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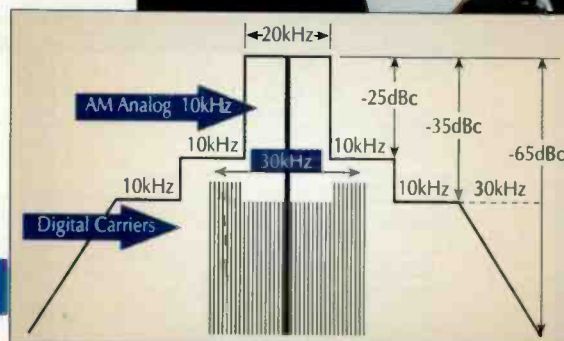
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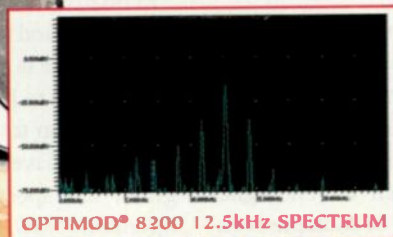
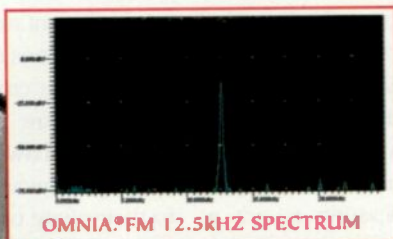
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When you hear the Omnia[®].fm, you'll know why broadcasters the world over choose it: Sound that's as smooth and fluid as analog, with absolutely none of the digital grunge you hear in other digital processors.

So what's digital grunge? Artifacts caused by aliasing distortion in yesterday's processors that lack the Omnia's 48kHz sampling, 192kHz virtual upsampling and unique anti-aliasing final limiter. In the FFT analyses shown below, you can actually see the grunge as well as its absence in the Omnia.

To hear the difference for yourself, contact your Omnia dealer and get your risk-free, 60-day demo*.

Here's how: The test results were obtained with a Hewlett-Packard Audio Test Set, Model 339A; the audio processor under test; and Rapid Systems R1200 Data Acquisition System for FFT analysis. The processors were set for 75µs pre-emphasis, and were carefully adjusted so the input levels were within the normal range of operation. The unit under test was fed a 12.5kHz test tone using the analog inputs. The discrete left channel analog output was connected to the FFT analyzer input. That's it. No tricks, no disclaimers about the test working only in our trade show booth or only in our lab, under the most arcane, non-real-world test conditions. In fact, you can duplicate the test results yourself in your own shop. Don't have an FFT analyzer? No problem. Just use an oscillator and your ears—you can clearly hear the birdies in the old processor! But this isn't about test tones; it's about music. And Fourier theory says that music—whether it's rap, oldies, urban, country, and yes, even grunge—is represented as a combination of sine waves. Imagine what this kind of aliasing distortion can do to complex musical signals!



Here's why: The Omnia.fm utilizes 48kHz sampling for dynamics processing and virtual upsampling at 192kHz for the final limiter, which is a unique, anti-aliasing design. The test used version 1.02 software and the 'Cranked' preset, which is the Omnia's most aggressive stock setting. The

Orban[®] Optimod[®] 8200 used for testing operates at 32kHz sampling for the dynamics processing and incorporates (4x) 128kHz upsampling for the clipping/low-pass filtering function. The test used version 3.0 software and the 'Urban/Rap-Dense' preset, which is the Optimod's most aggressive stock setting. Aliasing will occur with input signals above 5kHz in 32kHz FM broadcast audio processors unless mechanisms that cause aliasing are eliminated.

For a complete technical report, call us for a copy of our paper entitled "Omnia.fm: An Engineering Study." Or visit our web site at: www.nogrunge.com.



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*Contact your dealer for details on this demo program. Demo requests must be accompanied by a purchase order so our dealers know you're really serious about some serious sound.

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If you can't beat 'em, license 'em

The next time you're in a crowded room, pick out one person and focus on what he or she is saying. In most cases, you can make out what is being said. Take the same, already crowded room and add 5 to 10 percent more chatting people. You may still accomplish the same listening feat, but it will be harder to do so.

Four of the five FCC commissioners believe there's plenty of room for everyone to speak up. The Notice of Proposed Rulemaking released last month outlines the FCC's desire to open up the FM band to a greater diversity of voices. The main impetus for this action is to allow the public easier access to the airwaves. The commissioners seem to believe broadcasting is a right, based on the fact that the Constitution guarantees freedom of speech. But broadcasting is not a right; it's a privilege.



Consolidation of ownership, a result of the Telecommunications Act of 1996, has closed the doors to new entrants, according to the FCC. Granted, the purchase price of an individual license has been driven higher since the allowance of multiple ownership. It would be a great feat to amend the Act to reverse this situation — a move that group owners, the NAB and most of Congress would oppose — and that has yet to happen. Once a problem has been identified, the usual course of action is to fix it. Instead, the FCC wants to open the floodgates and let new stations pour in. This response merely covers the problem with a Band-Aid. By their own hand, the FCC began the many steps of deregulation. The Telecommunications Act furthered this effort.

What brought this NPRM on? The FCC states that it has received 13,000 inquiries over the past year concerning low-power station licenses. The NPRM explains that, during this time, there were an average of 1000 Web hits per month to the FCC page on low-power radio. However, this figure is not reliable, considering that any visit — unique or repeat — is a hit. One pirate operator could account for a substantial amount of that traffic. Also, during the time period in question, the FCC's Web page discussed only the possible benefits of LPFM — just what those visiting the site wanted to hear. The page made no mention of the negative effects LPFM could have on existing stations. Further, the commission received only three petitions related to LPFM. This is not a public outcry; rather, it's the commission's making a mountain out of a molehill.

The commission's primary concern is that not enough voices are represented on the airwaves. Part of the NPRM discusses relaxing or removing the third- and possibly the second-adjacent channel protections that currently exist. Some spectrum analyses were done with markets broken down into large, medium and small metropolitan areas. This study cites some possibilities for the number of new LPFM stations that could be allocated if this rule were enacted. In the largest markets, even with second- and third-adjacent rules removed, there may only be up to two LP1000 stations allowed. Two stations doesn't do much to diversify the crowd.

If there are truly 13,000 potential station operators interested in owning a new LPFM, only a small fraction will actually be awarded licenses. The rest will no doubt return to their pirate operations, further congesting the airwaves.

Kennard and Tristani state that they consider the airwaves to be a "natural resource." They seem to have forgotten that this resource is already scarce. They also mention that the FCC's job is to be the guardian of the spectrum. Yet filling the spectrum to the brim hardly seems like a responsible action. We have already seen that the FCC cannot properly guard the spectrum against the proliferation of pirate operators. Now, instead of enforcing its own rules, the FCC wants to bend them.

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

Chriss Scherer, editor

For more on this topic, see the story on FCC Commissioner Harold Furchtgott-Roth's statement against LPFM, p. 102, and see FCC Update, p. 32, for a general overview of what is proposed.



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Contract Engineering

Navigating consolidation

By Mark Krieger, CBT

Consolidation. The term has been used so often since 1986 that most people have become numb to it. As one industry observer puts it: "People don't speak of consolidation so much in negative or positive terms anymore...it has simply become a fact of life that isn't going to go away any time soon." This point is well-taken by hundreds of broadcast engineers across America who are witnessing an inexorable change

operating company's engineering personnel. More recently, the trend has been to combine station facilities, allowing owners to delegate tasks among multiple stations to fewer engineers. In this physically consolidated environment, a ratio of one engineer per station has become a luxury few of the big players feel they can afford in the long run.

Typically, the technical management of a market cluster (of stations) will center on a local director of engineering. In general, the DE will then be responsible for supervising a given number of staff or chief engineers. The number and title of these individuals depends on the owners, the size of the market and other variables unique to that cluster. Indeed, in some medium to smaller markets, the DE may be a one-man band with some part-time help. The DE answers to local management and often to a companywide engineering director as well. Hence, while a broadcast engineer today is more likely to be a full-time company employee, it is also likely that his responsibilities have been expanded to the point where his time and attention are spread very thin.

So where does today's contract engineer fit in? To start with, some groups will use contractors for day-to-day requirements under certain circumstances. Never make the assumption that any group simply won't work with you on a routine basis. While certain groups may pay lip service to a policy that excludes the routine use of a contract engineer, their ultimate guide is the bottom line. If you can demonstrate to a local DE that you can handle maintenance of a far-flung transmitter site in a way that is more cost-effective for the company, you may stimulate some interest. This is especially true in situations where an existing cluster makes an acquisition that might otherwise necessitate beefing up the full- or part-time staff. The key here is getting to know the local DEs and developing good relationships with them. SBE functions are a great place to network, as are certain online forums and list servers. An understanding of who's who and what's happening in a market is essential to successfully marketing your services.

Project work

There is one area in particular where a competent contract engineer can fill a real niche: projects. Radio consolidation has reached the point where even low-grade facilities (what some of us used to call throwaways) are being gobbled up and improved or moved at a blistering pace. Typically, owner groups want their



Sometimes a studio project needs to be completed immediately. Contract engineers can help meet tight deadlines.

in the landscape of their careers. Let's explore just exactly what those changes are and how the contract engineer can find new opportunities in the midst of them.

Current trends

Consolidation has affected the structure of the broadcast engineering work environment. Before consolidation, the industry trend was to move away from the traditional pattern of individual station engineering staffs toward widespread use of contract engineers. This practice was most widespread in smaller and medium markets but was beginning to gain acceptance in some larger markets until the Telecommunications Act of 1996 brought about a paradigm shift. As large operating groups began to accrue a number of stations in a given market, full-time staff engineers were suddenly back in vogue, since properties were moved around and a considerable amount of upgrading took place. In some areas, this meant that stations which had routinely employed the services of a local contract engineer were being turned over to the



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Contract Engineering

already overtaxed local engineers to complete these types of projects very quickly. This is a case where the use of a contract engineer can be a win-win situation.



Some group owners rely almost entirely on contract engineers to build a studio, as was the case with this Radio Disney studio in Cleveland.

Consider the following:

- The contract engineer can be brought in to handle a project or certain elements of a project on relatively short notice and will only be there for the project's duration.
- The contract engineer can devote full attention and energy to the project, since he will not have the types of distractions and interruptions staff engineers are subject-

ed to during day-to-day operations. This greatly enhances the contractor's ability to meet deadlines and is a key, but often overlooked, selling point.

• The cost of the contract engineering services can be rolled into the capital costs of the project. This can be a real advantage when the DE faces severe operating budget restrictions. Furthermore, if the project involves a newly acquired property, the contract engineering tab can sometimes be recorded as an acquisition expense. Doing so holds certain accounting advantages for the operating company.

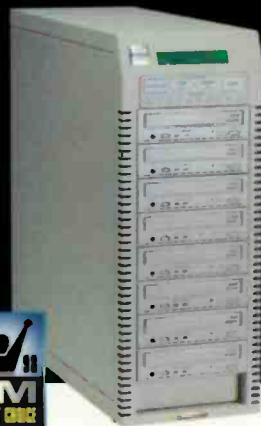
For large-cluster operators, then, there are significant benefits to using contract engineers as pinch hitters. But a few considerations need to be made on both sides before entering into a working relationship. Trust and accurate communication are critical to ensuring mutual satisfaction. Remember that the DE you approach about participating in a critical transmitter or studio project has a lot on his mind and on the line. You will have to convince him of your competency, honesty, discretion (a necessity for you and your client), and ability to deliver. Remember that his superiors will be asking questions and that the DE will have to justify your addition to the project. Make sure you can deliver what you promise. In addition, you will need to make every effort to determine your client's exact expectations. Have him map out the project in as detailed a fashion as time permits. Offer any

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Contract Engineering

suggestions you might have, but do so diplomatically. This type of collaborative approach will serve both parties well. In many cases, a fresh eye may detect details that have been overlooked or see an approach that can result in lower costs and faster turnarounds.

Making your bid

Bidding project work can be a challenge. In a perfect world, you should

be able to bill a client on a simple time-and-expense basis. But in the case of project work, the budget is the bottom line. In such situations, the client will want to know how long the project is going to take and, ultimately, how much it will cost. Only experience and thoughtful consideration will determine whether you wind up with a fair return or take a bath on a particular project. Remember, if you are being asked to devise a project plan or lay

out a detailed design, you are actually acting as a consultant and should charge accordingly.

A flowchart can be a useful tool for determining how and when things need to happen and who will carry out the necessary steps. You can use the flowchart to segment a project so you can better estimate how time will be spent and detail who is responsible for various project elements. Again, communication with the client is paramount. Put everything in writing and make sure both parties sign off on all written agreements.

Bear in mind that marketing your contract engineering skills in this era of consolidation requires greater flexibility than in the past. If you are involved in pinch-hitting projects, you will have to be able to adjust your schedule accordingly. This may mean that you'll work 70 hours some weeks and only 20 others.

If a client likes your work, you can count on being asked to go on the road for them to other project sites. For those with family responsibilities, this can be a tough choice. If you do accept, be sure to look realistically at the travel expenses involved and spell out who is going to pay how much ahead of time. Don't expect to stay at the Hilton, but don't settle for the YMCA either. Be fair to your client and yourself, and you'll both be happier.

Though there are those who speculate that consolidation threatens to place contract engineers on the endangered-species list, remember that the same was said about staff engineers not too many years ago. The truth is, no matter what the broadcast corporate landscape looks like, there continues to be a demand for contract and staff engineers who are competent and confident.

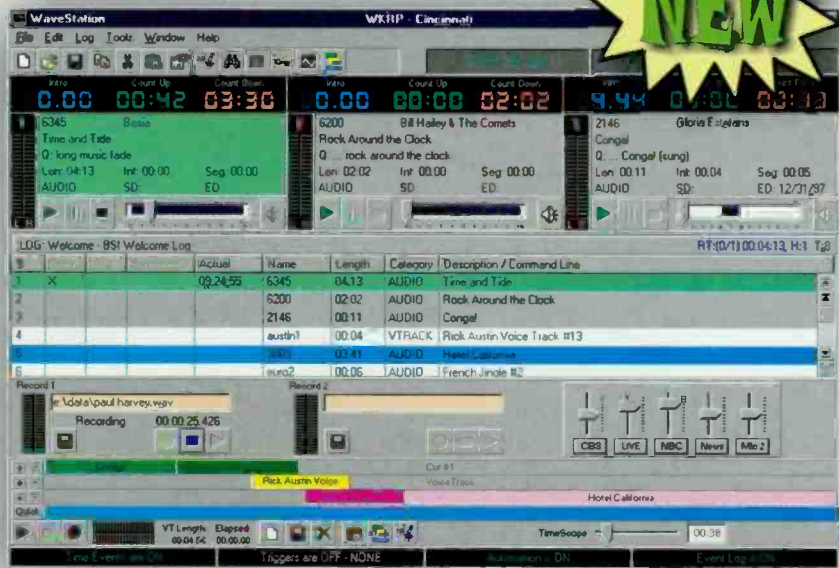
The challenge for today's contract engineer is to recognize and respond to the client's needs in a changing and consolidating ownership environment.

Mark Krieger is an active SBE member and contract engineer in Cleveland, OH.

