of Television and Radio opened its doors in 1996. The entire collection, which was created for and has been maintained in New York, is duplicated in Los Angeles. This duplication allows the public more accessibility to the resources. The museum occupies a two-story building in Beverly Hills.

The radio studio, named after Ralph Guild like its New York counterpart, is located on the first floor. The large glass window makes a dramatic impression on visitors and spectators. KRLA, a local station, broadcasts from the studio on a regular basis. The studio averages three visitors per week. The capability also exists for remotes to originate anywhere within the museum. There is also a listening room attached to the studio.

**EQUIPMENT:** PR&E RadioMixer console, Tascam 122 MKIII cassette, Tascam CD-601 CD players, Studer PR99 reel to reel, JBL Control One, Ramsa WP-1400, Electro-Voice RE-27 mics, Telos Delta 100 hybrids, Telos Zephyr, stereo 15kHz loops and fiber optic connection to Pacific Bell Hub

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# Universal Studios Escape Orlando, FL

Central Florida is a popular vacation spot with several theme parks and attractions in the area. Universal Studios added onto its park facilities this past year as well. Year round, park visitors can enjoy rides and shows that incorporate themes from famous movies and fictional characters. Many attendees at the last NAB Radio show had a chance to visit part of the park.

The radio studios were built in 1993 and currently host



three or four stations every week. There are two studios at Universal, each built around an attraction at the park: Jaws and Terminator 2. Both studios are well-equipped and are

used several times each week. One station even used the Universal facilities during its own studio relocation project.

You can see more of the Universal Studios radio facility in the Studio Spotlight at [beradio.com](http://beradio.com).

**EQUIPMENT:** PR&E BMX-III consoles, 360 Systems Shortcut and Instant Replay, Technics SLP-1300 CD players, Panasonic SV-3900 DAT, Otari MX-55 reel-to-reel, Tascam CD-601 CD players, PR&E Micromax cart players/recorders, Orban Audicy, Sony MDS-JE510 MiniDisc, Tascam 122MKII cassette, JBL monitors, Crown D-75 power amps, Technics headphones, AKG C3000 microphones, Telos Direct telephone interface, Telos Delta 100 Hybrids, Symetrix 610 broadcast delay, satellite uplink capability, Telos Zephyrs, Gentner three-line frequency extenders, ESE NBS Master Clock, DG Systems transmit terminal

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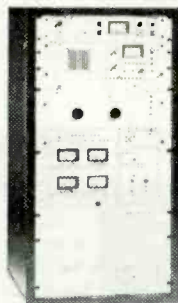
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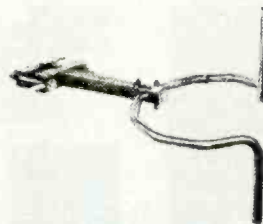
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# Windows to the Web



## www.contelec.com

**Continental Electronics:** Things to find on the www.contelec.com Web site are: District Sales Manager's contact data; Factory Marketing & Sales personnel contact data; E-Slide - FREE engineering software; Product Line Descriptions and Specifications; Links from Broadcast Supply Division to vendor Web sites.



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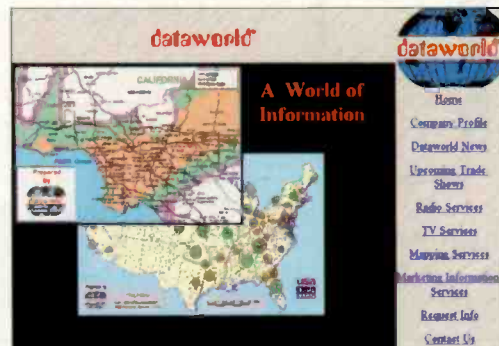
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## www.beradio.com

**BE Radio magazine:** BE Radio gives radio station managers and engineers the information they need to make critical equipment purchase decisions. The magazine is published 10 times a year and distributed to over 14,000 qualified subscribers in North America. Look online for the Studio Spotlight - an exclusive Website feature showcasing some of the newest radio facilities in North America.



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# ON LOCATION

## Six Flags Fiesta Texas San Antonio, TX

FiestaTexas, a Six Flags Theme Park, boasts several attractions and is currently undergoing a multimillion-dollar expansion with several additions forthcoming in the new millennium. The park also includes a live broadcast center, which provides an excellent remote venue for area radio stations.