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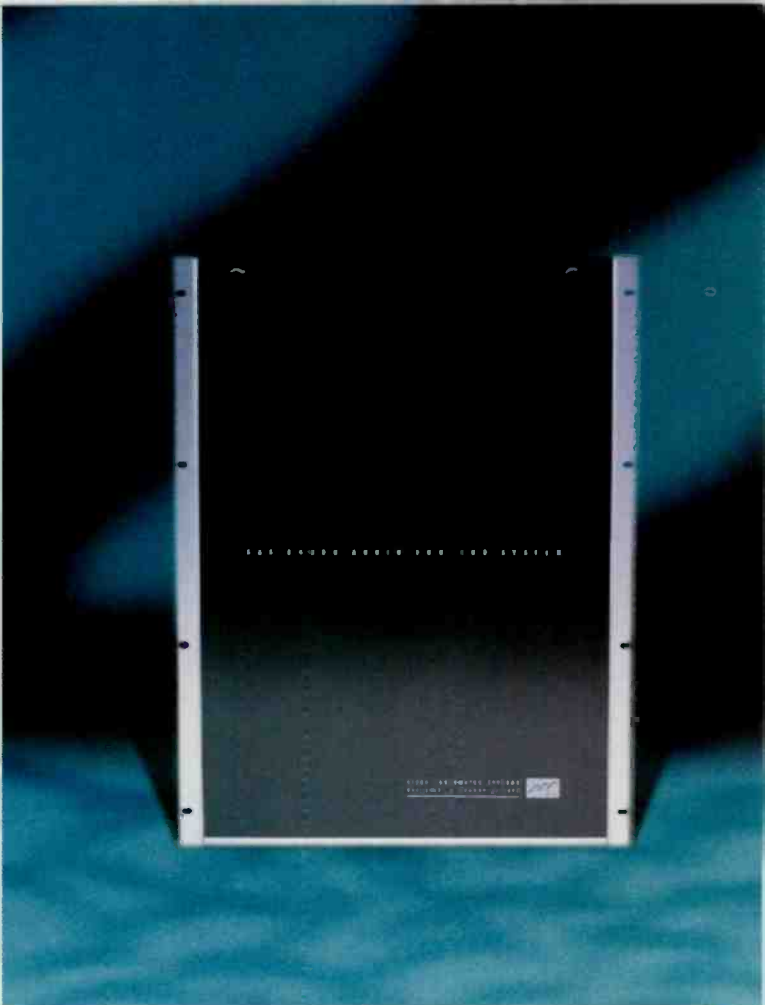
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DTV's impact on radio, part 2

By Don L. Markley, P.E.

Last month, in the first part of this article, the discussion focused on tower space, tower modification and sites. This month, the topic is the availability of skilled personnel.

For years, the broadcast industry has failed to realize the need to pay competitive salaries to keep qualified personnel in the broadcast business. Granted, the greatly improved reliability of solid-state systems, with their microprocessor monitoring and control, has virtually eliminated the need for the guy with a pocket protector and a screwdriver to lurk around the control room every day. Today's systems don't require the kind of nurturing that was the norm in the past. There are few styli to replace, tape heads to clean or transmitter tubes to change — most have largely gone the way of the mercury vapor rectifier. One good engineer can now provide all the service needed for several small stations. Even the major-market stations have reduced the size of their technical staffs. The problem is that some repairs and adjustments are still necessary, and there is often no one present to make them. Furthermore, the repairs and adjustments needed now are often far more complicated than swapping tubes. Digital systems offer many benefits but are difficult to repair. In many cases, component-level troubleshooting is not cost-effective, or even possible, in the field.

The DTV siphon

The number of TV stations has grown, which has contributed to the erosion of the radio broadcast engineering ranks. As old-timers retire, new personnel aren't available to replace them. The result is that retiring

engineers cannot pass on the knowledge they've gained from years of experience.

Now, young engineers are moving to TV systems at an even higher rate than in the past to meet these stations' DTV expansion needs. As more TV stations begin DTV transmissions, the number of engineers available to maintain radio stations will decrease, unqualified personnel will be pressed into service, and the overall quality of the technical work force will drop. These changes will occur at the same time that the onset of digital radio will demand better technical personnel at radio stations.

Filling the vacancies

The solution is simple — sort of. First, stations have to accept the fact that they must increase salaries for existing personnel if they expect to keep them. While this measure will help individual stations, it won't do much to curb the overall industry shortage. This shortage will only be checked by convincing more educational facilities to train technicians in the broadcast industry — both radio and television. Around the country, some community colleges do offer limited courses in broadcast systems. One manufacturer, Harris Corp., has developed such a program in conjunction with a community college. For that, Harris should be applauded.

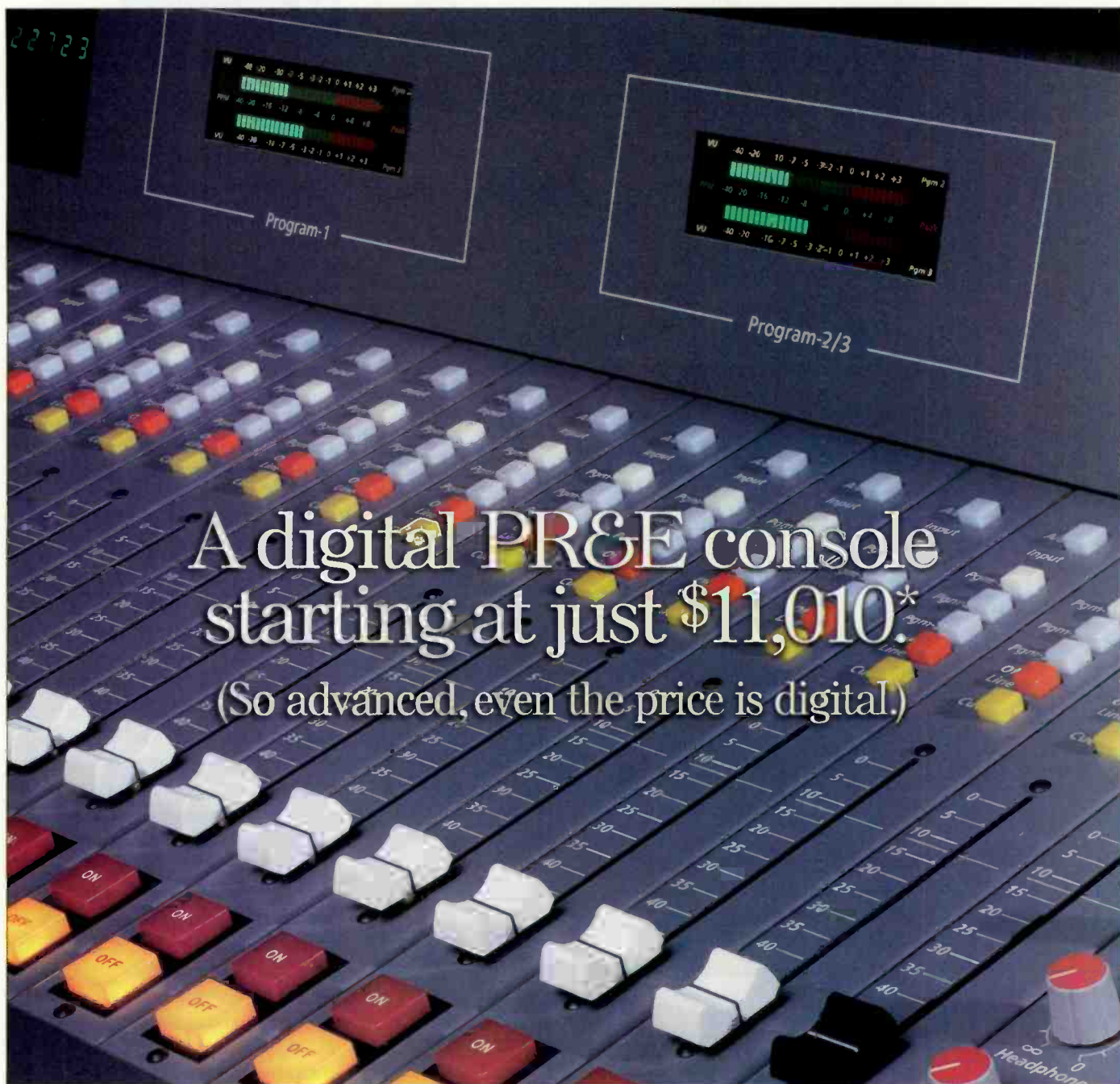
Harris' program certainly makes a dent in the problem, but it isn't enough. The majority of the industry has simply been unwilling to become involved in finding a solution to the shortage of engineers.

SBE has worked at offering seminars at its various meetings and conferences.

While they definitely help, these seminars aren't a substitute for the comprehensive programs that should be available at qualified technical institutions. What is left are some trade schools that, though helpful, don't meet the level of education necessary for today's radio and TV technicians. Furthermore, most of the best students in these programs simply ignore RF in electrical engineering programs and follow the trail of 1s and 0s to the bank.



The new challenges brought about by DTV may lure talented technicians away from the less rapidly evolving field of radio.



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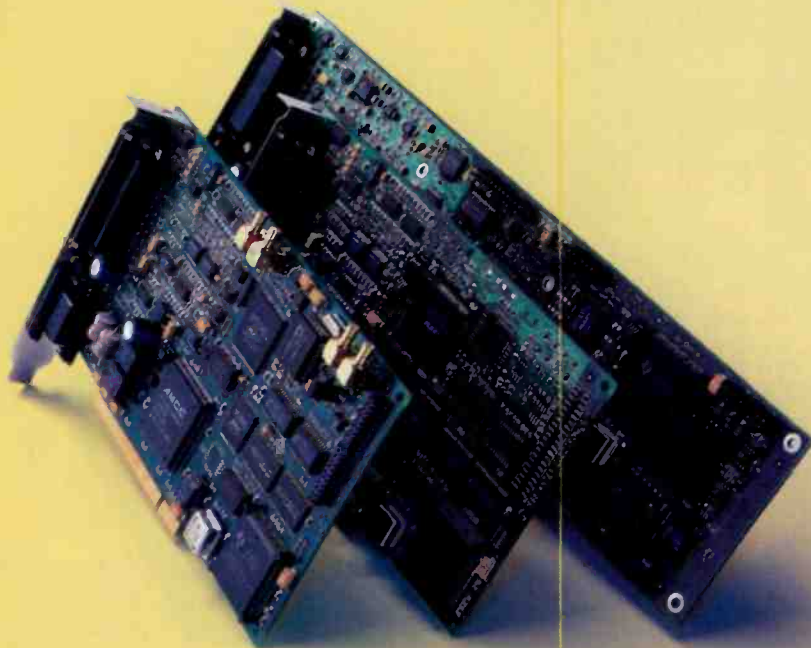
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Managing Technology

Retaining staff

For individual radio stations or groups, the quick fix is to keep existing staff. Making their positions adequately rewarding and challenging will lessen the temptation of moving to television. A start would be to treat good technicians like the professionals they are. They shouldn't be expected to mow the yard or fill the pop machine like many of us did when we started. Instead, they should be asked to participate in such areas as budget development and equipment purchases. The production staff obviously is

Now, young engineers are moving to TV systems at an even higher rate than in the past to meet these stations' DTV expansion needs.

involved in the selection of studio equipment, and the technical staff should be involved, too. With regard to buying transmitters and antennas, the chief engineer should be a major player in the management team, not just an adjunct to the station manager.

Keeping your lead technical people onboard involves more than salary and benefits; it also involves recognizing the value of their positions in the station. On the other hand, technicians have a role to play as well. If they want to be treated as professionals, they must demonstrate professionalism. They need to continue to pursue education in the field. Also, they need to be forward-thinking in their work, which includes going one step further to ensure that their recommendations are based on sound engineering principles as opposed to doing things the way they've always been done. If all of this comes together at a station, the staff will be happy and, more importantly, they'll stay.

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Don Markley is president of D.L. Markley and Associates, Peoria, IL.

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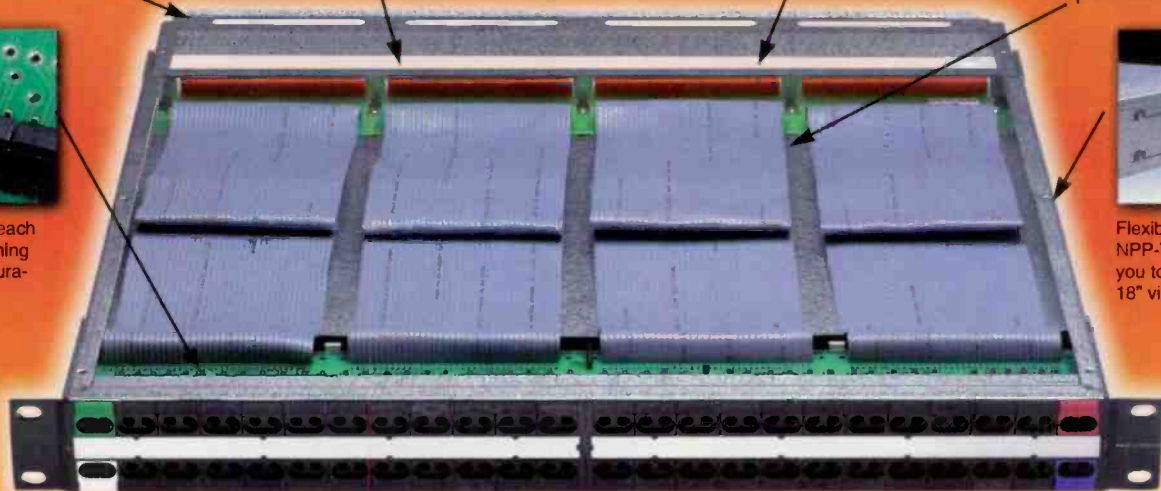
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Are you ready for IBOC?

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

IBOC broadcasting was proposed some years ago, but it was not until NAB98 that it began to look like a reality in the near future. In November 1998, the FCC issued a Notice of Inquiry, which usually presages a surge in a project's activity.

And there has been considerable activity. Several petitions have been filed with the FCC, but at the time of this writing no actions have been taken. However, if and when an IBOC system is approved for the U.S., its effects will not be felt for some time. Despite this, a number of proponents are ready to forge ahead.

The principle is appealing: The ability to add separate information channels to an existing carrier offers licensees another program source — maybe more than one — that can be used for revenue-producing operations. Just about all radio-station classes can benefit from IBOC by adding data services to their inventory. However, there may not be enough anxious users of data transmission, at least at first, to make it profitable.

There are three major players in the IBOC field: USA Digital Radio, Lucent Digital Radio and Digital Radio Express. The broadcast industry was surprised in January, when 11 prominent broadcast owners joined CBS and Gannet as USADR investors to support IBOC's development and implementation.

IBOC proponents have been performing system tests for some time, and they have held demonstrations on IBOC DAB. This year's NAB will see large steps forward in IBOC technique and final system development. It is hoped that the Commission will issue a sensible decree in time for the convention.

At this time, the IBOC systems in development must use some form of hybrid operation, though all plan to become fully digital as soon as possible. Hybrid operation will be a virtual necessity until the majority of receivers in use employ digital radio circuitry. Until this transition occurs, many listeners won't be able to enjoy the clarity of CD-quality reception.

IBOC development engineers and transmitter designers have been investigating the requirements of the various systems and the general system problems of combined AM and FM transmission through a single RF amplifier.

Some transmitter manufacturers are working on the compatibility angle, and Harris Corp. has presented

several papers on the topic. Because of the uncertainty about which system will finally be approved, it is rather difficult to lay down specific transmitter requirements. Since the final transmission techniques selected will depend on the modulation methods employed, we will look at the general requirements.

AM IBOC

Naturally, the system requirements differ for discrete AM and FM operations. Among those for AM is a precise (narrow) channel width of 20kHz, into which an analog and a digital signal will have to be crowded — and still produce CD quality. The proposed IBOC systems promise to provide a new transmission system and a wider range of programming without compromising the existing U.S. AM allocation standards. Combining the analog and digital

transmissions makes it possible to provide AM and FM programming (and data, if required) during the introductory period without outmoding existing AM receivers.

The principle of operation results in the generation of a complex signal with in-phase and quadrature components. Linear

amplification is required for proper operation, but this can be compromised by low VSWR and narrow-bandwidth antennas. The whole system of IBOC operation appears to be more complicated than some engineers initially anticipated. However, the concept should revolutionize AM broadcasting. Questions of power amplifier performance, the effects of filtering on the production of intermodulation distortion, and transmitter noise-floor levels appear to be vital subjects of continuing system development and research into the suitability of various AM transmitter models.

Figure 1 shows the USADR AM Hybrid DAB signal and its mask. A 30kHz channel bandwidth is needed to convey the AM and the frequency-modulated programming and datastream. Despite this requirement, the proposed operation falls well within the FCC NRSC AM mask because the two 10kHz wings carrying digital information fall beneath the interference limits.

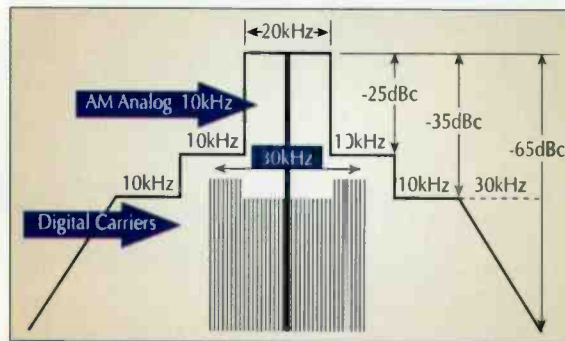


Figure 1. The spectrum mask of the USADR AM Hybrid DAB signal. This mask still fits the FCC NRSC AM curve.

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Air 3:57	True Colors Phil Collins :11/4:05/F HIT HM0105 8:15:47 #1 for 3 Weeks in Feb. '99	Shotgun Jingle :03 4	Fast Jingle :08 4	Medium Jingle :12 4	Slow Jingle :14 4	Long Jingle :17 4
Start 3	Written In the Stars Elton John & LeAnn Rimes :17/4:13/F HIT HM2603 8:18:40	Legal ID :11 4	Morning :09 4	Oldie Jingle :08 4	PSA Bed :30 4	Promo Bed :31 4
Start 3	Contest Promo Bed Instrumental :C0/0:30/F PRO TO2214 8:22:42	Weather Open :40 4	Weather Close :04 4	Slide Whistle :02 4	Sports Bed :60 4	News Bed :12 4
Start 3	Short Jingle Q-102 :C0/0:06/F JIN TO2215 3:23:02	Gong SFX :03 4	Drum Roll :10 4	Rim Shot :01 4	Traffic Bed :31 4	Weather Bed :13 4
Start 3	All I Have To Give Backstreet Boys :00/2:45/C 101 DA1234 8:23:08	Rooster :04 4	Bugle Revolve :16 4	Woman Yawns :02 4	Contest Bed :59 4	Winner Bed :59 4
Start 3	McDonald's 2 for \$2 Q: ...may vary. :00/0:30/F COM DA4315 8:25:53	Don't Go There :02 4	Gong SFX :03 4	Happy Birthday :32 4	Applause :08 4	Wow! :01 4

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Dallas Morning News 4:24:3 0:01:00C CM The News You Know	1034 Both of You - Maternity :00:0:30C CM	1035 Bright Truck Leasing :01:0:0C CM
Pepsi-Cola 7:327 0:00:30C CM	1036 Burns Security Syst :00:0:30C CM	1038 Car Nation - Tuesday :00:1:00C CM
	1039 Car Nation - Wed :00:1:00C CM	1040 Central Bank & Trust :00:0:30C CM
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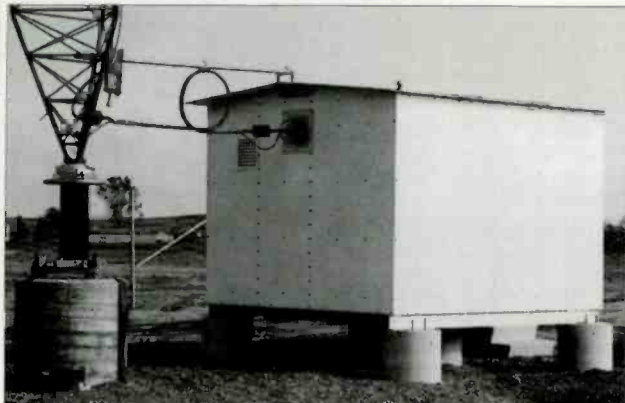
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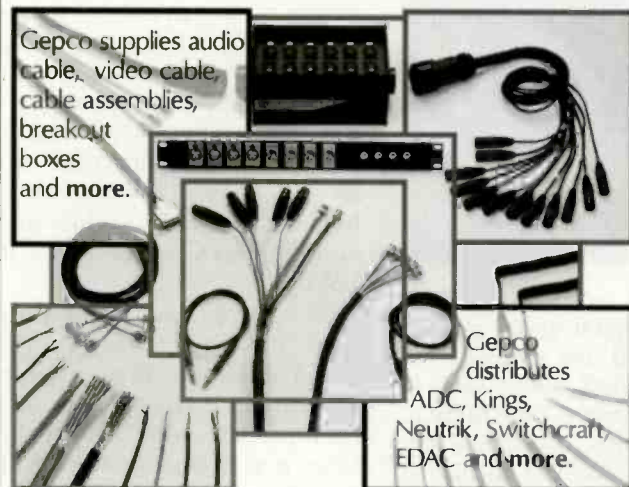
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RF Engineering

USADR AM Hybrid IBOC uses 62 digital carriers spaced under and around the AM carrier in its orthogonal frequency division multiplexed (OFDM) modulation to transmit the audio material.

Once the FCC gives the go-ahead to IBOC, equipment manufacturers will undertake a vast amount of development work. The greatest problem appears to be the need to accommodate analog and digital transmissions in the same RF sections of the transmitter. Once the final shift to digital takes place, the situation should be more manageable.

Several popular AM transmitters, each using different modulation methods, have been tested and evaluated to a limited extent. It appears that transmitters using PSM and PDM modulation may require careful adjustment to ensure that sufficient bandwidth is available to cope with digital modulation requirements. However, sufficient information is not available at this time to speak with complete certainty. Certainly, correction circuits, and possibly Nyquist filters, will be needed for successful operation.

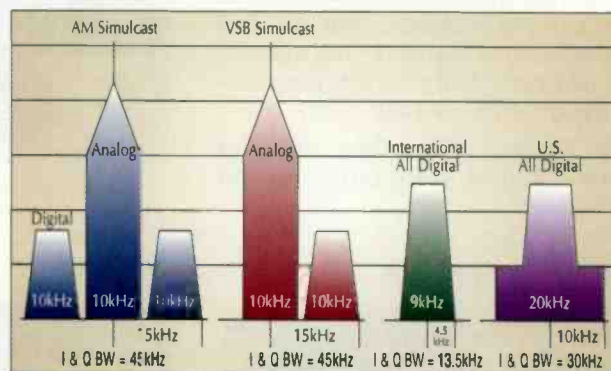


Figure 2. Various spectrum masks for broadcast services.

It appears that attention will have to be paid to methods and systems for STL work. The amount of change required will depend on the transmitter location and studio-equipment positioning in the audio equipment chain, although these specifications will probably be modified many times before the final operational system is selected. Like many, I hope the FCC will not stand on the sidelines as it did with AM stereo.

Hybrid IBOC

Figure 2 shows the shapes of the various possible emissions and their channel occupancy. In the U.S., we are concerned only with the AM and FM simulcast systems for use during the transition to full digital operation and the U.S. all-digital system, which spreads its shoulders out to $\pm 198\text{kHz}$ from the carrier frequency.

Although the IBOC DAB system may seem complicated, we should not lose sight of the fact that it represents a fantastic use of the FCC's authorized AM and FM bandwidths — it crams a number of additional programming possibilities into our well-worn AM and FM channels.

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Sharing audio file formats

By Skip Pizzi, executive editor

When we think of the data coming in and out of a computer, we often conceptualize a continuous stream of bits — 10111001001110... But just as you have difficulty reading this clause without spaces and punctuation, to be properly deciphered when read, computer data must be parsed into manageable bundles when written. This division of data is also a prerequisite for the addition of error correction, which allows the data to better survive the rigors of storage and transmission.

So instead of the continuous stream, digital signals are always broken into discrete chunks of data when written or transmitted, using a form that is known a priori by the reader or receiver. Industry standards are required to set the rules for this partitioning and organization of data bits so that interoperability among devices sharing this data is guaranteed.

In the real-time environment of digital signal transport systems, this parceling is known as *framing* of the data, as in the AES3 digital audio format. On the other hand, digital storage systems use *file formats* to determine the structure of data that will be placed on their magnetic or optical media.

In general, the design criteria for a file format is determined by the nature of the storage medium and the processing devices — just as digital transmission formats are designed for optimal robustness through the expected parameters of the channel. In some cases, file-format design may also take into account the needs of the software that will use the stored data.

For example, each different CD format uses a specific file structure that specifies the operation of that format. The Red Book, which specifies the audio CD file format, is optimized for continuous, sequential playback of audio. The Yellow Book, which specifies CD-ROM file format, is structured to better accommodate random access to any kind of data. Design differences also exist among the file formats used by computer audio applications for production or assembly of audio programs on hard disk.

Although the variety of file formats in current use is myriad, one common element exists among the various

forms. All formats divide their bits into two main classes: *headers* and *data*. In the case of digital audio file formats, this is more specifically called *header data* and *audio data*. Headers inform the receiving/reading device of the formatting used and disclose the settings of any variables the format permits. This information prepares the receiver to properly decode the audio data that follows the headers. Some header data appears only at the beginning of the file; other headers are repeated frequently. Some formats include header data in every

data block. In aggregate, the header data of some formats can approach the size of the audio data it accompanies.

Standard formats

In the computer multimedia environment, certain file formats have achieved the status of de facto standards. These “linguae francae” have made exchange of media data between computers possible, even when using different platforms or programs.

For example, the Wintel world uses the WAVE format (also known by its file

extension, *.wav*), while the Macintosh environment employs the AIFF format. These are standard multimedia audio file formats in use by native processes of the computer's OS and by some audio-specific applications.

But many audio applications find these formats too limiting or otherwise unsuitable. Though such applications may support these formats as I/O file types, they use a different, proprietary file format for the data created within the application. This is similar to word-processing applications, which all have their own proprietary file formats yet can read or save files as plain ASCII text. But just as the plain-text format does not convey all the attached details of the word processor's expression, a WAVE format file cannot retain the auxiliary labeling and other data specific to the application with its audio samples.

Thus, the computer audio world is fraught with a variety

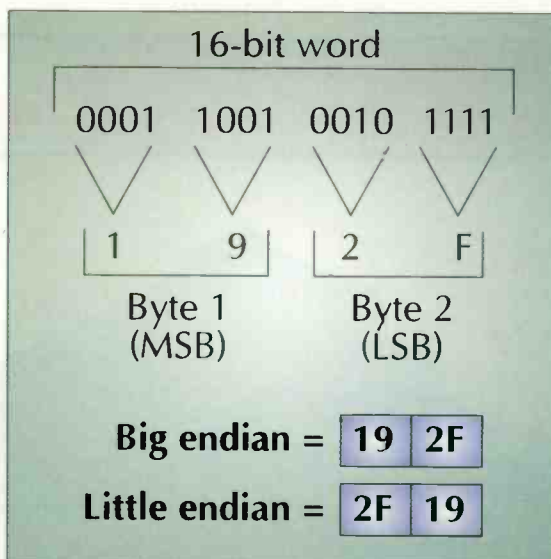


Figure 1. A 16-bit audio sample consisting of two bytes of data, shown in big-endian and little-endian order.

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of file formats, along with a few de facto interchange standards. Although none of the standard formats is truly universal or completely satisfactory to the needs of all applications, their existence makes possible some degree of interoperability.

Conversion

The motivation behind the developers' use of proprietary file formats is not simply protectionist. Computer audio applications are written in different programming languages (anything from Fortran to C++) and are intended for use on different platforms. Accessing and manipulating stored audio data in optimal fashion within these differing hardware and software architectures requires diverse data-formatting styles.

One frequently encountered example is the *endianess* dichotomy. Audio, like most of today's data, is stored in multiple-byte chunks. (A byte contains eight bits, so the common, 16-bit audio sample requires two bytes, and a 24-bit audio sample requires three bytes.) Whenever a data chunk involves multiple bytes, the order in which the bytes are stored becomes an issue. If you store the most significant byte first, the format is called *big-endian*. Conversely, if the least significant byte is stored first, the format is called *little-endian* (see Figure 1). Obviously, storing in one format and recovering in the other can create

grossly erroneous results. (Note in the figure that the bits inside the byte do not change their ordering in either case.)

There are two reasons these storage schemes have become such an issue in the audio world: On the hardware side, IBM-type PCs follow the little-endian scheme, while Macintosh follows the big-endian scheme. Second, WAVE files are little-endian regardless of the hardware environment, adding another layer of complexity when converting cross-platform, even using a "standard" file format.

Thankfully, a few handy file-conversion utilities accommodate most of the commonly encountered audio file formats. Again, as in the word-processing environment, these utilities allow conversion of any supported file format to any other, although the rewrite may require some processing time on large files. However, these utilities are intended primarily for the audio production environment and do not typically support the proprietary file formats used in some radio automation/delivery systems.

These utilities allow conversion of any supported file format to any other, although the rewrite may require some processing time on large files. However, these utilities are intended primarily for the audio production environment and do not typically support the proprietary file formats used in some radio automation/delivery systems.

Data compression

Complicating things further in the radio business is the potential use of perceptual coding (lossy data compression) on audio files. This type of compression algorithm reduces a file's consumption of hard-disk space and

To be properly deciphered when read, computer data must be parsed into manageable bundles when written.

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Next Wave

LAN bandwidth but may have the unwanted effect of reducing a file's interoperability.

Further, because they require fewer bits after compression, these files can be stored in blocks of data, each of which represents longer segments of time. This means that the temporal resolution of the compressed file format is reduced. If a compressed file requires subsequent editing, this loss of temporal resolution can be cumbersome. Edit points cannot fall inside a data block, and because the blocks are bigger (in terms of time), the possibilities for edit points are fewer and farther between. In many cases, this is not a significant problem because such editing is fairly forgiving in its requirements. Yet fine editing may be difficult without first decoding to linear PCM and then recoding to a compressed format after the edit session. A few PC-based editors intended for MPEG-encoded audio files avoid the deleterious effects of multigenerational applications of lossy coding.

Integrating applications

Today, a large number of audio file formats is likely to exist in the radio studio. Ideally, this should never need to be known by operating personnel. Cross-application and even cross-platform conversions should take place

Cross-application and even cross-platform conversions should take place transparently — but as of yet, they don't.