The center boasts a unique setting; it's located in the park's Crackaxle Canyon. The panoramic view includes 100-foot cliffs, a picture window looking out on waterfalls, a train track that passes by the booth and a paved sidewalk so guests can watch visiting stations as they broadcast.



The park provides several amenities for stations that perform remotes: accommodations for station personnel (one room per broadcast day), admission to the park for up to three station personnel, an engineer to orient the station staff and establish a broadcast transmission, a park staff person to arrange interviews and coordinate on-site activities, and a portable cassette recorder.

**EQUIPMENT:** Autogram Pacemaker console with Autoclock, Otari MX-5050 BIII reel-to-reel, Tascam 122MKII cassette, Sennheisser MD-421 mics, JBL monitors, Crown 150 power amps, Rane HC-6 headphone amplifier, Gentner SPH-5 telephone hybrid, Comrex three-line frequency extender

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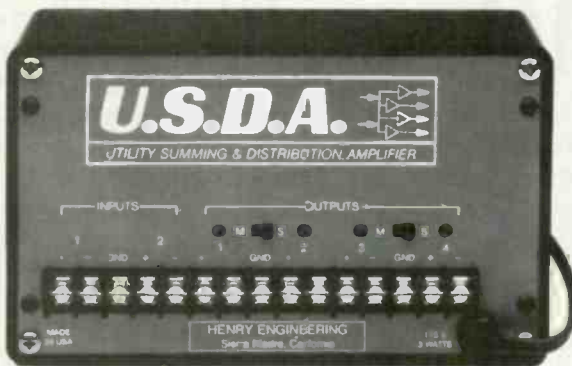
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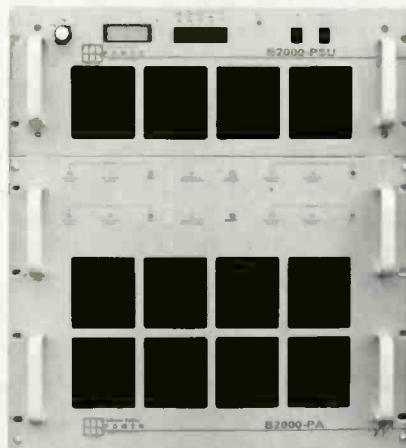
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## Audemat Measurement On Line

By Dan Rau

**W**ith more and more stations owned by fewer and fewer operators, keeping track of the operation of hundreds of stations is putting senior management to the test. How does an engineering director make sure that all transmitters are working properly and that all stations are within legal FCC limits? How does a group program director ensure that program guidelines are being followed in every market? How do group sales managers keep track of spot loads and commercial content? And how do they all determine whom the competition is targeting?

Reading the competition is easy: All you have to do is

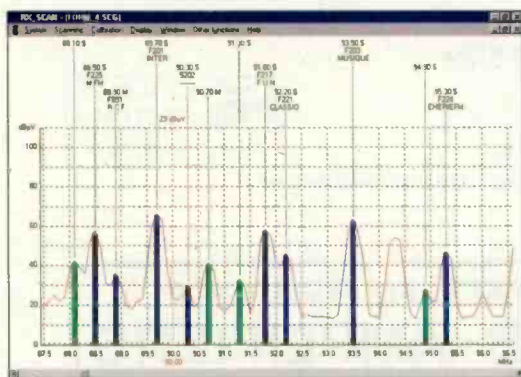
Pilot and the modulation mask. You can check and analyze the contents of related data, 67-92KHz, sub-carriers and RBDS and DARC signals. As an added bonus, peaks-over-time can also be measured and recorded.

Precision audio monitoring allows you to quickly identify program content and analyze various aspects of actual on-air audio quality. The program can also perform the following functions:

- Verify transmission performance by monitoring actual signal levels;
- Verify compliance to FCC modulation regulations;
- Access audio quality immediately;
- Eliminate extra manpower and recurring expenses;
- Improve programming and audio quality faster through real-time analysis and competitive information;
- Consult between different departments, record measurements, create and print reports.

### Market access

Active monitoring of every station in every one of your markets helps you spot potential problems. By scanning every signal in the remote market, comparisons can be made between several parameters, including signal level in dB $\mu$ V or dBmV, mono or stereo operations and RBDS usage. Audio levels can be viewed as discrete left and right, L+R and L-R. Scan results can be saved to a file for future reference. Full quality checks can be made on the broadcast signal. Modulation masks and modulation density can also be displayed with the built-in spectrum analyzer. Preset spectrum masks can be loaded to verify prescribed guidelines, including the AM NRSC standard. The RBDS analyzer can accurately monitor BER and signal integrity. This is especially important for stations leasing RBDS signals.