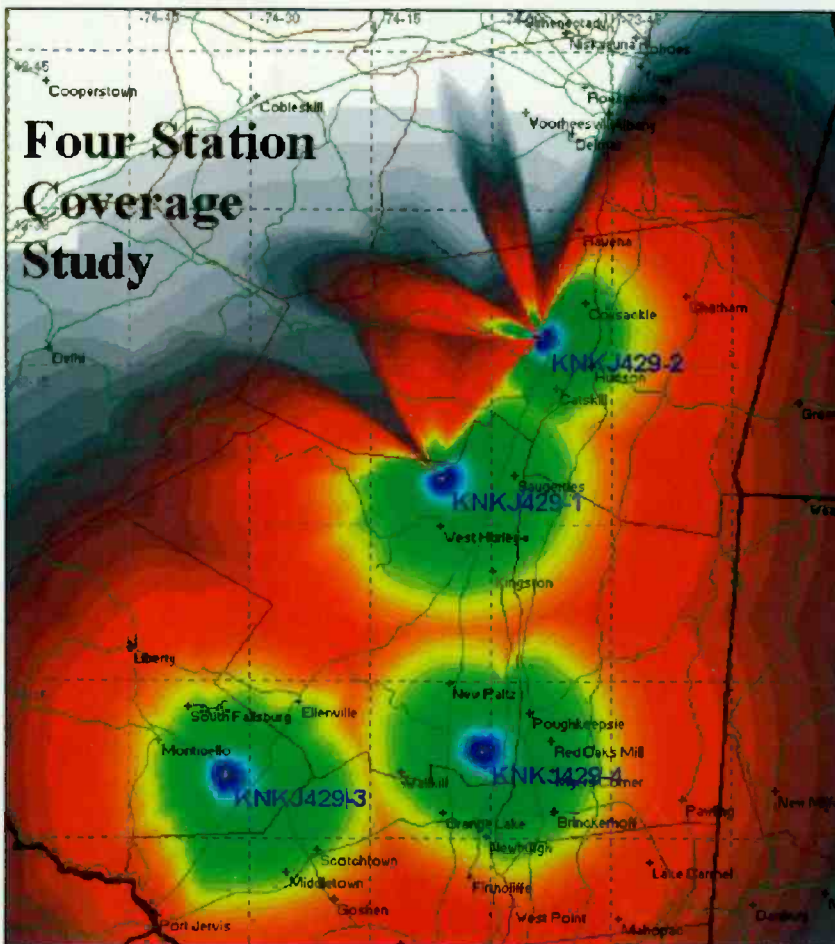
transparently — but as of yet, they don't. For now, at least, broadcasters are faced with some occasional heavy lifting in dealing with file-format conversion.

A few radio automation/delivery vendors targeting the turnkey approach offer the best solution to this dilemma. In this case, an audio file remains within its proprietary format throughout its life span at the station.

The next best solution is the attempt, by a few workstation manufacturers, to elegantly interface with one or more automation/delivery systems. Here, the production workstation not only converts the finished audio file format, but also queries the automation system's database for naming and storing the file. (Completing this process may take some time, but it beats playing the file out as audio to get it between systems.)

Finally, and least preferably, the station user can perform a "manual" file-format conversion, employing one of the file-conversion utilities mentioned above.

Learning the language is a prerequisite to success in any new environment. For at least a while, radio engineers and operators will have to concern themselves with digital audio file formats and their conversion. The file formats are fundamental to the architecture of the system, and a little knowledge and experience in this area will have the added benefit of helping broadcasters understand the inner workings of computer-based audio systems.



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LPFM service proposed

By Harry Martin

The FCC has proposed establishing a new low-power FM service within the current FM band. In its NPRM, the FCC puts forth two classes of LPFM service: a 1000W service (LP1000) of equal status with full-power FM stations and a 100W service (LP100) secondary to full-power FM and LP1000 stations.

The FCC poses new technical rules and spacing requirements unique to LPFM, which are intended to protect FM stations as well as the development of terrestrial digital radio (particularly IBOC technology).

LP1000 stations

LP1000 stations would operate with 500W to 1000W ERP and a maximum 60m antenna height above average terrain (HAAT). There would be no minimum HAAT. This would produce 1mV/m (60dBu) signal contours at a distance of 12km to 14.2km from the transmission facility. These signal contours would be protected and used to establish minimum separation distances between LP1000 stations as well as between LP1000 stations and FM stations. The FCC proposes that LP1000 stations give and receive the same co-channel, first-adjacent and IF channel interference protection that FM stations currently provide each other. The resulting minimum distance separation would be 65km between co-channel LP1000 stations.

Additionally, the FCC questions whether LP1000 stations should protect each other's IF channels and whether there is any need for second-adjacent channel protection. The FCC proposes no third-adjacent channel interference protection. Initially, no short-spaced LP1000 applications proposing protection through directional antennas would be accepted. As primary stations, LP1000 stations would not protect FM translators, FM boosters or noncommercial Class D stations, all of which are secondary services.

LP100 stations

LP100 stations would operate with 50W to 100W ERP and a maximum 30m HAAT. There would be no minimum HAAT. This would produce 1mV/m (60dBu) signal contours at a distance of 4.8km to 5.6km from the transmission facility. LP100 stations would operate on a secondary basis, providing co-channel, first-adjacent channel and IF interference protection to FM stations and co-channel and first-adjacent channel protection to LP1000 stations. The FCC asks whether LP100 stations should provide IF protection to LP1000 stations. The FCC also asks whether new LP1000 stations should protect existing co-channel and first-

adjacent channel LP100 stations and whether LP100 stations should be permitted to receive interference. Further, the FCC asks whether LP100 stations should be authorized on an equal basis with FM translators and boosters or be primary to them. If LP100 stations are deemed primary, the FCC asks whether existing translators and boosters should be grandfathered. The FCC questions whether translators and boosters should be precluded from rebroadcasting LP100 stations to promote localism.

Interference

The FCC poses various technical means for reducing potential interference from LPFM stations on second-adjacent channels. Out-of-channel emissions might be restricted by establishing a strict spectral emission mask (confinement of emissions within the channel width through attenuation of emissions outside the channel). In addition, the transmission bandwidth might be restricted to the center portion of the channel for LPFM stations.

FCC certification will be required for all LPFM transmitters to ensure compliance with out-of-channel emission requirements. The FCC is especially interested in whether these measures would minimize interference with digital radio.

Microradio

The NPRM raises the issue of establishing a "microradio" service for highly localized programming. Such stations would operate with 1W to 10W ERP and a maximum 30m HAAT. There would be no minimum HAAT. This would produce 1mV/m (60dBu) signal contours at a distance of 1.8km to 3.2km from the transmission facility.

Microradio stations would be required to protect all existing and future FM, LP1000, LP100, FM translator and booster stations against co-channel and first-adjacent channel interference. Microbroadcasters would receive no protection from any of these stations.

Harry Martin is an attorney with Fletcher, Heald & Hildreth, PLC.

Dateline

Commercial stations in the following states (or district) must file their annual ownership reports on or before June 1, 1999: District of Columbia, Maryland, Virginia, West Virginia, Michigan, Ohio, Arizona, Idaho, Nevada, New Mexico, Utah and Wyoming.

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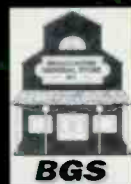
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NAB99

The annual NAB convention is quickly approaching. This ritual can be a time of great success or great duress. *BE Radio* is ready to make your trip to NAB the best it can be with the information packed into this issue.

The *NAB Extra!* is a sneak peek at some of the products that will make their debut at NAB99. Look for more new-product announcements in the April issue of *BE Radio*.

The North Hall at the Las Vegas Convention Center has been expanded, so the show-floor map will definitely come in handy. If you're shopping for specific equipment, the FASTtrack listing, organized by product categories, will make planning your time on the floor easier.

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Find more information on the NAB Web site:
www.nab.org/conventions/nab99

NAB EXTRA!



JK Audio/Booth L11256

◀ The **Innkeeper 1** digital hybrid is designed to get audio in and out of analog telephone lines without the transmit/receive crosstalk common to analog hybrids. A built-

in wired remote control that includes a DTMF keypad is featured. Other features include real screw terminals for remote connections, a front-panel headphone jack and volume control, and switchable automatic answer.

(815) 786-2929; fax (815) 786-8502; info@jkaudio.com; www.jkaudio.com
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Tascam/Booth L22383

▶ The **TM-D4000** digital recording console offers the user a flexible recording and mixing console based on Tascam's pinnacle technology employed on the larger TM-D8000 console. Features include 32 mono and two stereo inputs, feeding eight buses. The input section features six aux sends, four-band EQ and full dynamics on each channel. Professional-style 100mm motorized faders are used for the 32 mono inputs, the stereo inputs and the console master fader.

(323) 726-0303; fax (323) 727-7635; tascamsales@tascam.com; www.tascam.com
Circle (211) on Free Info Card



Neutrik USA Booth L16552



▲ The **2-Pole Speakon NL2FC** and **NL2MP** preamp connectors have fewer pins than the 4-Pole version. Compatibility between the NL2FC female connector and the NL4MP male plug is maintained. The housing is a two-piece configuration with insert, chuck and locking sleeve attached in one housing and cable boot as the other. The chucking design accepts a wide range of cable dimensions.

(732) 901-9488; fax (732) 901-9608
neutrikusa@aol.com
www.neutrikusa.com
Circle (212) on Free Info Card

TC Electronic Booth L10694



► The **DBMAX Mark II version 2.02** digital broadcast maximizer features 24-bit A/D and D/A converters among a comprehensive set of new hardware and software enhancements. The upgrade includes a dynamic stereo enhancer insert, the ability to handle analog I/O levels up to +26dBu (requires field-hardware modification), new presets and level setups — the presets have the ability to call level setups if desired. A 24-bit bypass mode and selectable high-cut and low-cut 20th-order filters on the inputs are also added. Two units can now work in redundancy and in bilingual configuration.

(805) 373-1828; fax (805) 379-2648; tcus@tcelectronic.com; www.tcelectronic.com
Circle (213) on Free Info Card

Audio Processing Technology/Booth L12470

► The **BCF256** broadcast communications frame exhibits negligible coding delay over dial-up ISDN and permanent digital networks. Applications include STLs, backhaul, studio networking and outside broadcast.



Standard features include an integral ISDN terminal adapter, automatic backup circuitry, analog and digital interfaces, a sample-rate converter and alarm functions.

+44 1232 371110; fax +44 1232 371137; salesuk@aptx.com; www.aptx.com
Circle (214) on Free Info Card

Wheatstone Corp./Booth L12171

The **D-600** digital on-air/production console is available in mainframe sizes up to 40 positions. Inputs feature four-band EQ, dynamics processing, ducking and eight-character source displays. Four stereo buses provide digital and analog outputs. All switches, faders and displays are addressable via serial interface.

(252) 638-7000; fax (252) 637-1285
email@wheatstone.com
www.wheatstone.com
Circle (215) on Free Info Card

Inovonics/Booth L13873

The **Model 520** AM modulation monitor includes a built-in, tunable preselector for off-air operation with a companion antenna. The unit also accepts a direct RF input sample from the transmitter. Features preset and adjustable peak flashers as well as loss-of-carrier and loss-of-audio alarms.

(800) 733-0552; fax (831) 458-0554
www.inovon.com
Circle (216) on Free Info Card

360 Systems/Booth L11272

► The **TCR8** is an eight-track digital audio hard-disk recorder that features 24-bit audio quality, high-density removable disks, massive internal hard-disk storage, complete time-code implementation and VTR emulation.

(818) 991-0360; fax (818) 991-1360; info@360systems.com
www.360systems.com
Circle (217) on Free Info Card



CartWorks/Booth L11591



► New digital audio formats are scheduled for release on April 31. Cartworks will add support for MPEG Layer II and MPEG Layer III audio compression as well as linear digital audio. The original apt-x audio format is still available.

(800) 795-7234; fax (601) 853-9976
bes@ucmail.com; www.cartworks.com
Circle (218) on Free Info Card

Kirk Harnack

Kirk Harnack is VP of engineering for Delta Radio Inc. and president of Harnack Engineering, Cleveland.



What do you see as the next major step for radio broadcasting?

One of radio broadcasting's next challenges will be to provide localized programming from regional broadcast centers. Some broadcasters are moving toward this goal now. A few broadcasters are falling short of programming for the localized needs of many listeners.

Many equipment manufacturers and engineers are making inroads to aid broadcasters in this challenge. For radio broadcasting to grow and compete, broadcasters must continue to work toward efficient, localized program offerings with steady community involvement. Engineers and manufacturers need to provide the tools and techniques that enable broadcast groups to think globally and act locally.

It's an age-old problem — being in two or more places at the same time. Today it's more important than ever that each radio listener perceives "his" station as being on the air just for him or her. Broadcasters who are committed to providing localized programming can do so with the dedicated involvement of savvy engineers and clever equipment implementations.



Leitch/Booth L22257

◀ The **Integrator** routing switcher integrates all digital and analog signal formats and allows flexible, soft-matrix partitioning of hardware matrices. This allows the user to integrate the router into present matrices. The unit is easily

reconfigurable for later matrices. Multiple signal formats can be integrated into the same frame with deterministic, field-accurate switching.

(800) 231-9673; fax (757) 548-4088; www.leitch.com
Circle (219) on Free Info Card

Holiday/Booth L13980



▲ The **HI-4417** meter/probe incorporates enhanced EMF measurement and analysis functionality in a new low-cost offering. Upgraded standard accessories provide easy portability during EMF measurement tests. Fiber optic connectivity between the meter and probe allows free positioning of the probe and an unhindered view of the display. Features include onboard logging and a tight frequency response. The unit's frequency range is 10kHz to 2GHz, its dynamic range is 1V/m to 300 V/m, and its overload limit is 1000V/m (continuous).

(612) 934-4920
fax (612) 934-3604
holaday@holadayinc.com
www.holidayinc.com
Circle (220) on Free Info Card



Russ Mundschenk

Russ Mundschenk has written several BE Radio field reports and articles on state-of-the-art equipment and procedures. He is chief engineer at WBEB-FM, Philadelphia.

What do you see as the next major step for radio broadcasting?

Many of us would agree that the next big step in radio broadcasting is a fully digital transmission system, from the announcer's microphone to the listener's speakers. The first steps toward that goal are digital facility integration — audio storage, mixing, switching and interconnection in the digital domain. When a viable RF transmission format is adopted, the final link will be plug-and-play.

However, we should not be content to stop there. Delivery of audio will not be sufficient to keep broadcasters competitive with a myriad of new information and entertainment delivery systems. Radio is a hometown friend — a live, spontaneous media that breeds listener allegiance. New technology must help foster that allegiance. The Internet and other technologies should be used to increase the level of listener interactivity. Information about a currently playing song or a link to an advertiser's Web site can generate interest and provide clients with added value. Polls can be taken and songs can be requested with the push of a button on a keyboard or cell phone.

The rule of thumb for future technology is "embrace it — or be eclipsed by it."

MediaTouch/Booth L11558

The new **Card Independence** technology allows broadcasters to play and record CD-quality MPEG-2 audio on any standard Windows sound card. Rather than relying on micro-processors embedded on the card to encode and decode MPEG audio, Card Independence contains the processing in a software codec. Card Independence is the core technology in the new **CD Ripper** utility that, in less than real time, converts music CDs to MPEG-2 audio files without dubbing.

(888) 665-0501; fax (352) 629-7000
omt@omt.net; www.omt.net
Circle (222) on Free Info Card

Intraplex/Booth L12853

The **STL Plus** is a popular digital STL system that supports bidirectional transmission of program audio STL/TSL, remote control, LAN data and telephone service on a single T1 digital line over leased T1 circuits, microwave radio links or fiber optic links. New features include a Windows-based user interface, an internal CSU and an enhanced front-panel display.

(978) 486-9000; fax (978) 486-0660; sales@intraplex.com; www.intraplex.com
Circle (221) on Free Info Card

Avocet Instruments Booth L11587

▶ The new version of the **AV-2000 Delay Canceller**

uses DSP processing to remove delayed audio feedback from live, on-air broadcasts or on satellite and ISDN communications.

(503) 671-9424; fax (503) 671-9626; erlci@avocetinst.com; www.avocetinst.com
Circle (223) on Free Info Card



Akai Musical Instrument Corp.
Booth L13966



▲ The **DPS12 version 2.0** is a 12-track random-access digital disk recorder and digital mixer. The unit allows users to record, edit, add effects, mix projects and produce a finished CD. Projects can be stored on the optional, removable Jaz cartridges or on optional SCSI hard disks.

(817) 831-9203; fax (817) 222-1490
akaiusa@ix.netcom.com
www.akai.com/akaipro
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PR&E/Booth L13670

QuikBilt II, a new line of modular radio studio furniture, is aimed at middle- and lower-market broadcasters. The furniture is constructed from materials usually associated with higher-priced offerings. Assembles quickly with few tools.

(760) 438-3911; fax (760) 438-9277
sales@pre.com; www.pre.com
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▲ The **DASW 2x1 AES3** digital audio switcher, housed in a 1RU assembly, serves several functions in an AES digital audio path. The DASW selects one of two compatible AES3 input signals. The unit's design allows it to handle balanced AES3 or unbalanced AES3-ID input and output signals. Possible applications include feeding two exciters simultaneously with the same digital signal or acting as a source selector for up to four digital devices, such as R-DAT or CD recorders.

(800) 622-0022; (513) 459-3890; broadcast@harris.com; www.harris.com/communications
Circle (224) on Free Info Card

HHB/Booth L13994



◀ The **Genex GX8500** is an advanced multiformat digital audio recorder. The expanded unit is equipped to record in linear and nonlinear modes and is designed for multi-channel recording and mastering applications in which the best possible sound quality is required. Records in AES/EBU, SPDIF, SDIF 2 and DSD (Direct Stream Digital) formats, making it compatible with the new Super Audio CD standard. Options include internal A/D, D/A converters that enable recording up to 24-bit/96kHz.

+44 181-962-5000; fax +44 181-962-5050; sales@hnb.co.uk; www.hnb.co.uk
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AKG Acoustics/Booth L18107

▶ The **C 4000B** microphone's capsule has been carefully tuned to preserve the integrity of the source while offering mild complements in the high frequencies. The optimized transformerless output stage ensures the accuracy of low frequency and a nearly nonexistent self-noise. The large-diaphragm transducer provides excellent response, and the microphone features selectable polar patterns.



A wide dynamic range accommodates every recording situation.

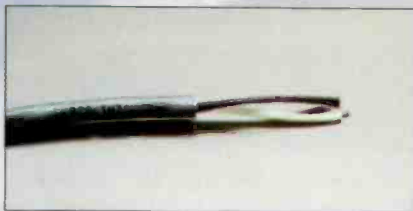
(615) 360-0499; (615) 360-0275
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www.akg-acoustics.com
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Barry Thomas, CSRE

Barry Thomas is technical director of KCMG - Mega 100, Chancellor Media of Los Angeles.

What new equipment is of special interest to you at NAB99?

This year at NAB, I will be evaluating the choices available for FM transmitters. I'm primarily interested in the solid-state options, but I'll be considering reliable single-tube systems as well. While solid state is a new technology, some sort of operational track record is necessary. The stakes are too high in L.A. to experiment on the air with unproven systems. With the increased responsibilities and reduced size of engineering staffs, low maintenance is a must. This is the primary reason for solid state: the elimination of the regular tube-replacement tasks. I also am looking closely at the development of the digital audio routing and transmission techniques. Last year's NAB was host to some of the first truly usable digital audio mixing and routing technologies. In that year, there was a wide variety of trials and good acceptance of the available options. I'll be interested in looking at the track records and seeing how real-world experience has improved the options and refined the choices available to the broadcast engineer.



Gepco/Booth L16461

◀ The **5524EZ** digital audio cable replaces the 5524 and offers improved performance. The 110Ω AES3 single-pair cable features two 24-gauge conductors and a high-speed foam dielectric with the low-

est available transmission loss for this cable type. The cable can be used for runs of more than 650 feet. Completely shielded by a bonded 100-percent aluminum/polyester tape with a 24-gauge drain wire, the cable's outer jacket is an easy-to-strip gray PVC that is UL-listed type CM.

(312) 733-9555; fax (312) 733-6416; gepco@gepco.com; www.gepco.com
Circle (229) on Free Info Card

Cutting Edge Technologies Booth L12594

The **Omnia** family of products has been expanded to include the new Omnia.fm.hot plug-in for ultimate loudness and the Omnia.sg, a stand-alone digital stereo generator. Other plug-ins include a special purist algorithm for classical, jazz and similar formats, and a stereo enhancement algorithm for broadcasters desiring a wide stereo image without multipath problems.

(216) 241-3343; fax (216) 241-4103
info@nogrunge.com
www.nogrunge.com
Circle (230) on Free Info Card

Telex/Booth L24228



▲ The **CDP 2001**, a desktop CD duplicator designed for multimedia and audio applications, supports all standard writing modes and is easily expandable to support DVD-R and CD-R. Direct SCSI allows the duplicator to operate stand-alone as well as to connect directly to a CPU/EDAT Duplication Workstation. All CD-R or DVD-R drives in the CDP 2001 become a target writer of a PC, Mac or Workstation. A duplicate can be copied directly from the host system on the fly without burning a master CD or DVD. Copies disc-at-once to disc-at-once and multisession to multisession. Converts multisession to disc-at-once and turns incremental writing on or off when copying a master to multisession.

(612) 884-4051; fax (612) 884-0043
pro.sound@telex.com; www.telex.com
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processing and an easy to use analog-like interface with factory and user programmable presets, Symetrix has created one of the most versatile yet reliable pieces of processing equipment on the market today.

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NAB EXTRA!

Antex Electronics/Booth L10952


The **LX-44** is a PCI-based digital audio adapter that builds on Antex's SX series. This DSP-based, half-sized card uses 20-bit A/D converters to achieve a dynamic range of up to 96dB. Features include four analog inputs, four output channels and the ability to simultaneously mix (under Windows98/NT) four virtual devices to any output.

(310) 532-3092; fax (310) 532-8509
sales@antex.com; www.antex.com
 Circle (232) on Free Info Card

Scott Studios Corp. Booth L11890



(972) 620-2211; fax (972) 620-8811; fax sales@scottstudios.com
 Circle (233) on Free Info Card



Brian Sanders

Brian Sanders is program director of KUNV-FM, Las Vegas.

What do you see as the next major step for radio broadcasting?

For public broadcasters, program distribution went to the top of the list last May when Galaxy IV failed. Our short-term solutions (realign the dish or carry Internet or ISDN) were both elegant and insufficient. This sudden transition from functional transponder platform to expensive space junk has jolted the broadcast community out of complacency and into an accelerated search for a new means of getting our programs around the system. How can we protect against future systemwide failures? Indeed, as streaming audio works out its kinks, we question the need for a satellite system at all. Implicit in this idea is the decentralization of our radio networks. How would such a system be managed? Do all programs need to be delivered in real time? Do we have enough time to build a new system? And the ultimate question: at what cost?

◀ The **Scott Linux System**, a touchscreen digital studio on Linux, plays commercials, songs and other recordings digitally in air studios. Linux is a stable UNIX-based multitasking operating system that is free off the Internet. Scott Studios supports the system 24 hours a day.



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www.akg-acoustics.com
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C 414 B/TLII

Specifically designed for vocals, the C 414 B/TLII features a transformerless output and the legendary C12VR capsule that enable vocals to soar over the rhythm section without disturbing the microphone's pristine sound.

NAB EXTRA!

Auditronics/L14191

The **COMET 4600** series analog console, with a new design, features hot-pluggable modules, differential busing and a choice of VCA or thru-the-fader level control. All indicators are LEDs, including on/off switches. Other features include four stereo buses, optional stereo aux, six mix-minus buses and stereo cue.

(901) 362-1350; fax (901) 365-8629
 sales@auditronics.com
 www.auditronics.com
 Circle (234) on Free Info Card

Klotz Digital Audio/L10994

▼ The **Spherion** digital audio console is founded on Klotz's 3d: router technology, which allows multiple control rooms to share sources, logic, control and DSP functions. Available in



two sizes: a 12-fader version with a minimum of 24 input sources and a 20-fader console with a minimum of 40 input sources and DSP production features. Sources include microphone, stereo analog line and various formats of digital line inputs. These sources can be routed to any fader. The unit eliminates the need for keyboards and computer monitors.

+49 89 462 3380; fax +49 89 462 3818; sales@klotz-digital.de
 www.klotzdigital.com
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Conrad Trautman, CSRE

Conrad Trautman is chief engineer/information systems manager for Cox Radio, Long Island, NY, and is currently acting chairman for New York SBE Chapter 15.

What do you see as the next major step for radio broadcasting?

In-Band On-Channel digital radio. I think television has an edge on us here, already on the air with DTV. Radio broadcasters have the ability to run a completely digital audio chain, from the studio to the STL and the processing, and even into the exciter. But it's still an analog signal that is transmitted. Tests I've had the opportunity to see prove that it can work. And I really believe that, once a system is selected, it will put AM on the same playing field as FM, increasing the value of AM radio stations considerably.

MediaFORM/Booth S8664



▲ The **CD-5400** CD-to-CD duplicator can record up to four CDs at once without a PC. One-touch operation makes copying from the CD to the CD-R easy, and no read-in is required. The technology enables a direct copy of all industry-standard formats. The system's format detection automatically identifies the master CD's format. Outfitted with 8x writer drives, the unit duplicates a full 74min CD in nine minutes. Can be connected directly to a PC to work directly with the computer's mastering software.

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▲ The new ceramic-plated **BASF CD-R** is suited for audio and data applications. Its hardened, ceramic coating results in better safety for stored information. The new master includes a silver reflective coating for improved reflectivity, an organic dye for minimal errors and long life, and a special on-disc writing surface.

(805) 295-5551; fax (805) 295-5554
www.emtec-usa.com

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Audioarts/Booth L12171

SPARKY, the digital on-air console, accepts and outputs analog and digital signals. The unit is an open-architecture design with 12 inputs, three stereo buses, multiple format A/D input converters, machine control, digital mix-minus and phone-module support for two callers.

(252) 638-7000; fax (252) 637-1285
email@wheatstone.com

www.wheatstone.com
Circle (240) on Free Info Card

Sound Devices Booth L11465

▶ The **MP-1** is a portable, battery-powered microphone preamplifier with phantom power. The unit provides studio-quality sound, outstanding dynamics control in field conditions and immunity to interference. Created for high-bandwidth 96k/24 digital productions, the unit's dynamic range exceeds 120dB and its bandwidth is more than 50kHz.

(608) 524-0625; fax (608) 524-0655; info@sounddevices.com; www.sounddevices.com
Circle (237) on Free Info Card



EVI Audio Booth L24228

◀ The **R100** is a diversity wireless microphone system featuring the patented Secure-Phase diversity circuitry that provides strong, clean signals. Secure-Phase uses the signal from both antennas at all times to increase signal strength, minimize dropouts and increase

range. The system offers a range of wireless systems to meet any need.

(616) 695-6831; fax (616) 695-1304; tbriggs@eviaudio.com

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Sonifex/Booth L10687

Version 1.5 software for the Courier portable hard-disk recorder adds cut-and-paste editing capability and additional Mac support. The software adds

support for AIFF recordings and extends the editing capability with multiple-cut, multiple-mark cut-and-paste editing. Modem support is included to transfer audio over a telephone line. Frequently called numbers can be stored in memory.

+44 1933 650700; fax +44 1933 650726
sales@sonifex.co.uk
www.sonifex.co.uk

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Belden Wire & Cable Company Booth L22974

The **Brilliance** audio snake cable with enhanced NEC ratings features the 1408R Series CMR-rated audio snakes (UL 1666). For installations that require penetrating multiple floors, this riser-rated cable is economical, eliminating the need for metal raceways, fireproof shafts and firestops.

(765) 983-5200; fax (765) 983-5294
www.belden.com

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Ron Bartlebaugh

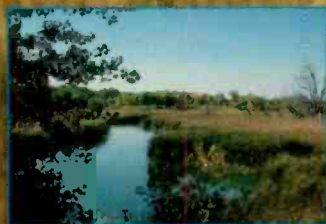
Ron Bartlebaugh is engineering manager of WKSU-FM, Kent State University, Kent, OH.

What new technology is of special interest to you at NAB99?

I realized today that I will be attending the last NAB show of this century. As I reflect back on how technology has changed over the past 100 years, I sit amazed. How can we improve on what has already been achieved? I will be looking for improved audio as I cruise the exhibit floors, although I don't expect to audio to sound much better than it already does. What I do expect and hope to find are digital audio consoles that make sense, from both a user and a technical viewpoint. I also hope to find audio processors that have been designed with a new paradigm in mind and not the "same old, same old" in a new box.

Also on my mind is how TV stations intend to compete with the high-quality audio found on DVD, DirecTV and other video sources. Perhaps it is time for the videographer to wear a hard hat with an array of microphones that would input 5.1 audio into the news report. I wonder if anyone will have those 5.1 audio hard hats on display at NAB. I'll be looking.

It just *looks* like we came out of nowhere.



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KD Kanopy/Booth L12896



▲ The 10'x10' **KD Majestic** weighs only 48 pounds and is constructed from an aluminum frame with fiber-reinforced DYNIDIOM fittings. Call letters and logos can be printed oversized on the canopy's side panel, top and rail curtains. The canopy's polyester tops are fire-retardant, water-resistant and come in an array of colors. All units come with a free carry bag and stakes.

(800) 432-4435; fax (303) 650-5093
askme@kdkanopy.com
www.kdkanopy.com
Circle (243) on Free Info Card

Belar/Booth L12881

CSA-1 is a composite FFT spectrum analyzer that features VGA output for driving an external CRT monitor, an RS-232 port for connection to a PC, and analog composite 150kHz inputs. Also featured are analog, 24kHz left and right inputs and an AES/EBU input with a rate converter that accepts any sample rate from 24kHz to 56kHz. For amplitude, features include a 120dB dynamic range (adjustable), amplitude resolution to 0.1dB, and linear (percent) and decibel scales. For frequency, features include a display of up to 150kHz on composite input, a frequency resolution that is adjustable from 10Hz to 500Hz per division, cursor display of frequency and amplitudes to 0.1dB.

(610) 687-5550; fax (610) 687-2686; sales@belar.com; www.belar.com
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Ben Brinitzer, CSRE

Ben Brinitzer is a regional director of engineering for SeaStar Communications Inc. He is based in Raleigh, NC.



What new technology is of special interest to you at NAB99?

The best new technologies will be those that enable a centralized and seamless installation for new consolidations. This technology will range from new ways to implement wire in an installation to centralized routing built into consoles that can be expanded and linked. Imagine a single connection for a circuit to be delivered anywhere in a facility on any console. I look forward to seeing the new developments accomplished by vendors that already market such products to those that don't. Given our ever-changing operating environment as we shift from owner to owner, the company that stands to make a fortune will be the one that develops a system for simplistic studio implementation. NAB99 will prove to be an exciting proving ground.

Continental Electronics Corp./Booth L18830

The **50kW AM transmitter** accepts and generates digital broadcasts. Building on the AES3 digital audio path, the transmitter gives customers more control over their stations' sound. The all-digital path reduces noise and prevents signal degradations.