The entire frequency band can be viewed at one time.

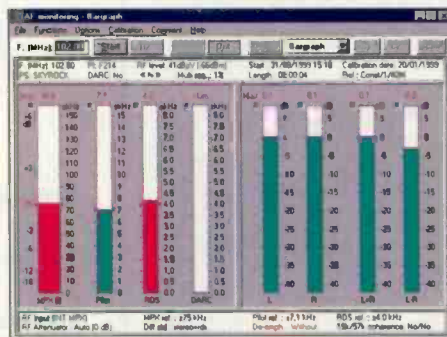
travel to each market, check each transmitter, air check each program and monitor all stop sets. It's simple but not practical. Remote monitoring is another way for group owners, corporate engineers

and group sales managers to monitor all their stations in all their markets. Inexpensive monitoring equipment can be placed in each market and connected to the Internet for real-time analysis of the group's stations and all the competition.

### Technology for management

To optimize service, protect audio identity and heighten awareness of co-channel protection in the face of LPFM, there should be one product dedicated to monitoring quality broadcasting. New technology now makes that possible. Measurement On Line allows you to dynamically monitor the modulation and audio quality of your properties and other properties anywhere in the world.

One unit in each market allows monitoring and measuring that can be accessed via the Internet, allowing you to rapidly and efficiently carry out a routine check of broadcast signal levels. This includes traditional modulation monitoring L+R, L-R,

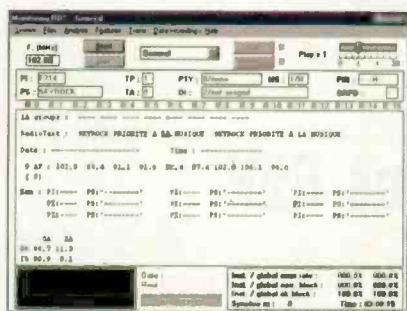
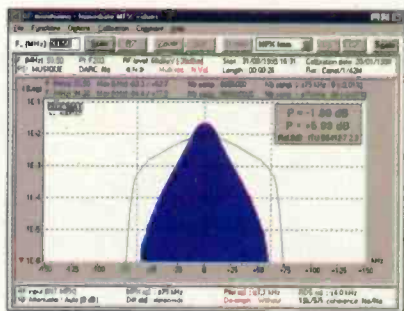


Audio and injection levels can be accessed and displayed.

### Department benefits

Other departments can also access the system and gather useful information. Group sales directors are able to accurately account for spots on all their stations and monitor competitive commercial sales.

Group program directors have immediate access to their stations' audio for verification of program con-



The spectrum analyzer and RBDS parameter screens.

tent. By connecting a DAT logger to the computer audio output of your facility, you can record entire shows remotely, thus eliminating the possibility of an edited air check. Some versions of Measurement On Line allow recording directly from the remote installation into your computer with MP3 files. An entire market can be monitored in real time for competitive analysis.

For the bottom line, Measurement On Line can help avoid costly FCC fines. Because the system is a real-time monitor, it can check modulation and composite signal power to ensure that each station is broadcasting within the legal limits. When combined with new multisite remote control technology, it can interface to a transmitter remote control system to automatically correct transmission parameters before they become expensive technical or regulatory problems.

By archiving modulation parameters, a baseline modulation graph of an entire market can be created. In the event of a problem, the local engineering staff can be alerted.

Engineering managers can use the system to remotely verify equipment after service by recording for 72 hours to check for intermittent defaults. Users can also perform third-party analysis through Internet access, real-time checking of remote processing tweaks and comparison of multiple audio signal levels and quality.

Measurement On Line is an overall management tool that can be used by the entire station: engineering personnel to check technical quality and performance of transmitter facilities; the programming department to monitor program/format content and audio quality; and sales managers to research competitive marketing opportunities.

Dan Rau is vice president of Applied Wireless Inc., a provider of technical services and support to operators of broadcast, PCS/cellular, LMDS, broadband wireless, microwave, two-way and satellite systems.

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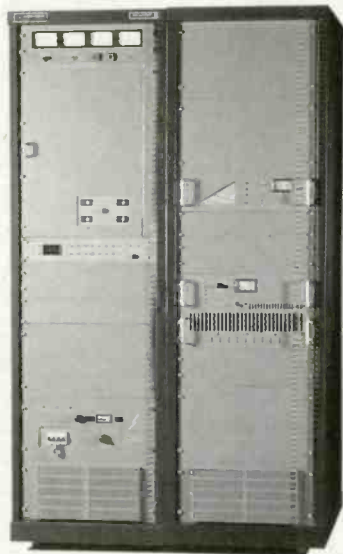
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## Ward-Beck Systems R2K

By Charlie Tryon

**O**n December 16, 1998, I attended the Ward-Beck Open House in Toronto. Besides wine, cheese and a tour of the new facilities, the evening was an opportunity for the company to unveil the prototype of its new R2K console series.

Because our station was in the market for new consoles, Wally Lennox (the director of engineering for Telemedia) and I took a close look at the R2K product line. Our decision to purchase three R2K boards was based on the facilities they offered, our trust in the company to deliver a well-engineered product, and the ongoing factory support we've had as owners of several Ward-Beck R and Renaissance MK series consoles. The price of the R2K consoles was extremely attractive to boot.

### Getting started

The first console, for installation in production, was delivered in February. The pluggable, three-pin Phoenix



### Performance at a glance

- Lightweight, modular, all-metal construction
- 8-, 12-, 20- and 28-module frames available
- All connections via Phoenix, pluggable, screw terminals
- 4 stereo program outputs
- 2 assignable mono mix buses
- 6 telephone clean-feeds
- Balanced inserts and direct outputs from each module
- Digital shaft encoder control room monitor level control
- Rackmount power supply frame offers dual redundancy

screw terminals made installation of this console a breeze — no special crimp tools or soldering irons were needed. We were pleased with the light weight and low profile of the console. We also approved of the new color scheme: black with white and green screening.

There was no scrimping on the quality or the features of the R2K. This console provides A/B input selection, four assignable stereo programs, two assignable mono programs, cue, a single on/off control and a full-throw linear fader in the input module. We selected the only option on input modules, the left/right balance control.

Metering and monitoring for eight sources is provided in the control-room monitor module, and the company still provides the reliable digital shaft encoder for control of monitor levels. The studio monitor provides separate source selection for two studios and independent talk-back to each studio. The console meter bridge is equipped

with four high-quality ANSI spec VU meters, a cue speaker, a clock and a timer. The timer controls, including presets and up/down counting, are housed in the Utility module, which also provides a stereo LED bargraph level meter, cue and headset controls.

For additional source selection, an 8x2 selector module is available. To handle telephone and remote feeds, the Clean Feed module can be installed, which directs the two mono mix programs singly or in combination (summed) to six send outputs and allows for call conferencing.

The big plus of the R2K's design is under the hood, where all good stuff is usually found. The console has an RS-422 serial port to facilitate external control from studio turrets or automation systems. Each module has a distinct address, and functions such as channel on/off, cue, A/B select and program assign may be controlled via this serial port.

Because the switches on all modules are under software control, it is easy to change functions and provide I/O tally and control to suit different operational requirements.

Four input controls (closure to ground) and four output tallies (open collector) are available for each input channel. Several field-selectable combinations of these I/Os are provided, and we are sure that future requirements for specialized functions can readily be implemented. Several unexpected features, such as the monitor dimming when cue is activated, were welcome surprises.

With the power-supply system, Ward-Beck has hit a home run. In the space of two rack units, we have two 7A supplies in a dual redundant configuration. The power-supply modules plug into a modified version of the Ward-Beck card distribution amplifier frame, which additionally provides six slots for any of its 8200 series cards.

### Installation

We were the recipients of the first R2K consoles. Most early units have unexpected glitches when they first come on the market, and we did experience slight problems with the R2K units. To its credit, Ward-Beck made every effort to resolve our problems in a timely manner. It is much easier to tackle problems when you can speak directly to a rep and get results right away.

After completing the cable installation to the console, we discovered the first problem: The cover panels were not deep enough to clear all cables. We placed a call to the factory, and modified panels arrived within a few days. In

addition, the first console arrived only partially fitted with modules, which made testing somewhat cumbersome, but we soon received our full complement of modules. A few bugs in the software also surfaced, but they were quickly addressed by the factory. The documentation accompanying the firmware revisions could have been a bit more explicit; it would have saved a call to the factory for clarification.