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With this reserve power, an XL transmitter virtually has a spare module built in. They're hot-pluggable, which means you



benefit from unsurpassed system reliability and can maintain full operation even in the unlikely event that a power module requires service. Full duplication of critical low-level circuits further contributes to system reliability.

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For more information about our full line of AM and FM transmitters, visit us on the Web at www.nautel.com.



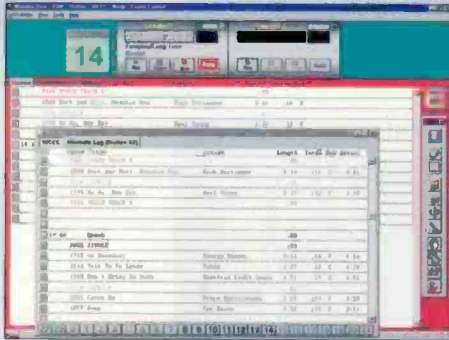
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Computer Concepts Corp./L13666



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Circle (245) on Free Info Card

Andrew/Booth L22937

The pipe-mountable 3.7-meter earth station antenna can be securely mounted onto a customer-supplied six inch (6.5-in O.D.) nominal pipe instead of a pedestal. The design eliminates the equipment enclosure, enabling the antenna to be installed in areas where space is limited. If required, outdoor RF equipment can be attached to the antenna's mounting frame in close proximity to the antenna-feed system. Available with C-, X-, Ku- and K-band feed systems. Uses advanced dual reflector technology with a two-piece precision-spun aluminum reflector to provide accurate surface contour, high gain and closely controlled pattern characteristics.

(708) 349-3300; fax (708) 349-5444
robert.leonard@andrew.com
www.andrew.com
Circle (247) on Free Info Card

Gentner/Booth L10671

Enhancements for the **GSC3000** remote facilities management system have been released. Software version 1.9 and a network module allow users to access the system through wide area networks and corporate intranets. The network module uses TCP/IP to make information on a host computer available to all other networked computers. Security features ensure that only authorized personnel can gain access.

(800) 945-7730; fax (801) 977-0087; info@gentner.com
www.gentner.com
Circle (248) on Free Info Card

StarGuide Digital Networks

The **StarGuide Digital Audio Storage** module is the latest option for use with the StarGuide II receiver. The unit is a high-performance, computer-on-a-chip board that provides local storage from 30min to 144min of 128Kb/s stereo audio spots. The module features state-of-the-art audio insertion technology, including external playback control, cross-fading and spot localization. Fully compatible with industry-standard audio automation systems and digital audio-receiver products, including equipment manufactured by ComStream, Wegener and IDC.

(619) 452-4920; fax (619) 452-3095; sales@stargulde.com; www.starguldedigital.com
Circle (249) on Free Info Card

◀ **Maestro 2.5**, the latest version of the WindowsNT-based digital audio hard-disk storage system, provides multiple record/play audio channels, an easy-to-read display with on-screen countdown, and full integration of all digital and audio operations. Enhanced graphics and user-friendly options are features in this version.

Sennheiser Electronic Corp. Booth L24825

The **D1000** digital wireless microphone system is a four-channel user-selectable unit that operates at 900MHz bandwidth. Internally mounted antennas operate in two independent diversity and audio sections, eliminating compander use and the audio degradation commonly associated with it. Inputs for optional external antennas accommodate extended-range applications.

(860) 434-9190; fax (860) 434-1759
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Circle (246) on Free Info Card

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



What do you see as the next major step for radio broadcasting?

Provided that the FCC does not treat IBOC DAB in the same manner as it treated AM stereo, I feel that digital broadcasting will be the next major step for radio broadcasting. Digital technology has been developed for television and is being implemented. The digital mechanism is available, and I hope there will be a demand for a large number of radio program sources and data transmission.

Whether the existing radio station owners will embrace IBOC DAB with open arms remains to be seen. In some areas, the increase in the number of available signals will be welcome — in fact, it might provide an answer of sorts to the pirates' demand for more channels. Perhaps the "have-not transmitter" group would accept an auxiliary channel on an IBOC transmitter for their radio voices of "civic salvation."

However, for the small market operator fighting for dollars, additional IBOC channels may be far less desirable. Time will tell.

Telecast/Booth L25147



▲ The **Sector** (pictured) studio mixer features intuitive handling, user setups, comprehensive monitoring/talkback, and routing and assigning flexibility. The **Sector** features simultaneous handling of asynchronous sources, internal A/D and D/A converters, and interval remote signaling.

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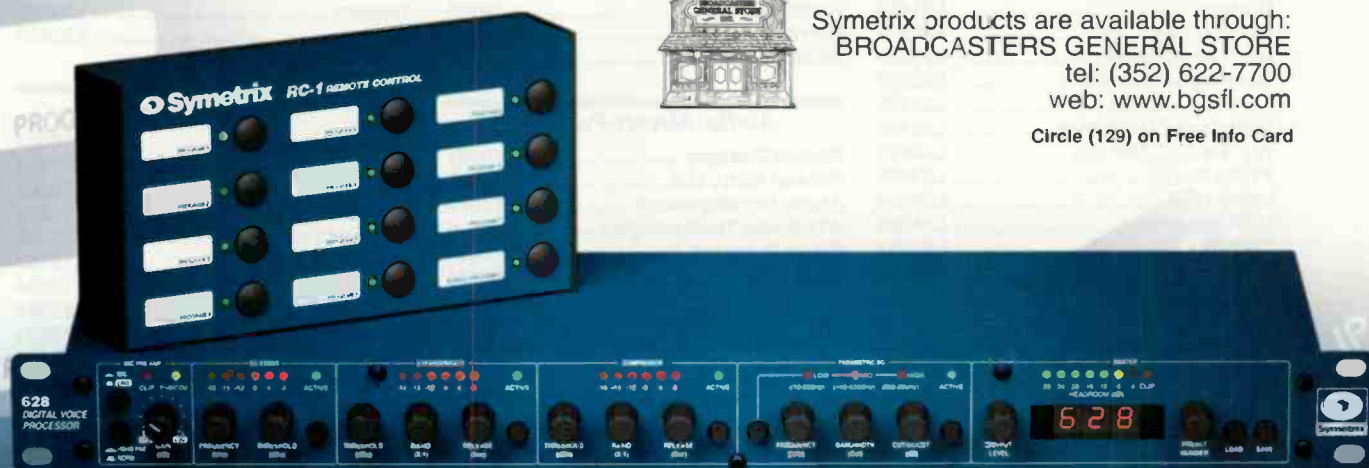


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Jeff Keith, CPBE, NCE

Jeff Keith is director of engineering, Jacobs
Communications of Cleveland



What do you see as the next major step for radio broadcasting?

I see the next major step for radio as a refining process. Technically the industry has never had more (and comparatively inexpensive) technology available with which to create and deliver its product to the listener. But how does it best use that technology?

On the business side, radio will be trying to figure out how to meet its new and aggressive financial performance objectives in the face of a potentially unstable stock market.


On the personnel front, radio will be suffering some attrition as those who once loved and worked in the industry leave it for their own, or other, reasons. And those who are left or those who've just joined us will be faced with having to do much more with much less than they ever believed possible. I believe that it will be an interesting journey!

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Steve Fluker
Steve Fluker is director of engineering for Cox Communications, Orlando, FL.

What do you see as the next major step for radio broadcasting?

Large radio groups are now building new facilities to combine multiple stations in a market under one roof. This has been an excellent opportunity to upgrade old, outdated equipment to state-of-the-art technology. With this development, we are seeing stations implement computer audio storage and delivery systems with voice tracking. With new voice tracking techniques that make it sound like a live DJ is sitting behind the microphone, we are seeing automation not only as a small market tool, but also — now and in the future — as a way to get top talent to do localized shows in several markets across the country. One top-rated DJ can now do voice tracks for four or five radio stations in the time it used to take to do one live local radio show.

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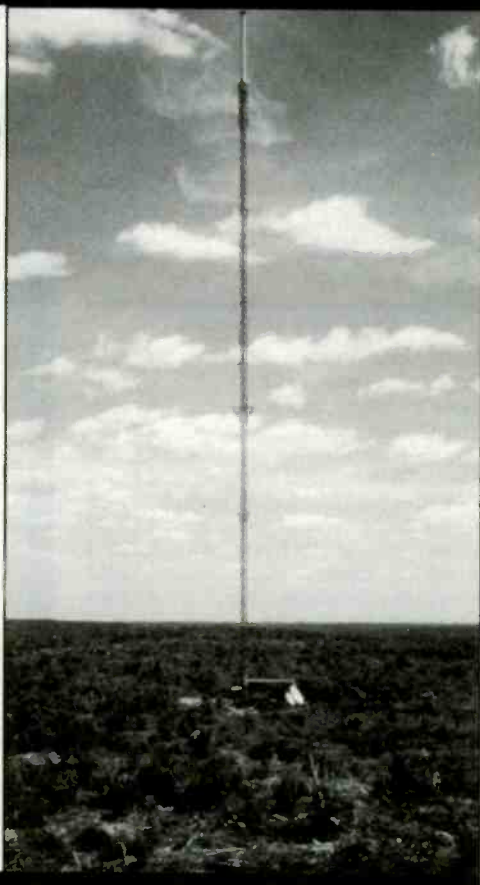
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Tom Ray, Technical Director at WOR in New York, talks about his Smartcasters...



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the potential 7+ MILLION listeners on the WOR Radio Network, providing programming to over 300 radio stations nationwide. With that kind of potential listenership WOR, America's Talk and Information Station, requires the best, most rugged tools available to keep 50,000 watts alive in the City that Never Sleeps, and to keep audio available to 300+ radio stations nationwide that rely on WOR to be there when they need us.

The Smartcaster Digital Audio System is just such a tool. The Smartcaster automates WOR during the times we are an affiliate of our own network. In New York afternoon drive, this means switching to the newsroom, to live traffic reports done by Metro Traffic across town, and back to the network. There's no room for error. The SmartCaster handles these chores admirably, and more.

Smartcaster can do our EAS tests. Smartcaster automatically records our network programming that we re-feed at a later time. And automatically refeeds these programs at the correct time. SmartCaster can record a news update on the Iraq crisis and place it into the bottom hour break seamlessly.

Smartcaster performs our automated network studio switching. Smartcaster fires off the cues that allow our affiliates to fire off their own local commercials. About the only thing it doesn't do around here is call to talk to our hosts...hmmm, maybe with the addition of a modem...

Audio can be input from any location and is available immediately at any location over the network that connects the workstations to the central servers. With weekly tape backups, losing any substantial income is very small in the event of a hard disk failure.

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ers first and computer programming types second. **At WOR, we have the Smartcaster difference."**





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By Sam Stemm, WBGZ, Alton

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The Generation 2000 system has done everything we envisioned and more. We do not own a cart machine. Every bit of audio aired at the station (We are news-talk) comes from the Smartcaster. It works well in live assist and works well in automation. We use the SmartTouch feature and it works well too. In the few instances when we experienced minor glitches with the system, SMARTS support was Johnny-on-the-spot to help us out. Our system has been down just twice in two years and never more than a matter of minutes because of the prompt and capable support from SMARTS.

Let me conclude by saying that I can highly recommend SMARTS equipment and software. The people at SMARTS are broadcasters and understand broadcasters' needs and concerns. Our 7 year association has been a profitable one for our operation."



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Steve Newberry, President
Commonwealth Broadcasting

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Kevin McNamara, CNE

Kevin McNamara is President of EXEgesis Technologies, a communications consulting firm located in New Market, MD.

What do you see as the next major step for radio broadcasting?

I think the broadcast industry, particularly radio, should brace for the next (and probably last) phase of the consolidation process — namely, the breaking up of those clusters that were created over the past two years. It is likely that you will see some new and perhaps familiar names returning to ownership roles. Look for existing companies that are committed to the business for the “long-haul” to begin selling off properties and focusing on fewer markets. As engineers, this should create some interesting situations. On one side, the dismantling of existing facilities, and on the other side, the building of new, scaled-down plants. The lack of qualified engineering personnel created by the downsizing process should put current engineers (and just about any experienced employee) in an excellent negotiating position during this “next round.” I expect the level of capital spending to be significantly reduced over the next several months for the publicly held corporations that are anticipating such a large scale sell-off.

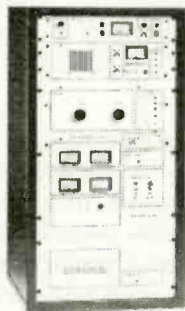
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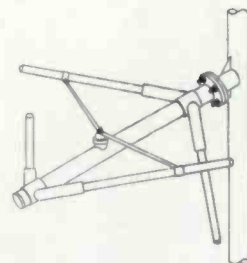
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Shunt-fed antennas

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

Considerations for shunt-fed antennas

This is the third in a series of nine articles on basic broadcast antennas.

This installment concludes last month's discussion of series-fed antennas and moves into a discussion of shunt-fed antennas.

Vertical AM radiators

Radiation from a nondirectional vertical antenna is expected to be circular in the absence of distorting objects, such as power-line towers, other radiators and large metallic structures close to the antenna. The FCC lays down specific ground-system expectations, basically 120 radials the same length as the radiator, buried about 8 inches to 10 inches in the ground. This is to protect the radials from damage as well as from vandalism and theft. If a nonstandard ground system or antenna is proposed, the FCC may require a proof after construction to show that the antenna system is operating as proposed.

Section 73.190 of the *FCC Rules* depicts curves showing the radiation required from specific antenna systems and makes it easy to convert from frequency to wavelength (see Figure 1).

From a station engineer's point of view, it is unfortunate that the commission does not require a proof of performance for nondirectional stations. It would make life much easier

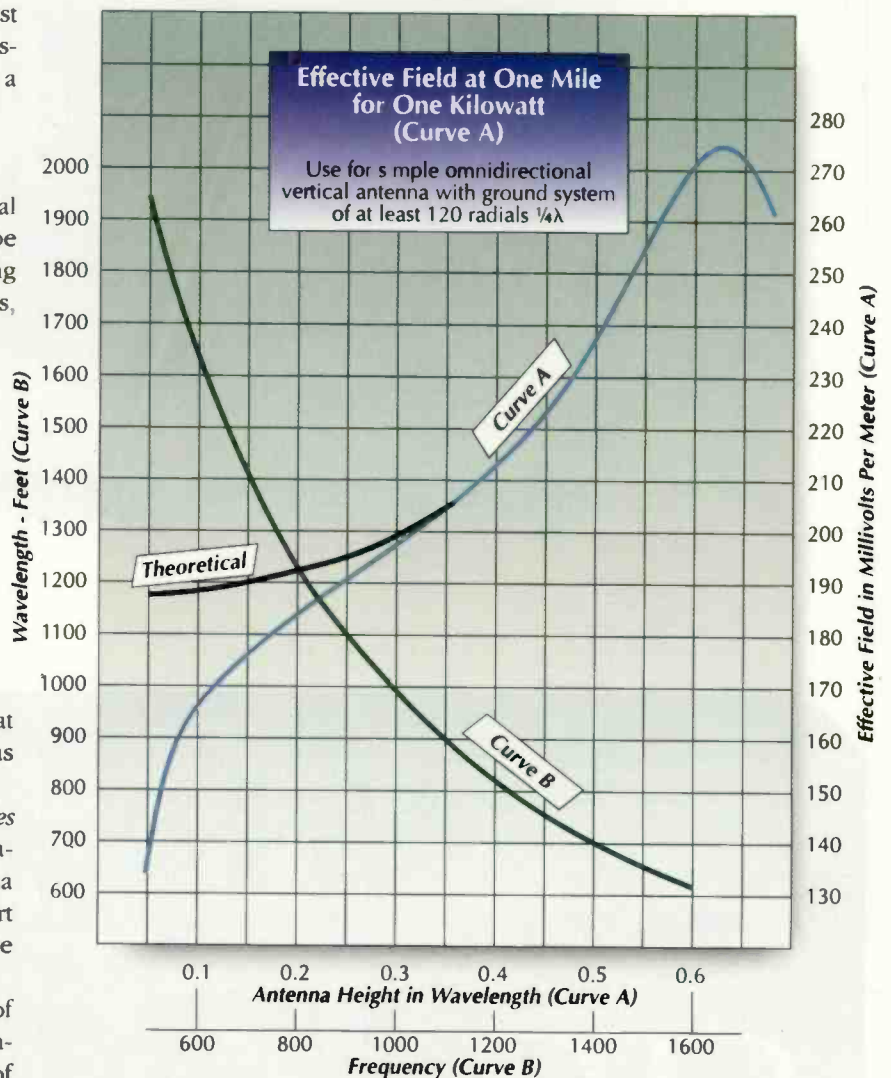


Figure 1. Use this chart to obtain tower height in wavelength and determine the effect of height on radiation.

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for a station engineer or consulting engineer when management complains that the signal is down. Only in exceptional cases has a proof been performed on non-DAs, but its existence certainly simplifies the investigation.

The measure of an antenna's efficiency is the inverse field at one kilometer. Also known as the unattenuated field at one kilometer, this theoretical value is used for comparison of nondirectional and directional antenna patterns. It is also determined after the proof of performance measurements are made by examination of the ground-wave curves. (This topic will be discussed further in the section on directional antennas in the May/June issue.)

When considering the efficiency of an antenna system, either DA or non-DA, its *root-mean-square* (RMS) value is often used. This value is simply the radius of a circle that has the same value as the area enclosed by the inverse field strengths in all directions at one kilometer from the trans-

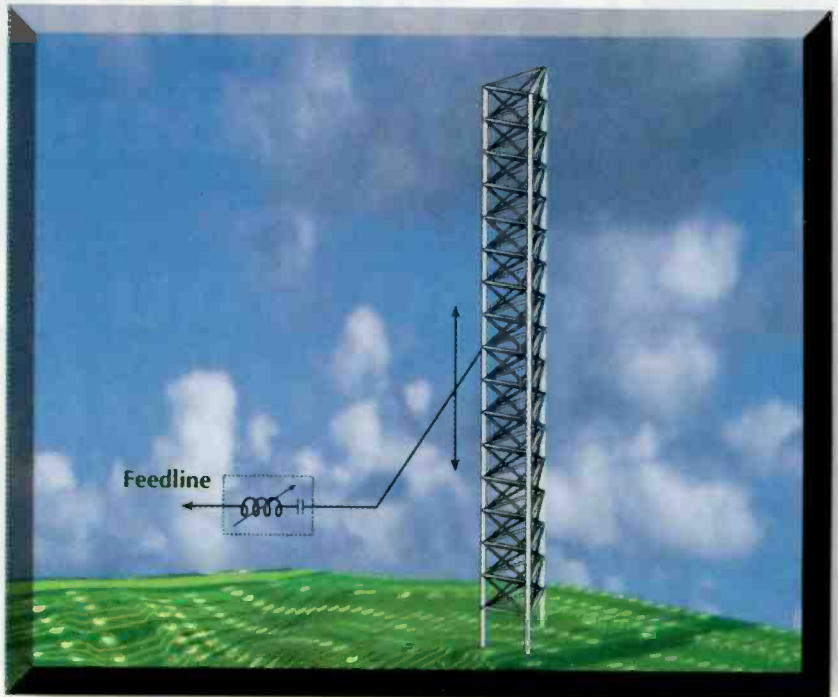


Figure 2. The position of the feedline as it is attached to the tower determines the operating impedance for a shunt-fed antenna.

mitter. If you don't have a polar planimeter, this measurement can be taken by plotting the pattern and circle on polar graph paper. The RMS

is found by calculating the square root of the sum of the squares divided by the number of squared radiations. The RMS is useful when checking a transmitting system's efficiency. It will give you a good idea of any deterioration that may have occurred since the station was built.

Though vertical antennas are usually envisioned as towers or, for short antennas, as metal columns or tubes, another type of antenna is in development: the *crossed field* antenna. Three are in use in Egypt, with exceptional results reported. In the future, we'll probably hear much more about this antenna.

Shunt-fed antennas

Although the series-fed vertical antenna is popular, and most broadcast antennas are series-fed, there is an alternative method of driving a vertical antenna. This is known as *shunt feed*. Shunt feeding was introduced prior to World War II, but exactly when, and by whom, remain unclear. One of the radio-field giants probably developed it for a problem station.

Series feeding a vertical antenna requires insulating the antenna from ground by means of a large and quite expensive base insulator that must support the weight of the tower as

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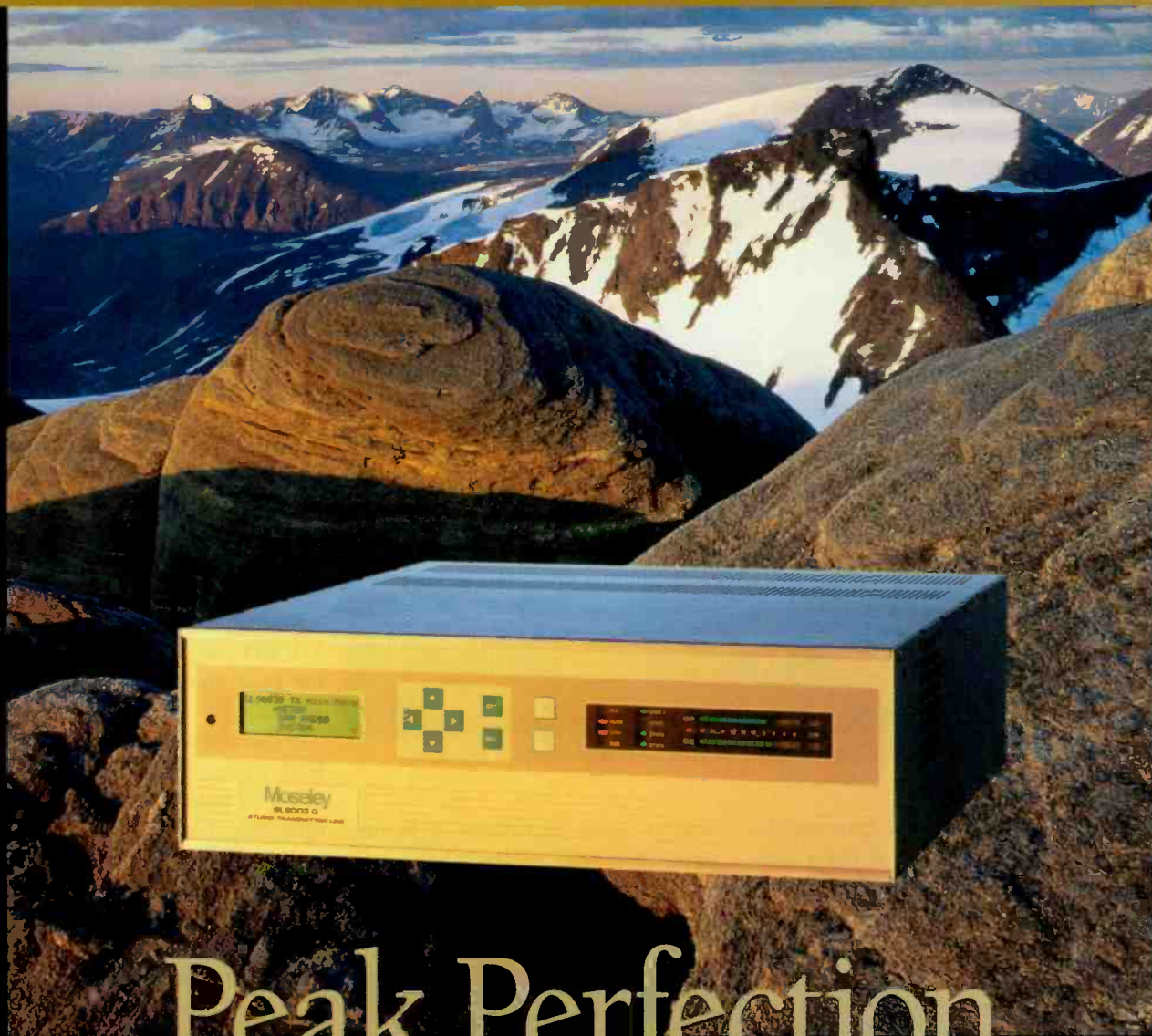
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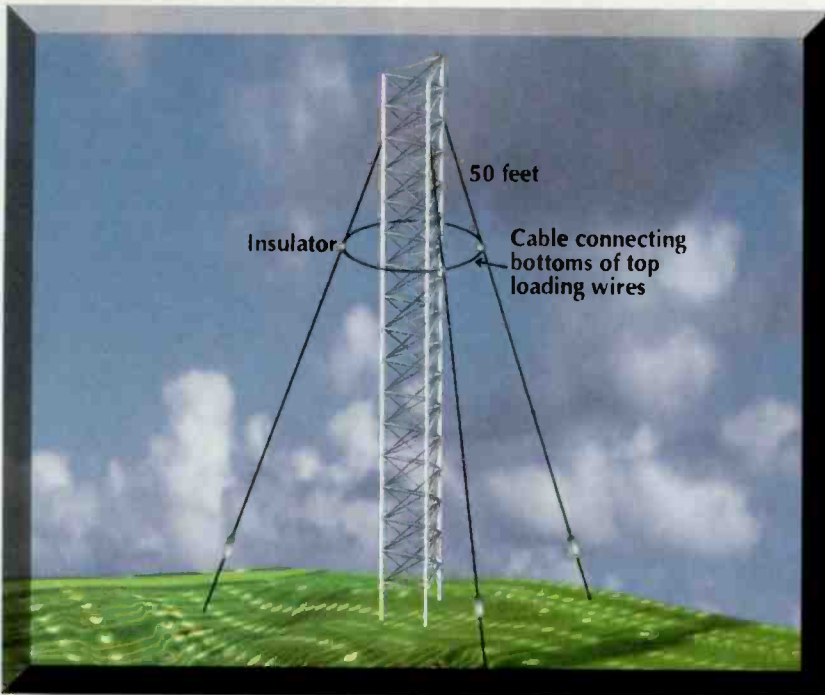


Figure 3. Top loading by means of approximately 50 feet of attached guy wires.

well as guy wires and anything else hung on the tower. It is not a common occurrence for the base insulator to crack, but it does happen from

time to time. Sometimes it is not discovered until the crack holds water and destructively cracks when the water freezes in severe weather. Even

though the tower may not come down, it will certainly be useless.

Sometimes it is possible to jack up the tower and replace the insulator. Other times, much more work is required. In any case, the presence of the insulator usually means greater expense when tower work has to be done. So, it makes sense for a station to operate without one if possible.

Shunt feeding provides the following benefits:

- Eliminates the expense of a base insulator;
- Grounds the tower and eliminates lightning problems;
- Allows the addition or removal additional antennas, such as FM, TV, STL, RPU and anything else affecting the base impedance of a series-fed antenna;
- Eliminates the need to notify FCC when changing antennas on tower because there is no change in operating impedance;
- Allows the use of a tall FM or TV tower for AM when properly tuned.

The idea of grounding an antenna and feeding it part way up the tower is not new to ham operators. For years, we have been accustomed to feeding power into strange combinations of wiring that look like short circuits. Nevertheless, an engineer new to AM RF work might find shunt feeding a little strange.

Figure 2 shows the type of basic shunt-fed antenna that the FCC no longer allows for night operation in critical conditions. Many antennas of this type still in operation, usually in lower-power stations. But the Commission does not like this type of antenna for critical operations because of the nonuniformity of the fields produced by interaction between the shunt-wire current and the ground current.

Shunt feeding actually forms a triangular loop consisting of the lower tower portion, the ground connection from the coaxial cable and the slanted feed wire. The magnetic flux of this loop induces the desired voltage in series with the tower. Towers of less than approximately 70 degrees are not suitable for shunt feeding because of the high-induced



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voltage required to overcome the high negative reactance.

Experience has shown that shunt feeding is flexible — the slope and height up the tower of the shunt-feed connection determine the actual operating impedance. It is usually possible to obtain the desired impedance by moving the feed line up or down the tower until the preferred value is reached. An angle of about 45 degrees is usually satisfactory. The optimal location is preferably determined by use of an in-line operating bridge at reasonable power. Although the older method of a signal generator and separate detector and impedance bridge can be used, this method is usually less convenient. It is usually possible to obtain a desirable operating resistance in the order of 50Ω , or whatever the coaxial cable requires.

With a positive reactance, a series capacitor of the correct value or a combination capacitor and variable inductor can be used to obtain a $j\pm 0$ match. Many stations using shunt-fed antennas don't use an ATU. After

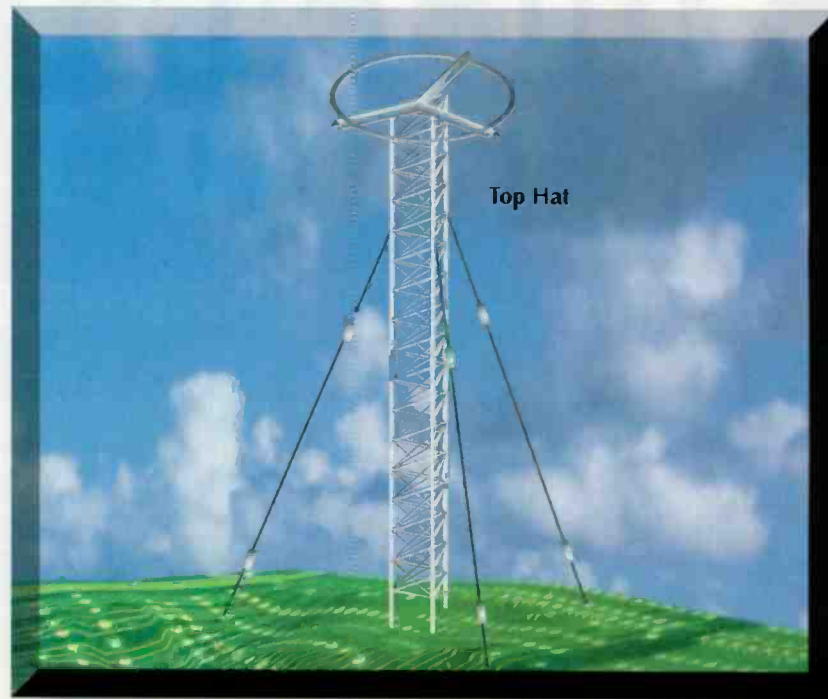


Figure 4. A top hat can be used to increase the tower's operating impedance.

setting the operating resistance to the desired value, they merely use a correcting L or C combination to complete the antenna match.

Another method of driving a grounded tower running a coaxial cable up the inside of the tower and connecting the center conductor to the tower. This method produces a cleaner radiated signal in that there is no radiation from the slanted external shunt-feed wire. But, for obvious mechanical reasons, adjusting the drive point impedance is more difficult using coax.

Top loading

Many engineers today have encountered problems with zoning boards as well as the FAA when attempting to build new antennas. In many cases, it is simply impossible to obtain the FCC's required minimum radiation efficiency with the tower height permitted. In cases such as this, top loading can often solve the problem.