The installation information that came with the consoles was sufficient, containing only minor errors. Ward-Beck's toll-free telephone number came in handy with accurate help regardless of what time we called.

Once we gained some familiarity with the R2K consoles, we found the connector scheme quite intuitive. The second and third console installations went much more smoothly.

In terms of the unit's design, a module guide-rail system would be a positive addition. For normal operation, this omission is not a big issue. The lack of guides is noticeable, however, when installing a single module in a fully fitted board that is already in use. It takes sure hands and correct alignment to line the module up with the back plane connectors. One company representative explained that, because the module circuit board is so shallow, off-the-shelf guides are not available. The company is in the process of finding a solution to this problem.

The second console went on-air in April and the third is installed in our sister station in North Bay. All consoles are performing flawlessly, and we believe they will continue to do so for many years.

*Charlie Tryon is chief engineer, CIGM, CJRQ and CJMX Radio, Sudbury, Ontario, Canada*

**Editor's note:** Field Reports are an exclusive BE Radio feature for radio broadcasters. Each report is prepared by well-qualified staff at a radio station, production facility of consulting company.

These reports are performed by the industry, for the industry. Manufacturer's support is limited to providing loan equipment and to aiding the author if requested.

It is the responsibility of BE Radio to publish the results of any device tested, positive or negative. No report should be considered an endorsement or disapproval by BE Radio.

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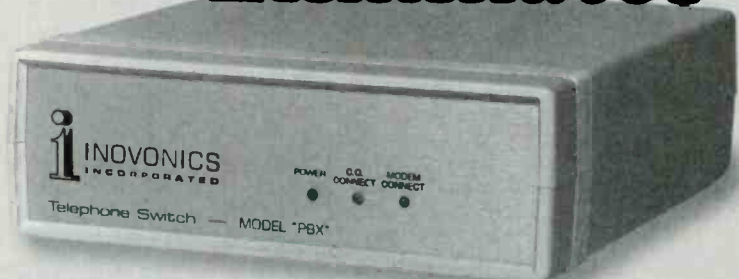
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# New Products

## Digital broadcast console Pacific Research & Engineering

▼ **Impulse:** This desk-mounted console is a lower-cost partner to PR&E's existing digital line of AirWave Digital and Integrity consoles. Available in two fully equipped frame sizes with a choice of 12 or 20 input faders plus two standard Telco input positions. Inputs accept either digital or analog sources and are reconfigurable in the studio from analog to digital or vice versa by simply swapping internal input configuration sub-modules. Optical digital input modules are available to accommodate semi-pro digital source equipment. Full-facility remote-control logic with built-in opto-isolation interface is standard.

760-438-3911; fax 760-438-9277; [www.pre.com](http://www.pre.com); [info@pre.com](mailto:info@pre.com)  
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## Handheld analyzer Neutrik



▲ **Minskyzer Audio Analyzer:** The Minskyzer continuously measures audio levels as RMS or peak levels, absolute or relative to a definable reference with selectable units. The frequency measurement, with high resolution of 100ppm, gives additional functions and acts as the base for distortion measurement. Distortion is measured as THD+N, automatically rejecting the fundamental frequency and calculating the THD+N value in dB or percent. A set of audio weighting filters can be activated in all measurement functions. A balance indicator continuously monitors and displays the quality of the signal balance, giving immediate detection of defective or wrongly wired cables. Results are displayed on a high resolution 100 x 64 pixel backlit LCD as numerical values, a bargraph when in meter mode or recorded as a curve versus frequency in sweep mode.

732-901-9488; fax 732-901-9608  
[www.neutrikusa.com](http://www.neutrikusa.com); [neutrikusa@aol.com](mailto:neutrikusa@aol.com)  
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## Automation updates Mediatron

**AirControl NT 2000:** The new version of the AirControl NT, this unit is available in three versions, standard, live assist and professional to meet various price points. All versions are 32-bit applications exclusively designed for Windows NT 4.0. New plug-ins include VoiceTrack+, HotRecord, HookMaker and SoundConvert.

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fax +44-49-8131-8305-25  
[www.mediatron.com](http://www.mediatron.com)  
[info@mediatron.com](mailto:info@mediatron.com)  
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## MiniDisc recorder/reproducer TASCAM

### ▶ MD-301 MkII MiniDisc Recorder/Reproducer:

Features include a 20-bit A/D and D/A, sample rate conversion facility for digital inputs, monaural recording mode, front-panel keyboard connection (PS/2-type keyboard connector), XLR balanced analog inputs/outputs and RCA unbalanced analog inputs/output. There is a timer record/play function, sampling monitor function, auto track function, record function, overwrite function, auto space/auto ready functions, shuffle play, program play and repeat play functions. Equipped with balanced inputs and outputs, front digital input, sync recording and rackmount construction.

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## Mod monitor and analyzer Audemat Inc

**AM-MC3:** As a mobile field-strength analyzer, the unit provides simultaneous measurement of up to 99 stations and has a cartography setting function and internal GPS receiver. As a mobile dynamic base-band measurer, provides dynamic audio signal deviation measurement; complete and comparative statistical pictures and an automated report function; multiple configuration to qualify signals all along the broadcasting chain; and comes with complementary software modules, accessories and services.

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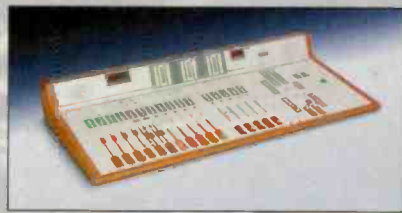
**WireReady**

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**Digital radio console**  
**Audioarts Engineering**

▶ **RD-20:** Expands the engineering of the RD-12 to a 20-position console. Totally modular, the unit has the power of floating point 32-bit DSP processors to handle complex tasks.



Accepts analog and digital input signals, processes them in the digital domain and outputs the signal in both digital and analog formats. Adds eight additional board positions and one additional cue speaker to the console.

Features advanced technology for talk segments, including digital, error-free mix-minus to feed up to as many as four callers on a single, selected bus. Has three stereo buses with both digital and analog outputs. The digital inputs accepts both EAS/EBU and SPIDF formats, and an external digital line pre-selector can accept eight analog, digital or mixed analog and digital inputs with both analog and digital outputs.

252-638-7000; fax 252-637-1285; sales@wheatstone.com  
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**Directional couplers**  
**Andrew Corporation**

▶▶ **S-Band DAB Bandpass Filter and Low Power VHF DAB Bandpass Filter:**



The S-Band filter is designed for 2.3GHz for critical and noncritical emission masks. The performance of the new filter meets the sharp response characteristics specified for DAB out-of-band emissions as well as providing low insertion loss and VSWR. The Low Power VHF is for lower power ranges below 500W and is suitable for European

DAB broadcasting. Both offer DAB band tunability, small size, temperature stability and power handling capability.

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**Errata**

**Mistaken identity**

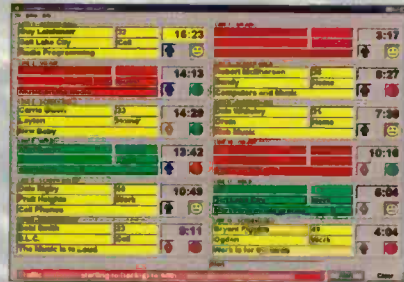
In the October 1999 Facility Showcase on Emm's Communications' new home in Indianapolis, most of the photos were taken by Jon Miller of Hedrich Blessing Photographers, Chicago. However, the photo of the people in the showcase studio on page 48 was taken by Dan Francis of Mardan Photography, Indianapolis.

**Very observant**

The Baseball All-Star Game On Location article in the September 1999 issue mentioned that a Telos Zephyr was used for the broadcast. Several observant people noticed that there was a Comrex Nexus in many of the photos as well. During the game broadcast, the Nexus was used for a separate feed from ESPN master control in Bristol, CT, to a VIP press box at the game for a closed-circuit audio feed that was not part of the on-air broadcast.

**Call screening software**  
**Gentner**

▼ **ScreenWin:** This Windows-based call-screening software package for radio is designed to interface with Gentner's TS612 multiline telephone system. Provides program hosts with



real-time updates on the background information and status of each caller, including who is on air, on hold or next in the queue, and how long callers have been waiting or talking. Supports English, French, German and Spanish, and enables remote access to caller information gathered in the studio via a laptop computer.

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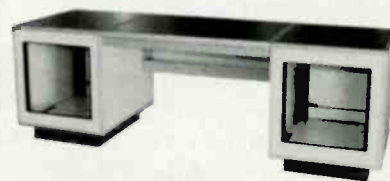
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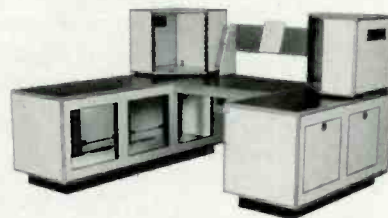
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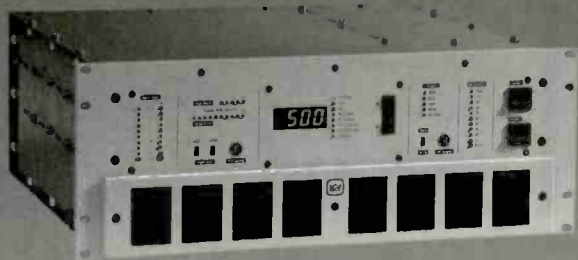
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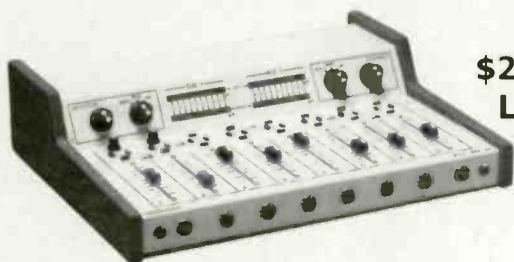
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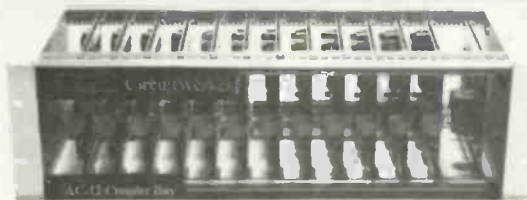
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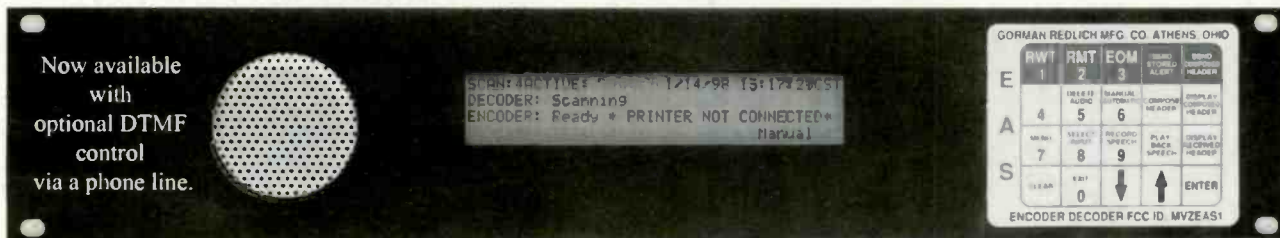
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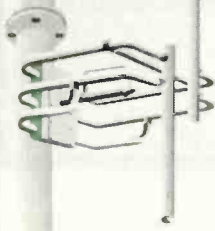
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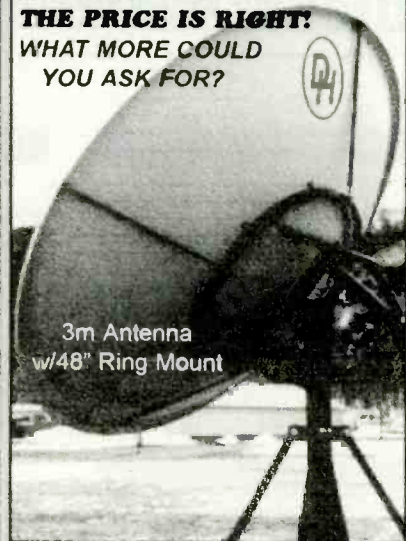
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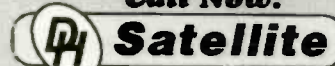
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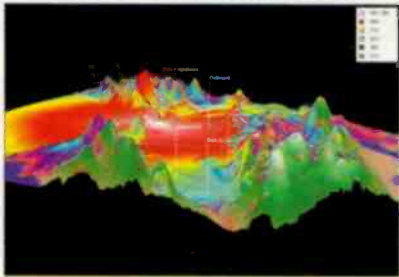
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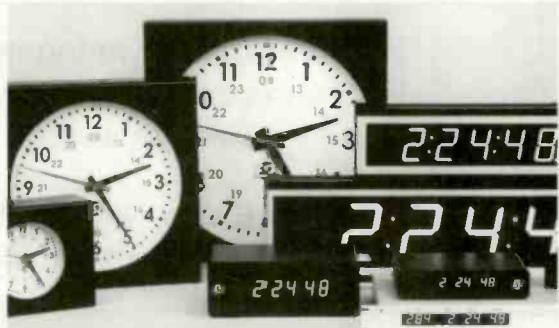
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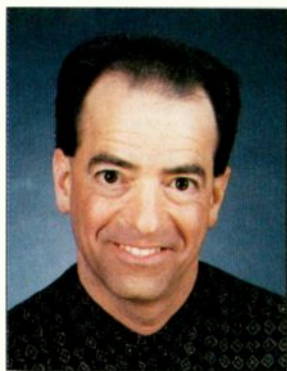
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## Fasten your seatbelts

By Skip Pizzi, executive editor

If history is any indicator, radio broadcasting is in for a bumpy ride as the new millennium dawns. Transition in the broadcast industry has never come easily. Witness the current *battle royale* in the DTV world. Similarly, look back at the introduction of FM, which saw a few false starts and a nasty, drawn-out struggle that eventually resulted in the suicide of its inventor, Edwin Armstrong. The introduction of television forced an equally painful metamorphosis on the then AM-dominated radio industry as it moved from a program- to a service-based orientation.



In U.S. radio broadcasting, probably the most important development of the current period has been the consolidation frenzy set off by recent regulatory changes. Although relatively transparent to audiences, the trend has been rich with upheaval in the personal and professional lives of radio professionals — and it isn't over yet.

Looking forward, the big story of the next decade is likely to be the launch and establishment of satellite DAB in the U.S. This has the potential of making the consolidation story look like a nursery rhyme. Let's consider some of the effects that this transition might have on radio as we know it.

### Change is in the air

As the new top of the fidelity food chain in audio broadcasting, satellite DAB could do to FM what FM did to AM in the 1970s. Because the benefits of higher-fidelity transmission are most evident in music, formats that feature musical programming could gravitate toward satellite DAB, leaving the FM band to host mostly voice-driven formats like news, sports and talk. This isn't necessarily a negative development, and FM could remain a stable, profitable business, but it will be tough for many to swallow.

Meanwhile, the national nature of satellite DAB could motivate terrestrial radio services to renew their commitment to localism, with emphasis on homegrown talent and locally oriented content. Again, this is a largely positive development, but it would constitute a near reversal in some current philosophies of the trend toward national consolidation, so it represents another potential hairpin turn to be negotiated.

Note, however, that there is synergy between localism and the all-talk trends. Much popular radio talk content is intrinsically local, such as weather, traffic and sports, and local news is generally highly valued as well.

Next, consider that satellite DAB will primarily target the mobile market, leaving the home and office listening markets more open to capture by terrestrial radio. Again, this is

not a bad thing, but it represents a precipitous shift from the heavily drive-time oriented programming attitudes of most current radio stations.

Another area of change may involve responsiveness to the audience. Because many national channels will address larger, more diverse audiences, it may be harder for them to be directly responsive to audience needs. Local radio can fill this gap by becoming extremely responsive to the particular requirements of its more targeted audience. By classic information theory, a local radio station can know more about its audience because it is literally closer to the ground. This advantage should be exploited and its results reflected in the station's programming. The station's website can be used to capture this information in a way that is not labor-intensive. The increased use of other, more expensive qualitative research techniques (focus groups, surveys, telemarketing and the like) can also play a role. This is yet another potentially beneficial trend but will require some serious retooling for many stations.

Finally, consider that a *mêlée* of its own sort has broken out in the music business. Artists are asserting their independence from publishers and a disintermediation of the traditional music-retailing channel has begun — all thanks to the World Wide Web. If this happens on a sufficiently grand scale, it could affect (i.e., reduce) the role that radio has traditionally played in retail music marketing, so the possible trend away from music programming in terrestrial radio, as mentioned above, may have some serendipitous timing.

It's clear that, even without a terrestrial DAB solution, AM and FM broadcasters can survive in a satellite DAB environment, but not without some growing pains. The radio industry has proved its resilience before, although it has enjoyed a fairly stable and unchallenged path in recent years. Soon, it may be time to buckle up and hang on as the old industry corrects its course one more time.

**The big story of the next decade is likely to be the launch and establishment of satellite DAB in the U.S.**



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