One station in Alaska had a 10kW station on a very low frequency. The tower height was limited to 214 feet above tundra. The tower, like many in Alaska, was an old FCC mf beacon radiator. It was impossible to increase tower height. The only thing to do to obtain the required efficiency was to top load it and use a folded unipole.

Top loading was accomplished by removing the guy insulators at the

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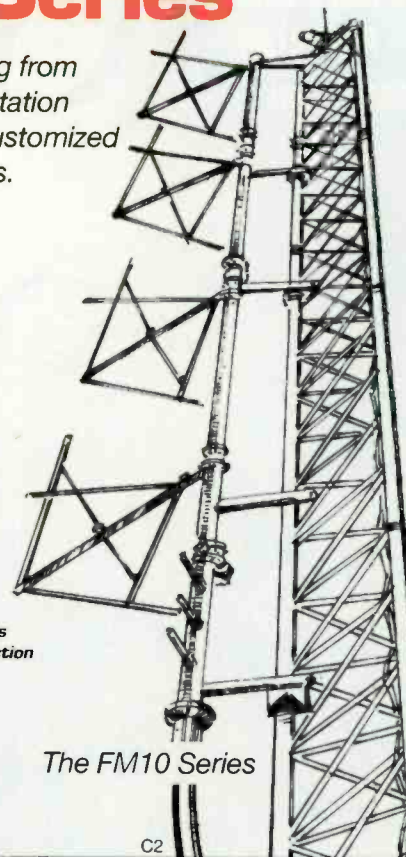
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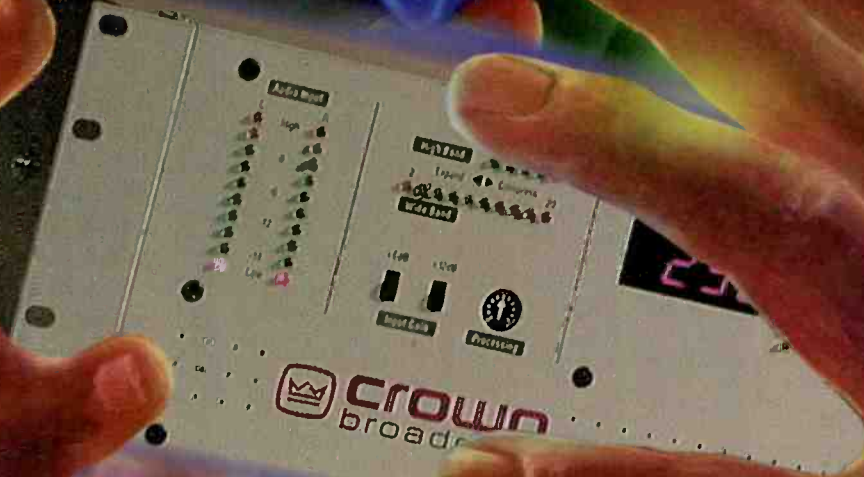
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top of the tower and brazing the guys to the tower. The top guys then extended down for 50 feet, where they were joined by an insulator to the bottom part of the guy. Three wires were dropped from the top to form a folded unipole (see Figure 3). This was done to raise the base operating resistance and broaden the bandwidth. When put into operation, the antenna more than met the commission's requirements. And the station's chief engineer reported a hard-to-believe 10dB improvement in one direction.

Using top loading to increase the *electrical length* of a tower will improve the horizontal pattern. Within limits, as this length increases, high-angle radiation will decrease and ground-wave (low-angle) radiation will increase. In effect, top loading raises the apparent current node above the top of the antenna and produces a finite current value where the top loading is — at the top of the tower.

Very briefly, tower sectionalizing, mentioned earlier, provides a method of improving current distribution control. In the top section, top loading controls the current. In the lower section, a reactance across the sectional insulator controls current. Maximum effect can be obtained by using both top loading and sectionalizing.

Top loading with guy wires is a simple project and usually results in considerable improvement. It is necessary to file Form 301 or 340, "Application for Construction Permit," to change the antenna system and to go to indirect-power measurement during construction. A sketch of the antenna system is required along with engineering estimates of the radiation efficiency, (i.e., field at 1km). 73.160 of the *FCC Rules* includes instructions for calculating sectionalized towers. Though these instructions contain

some useful information, sectionalized antennas probably are not a concern for most readers at this time.

Another way to top load an antenna is to use a *top hat*. The top hat is often a circular frame of aluminum or steel tubing, extending at least 10

forces during World War II. This antenna is perhaps the best way to add extra electrical height to an antenna. The principles are easily understood and well-known. This antenna can also be used for directional arrays, whereas top-loaded antennas in closely spaced arrays can lead to mutual impedance problems.

In a typical folded unipole antenna, three or six drop wires can be used to form the *skirt*, which produces the efficiency of this antenna (see Figure 5). It is possible to put together one's own package of insulators and drop wires, but I find it better to purchase a standardized package from an engineering company.

The number and arrangement of the skirt can vary. Between three and six drop wires are normal, and they should be spaced about 24 inches from the tower. Mounting on the face side or corner angle makes a slight difference.

Each drop wire is connected electrically to the top of the tower and spaced out from the tower by insulators that are about 20 inches long. The bottoms are connected to a ring around the tower. This is the drive point of the antenna.

The folded unipole antenna is a very useful device. Its best results are often obtained from towers 45 degrees to 70 degrees high. A 90-degree tower has a reasonable base impedance and normally won't gain very much by conversion to a folded unipole. The most noticeable result

with a 90-degree antenna is usually broadened bandwidth, which improves audio response and often makes a station sound louder. A station with a short, skinny tower usually demonstrates a strong improvement.

At more than about 110 degrees, usually very little improvement is noticed because the antenna is already developing good radiation.

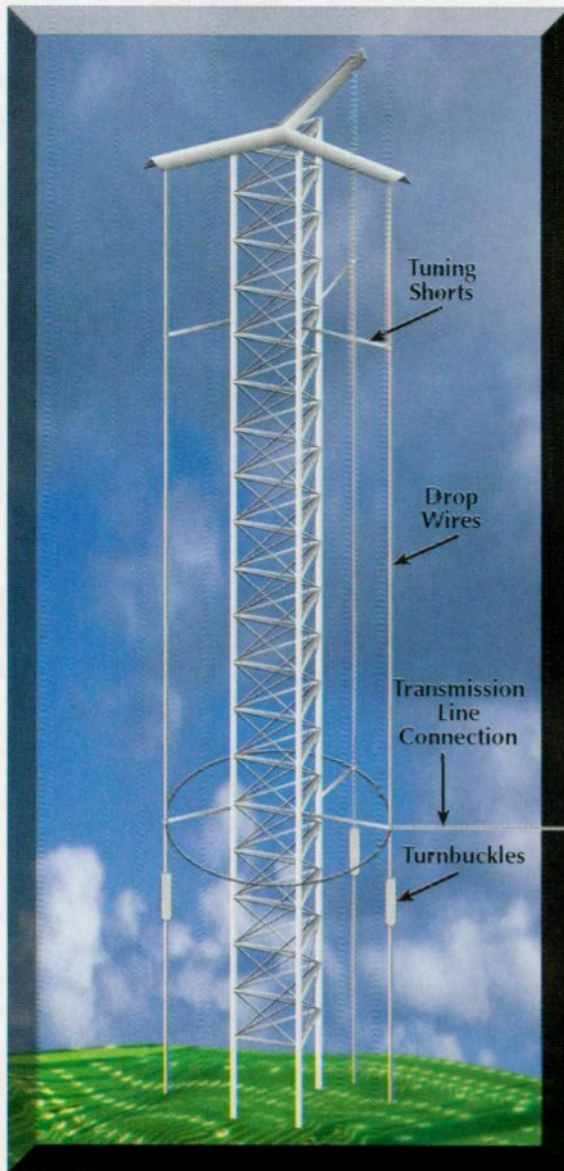


Figure 5. The folded unipole antenna. The drop wires hang about 24 inches from the tower face, and the tower structure is grounded.

feet, attached to the top of the tower (see Figure 4). This can increase base operating resistance as much as 10 percent.

Folded unipole antenna

The late John Mulaney, P.E., developed the folded unipole antenna for broadcasting. He based it on the antennas he developed for the armed

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MP-2-4	4	2,000W	3.3	\$1,820
MP-3-5	5	3,000W	4.1	\$2,270
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GP-4	4	6,000W	3.4	\$2,600
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GP-6	6	6,000W	5.5	\$3,700

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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

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When considering taller towers, caution is required because towers appreciably taller than 110 degrees require care in tuning and usually need a second, folded section separate from the base-tuning part. This second section has to be carefully tuned to remove the effect of the top portion from the radiating system.

Construction is simple: The main points to watch are perfect connections and grounding of cables on the tower. The lightning neutral *must* be grounded to the tower and the wires placed in a metal conduit that is grounded every 20 feet or less. Any other coaxial cables on the tower must be grounded in the same manner. If this is not done, random currents will appear and adjustment could be very difficult.

Adjustment is by means of shorting stubs that connect each drop wire to the tower. The impedance is first measured with the stubs at the top. The top point will read $j + \text{something}$. They are then moved down until $j0$ is

found. If the stubs are moved down past $j0$, a negative reactance will be found. This is often called the *first resonance*.

This antenna has gained a reputation as a miracle worker. It is an extremely good modification for many stations. Frequently, it seems to produce the greatest improvement for short towered stations with old, worn-out ground systems. There is some argument about its effect on field strength. In my experience, shorting stubs don't usually result in increased radiation. In many cases, a change to a folded unipole does not require an application to change antenna system. Only a new informal license change application after modification to show new antenna impedance and current is required. Any increase in field strength is usually about 2 percent to 10 percent.

It is not uncommon to find folded unipoles used in directional antennas. Unlike the regular shunt-fed antennas, the use of folded unipoles

does not create unstable vertical radiation characteristics. However, as mentioned earlier, because of the increased diameter of a folded unipole, its use in a large, closely spaced array might produce undesirable changes in mutual impedance. Careful consideration should be given to such a change.

Next month, we'll cover the feeding, driving and grounding of vertical antennas.

This is the second in a series of nine articles on basic broadcast antennas. Upcoming installments will appear monthly in BE Radio through 1999. Once all the installments are published, the series will be available for purchase as a single document. For information regarding bulk orders of this series in quantities of 500 or more, contact Jenny Eisele at 913-967-1966.

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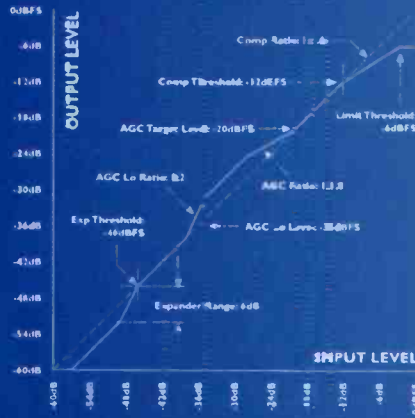


OUTPUT FORMATS

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Example of gain transfer and parameters using a DBMAX.



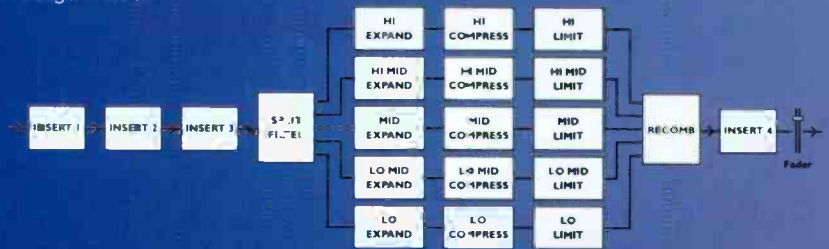
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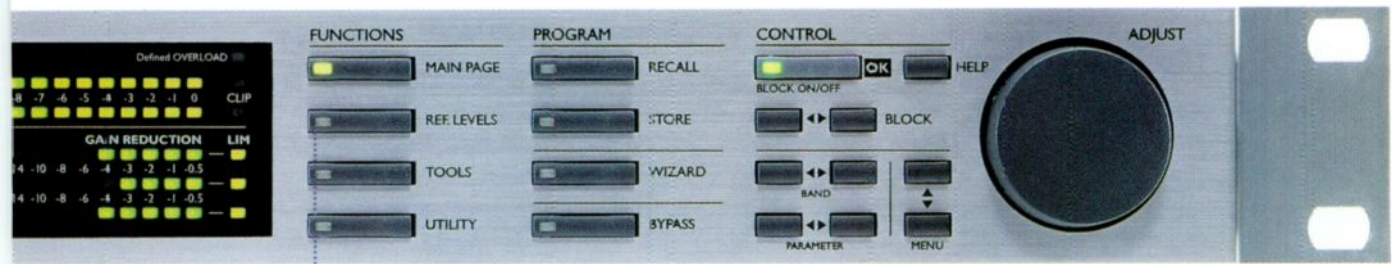
Four selectable Insert algorithms surround the multi-band structure. The digital output filter may be remotely set via voltage control.



NOTE:

The focus of this brochure is Transmission. The DBMAX also provides a variety of tools for Post Production use. Read more about this in the separate DBMAX Post Production brochure.



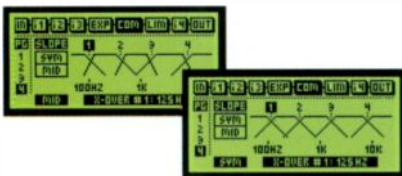


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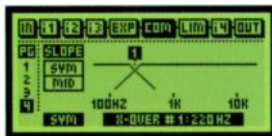
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COMPRESSOR

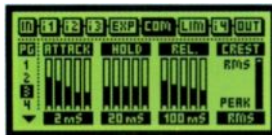
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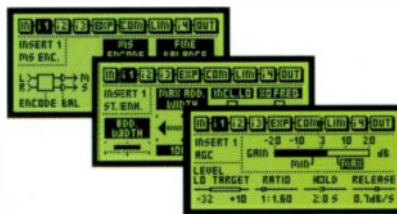
Find a Preset you like and adjust the More / Less master compression control.



INSERT BLOCKS

Insert blocks give you the ability to use plug-in types of processing tools before the 5-band Compressor/Limiter/Expander. Three simultaneous pre-dynamics inserts are available and you decide the order.

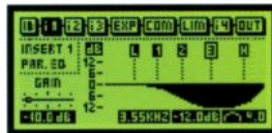
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CONNECTORS:	XLR (AES/EBU) RCA Phono (S/PDIF)
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OUTPUT DITHER:	TPDF dither 8-24 bit
WORD CLOCK INPUT:	BNC, 75 ohm, 0.6 to 10 Vpp
SAMPLE RATES:	32 kHz, 44.1 kHz, 48 kHz
PROCESSING DELAY:	0.5 ms @ 48 kHz
FREQUENCY RESPONSE DIO:	DC to 23.9 kHz \pm 0.01 dB @ 48 kHz
SAMPLE RATE CONVERSION	
TYPE:	Asynchronous
DYNAMIC RANGE:	120 dB
THD+N:	-106 dB 44.1 to 48 kHz @ 1 kHz, -2 dBFS
INPUT RATE RANGE:	31 kHz to 49 kHz

ANALOG INPUTS

CONNECTORS:	XLR balanced (pin 2 hot)
IMPEDANCE:	20 kohm (balanced)
MAX. INPUT LEVEL:	+27 dBu (balanced)
MIN INPUT LEVEL (FOR 0 dBFS):	-4 dBu (balanced)
A TO D CONVERSION:	24 bit (1 bit, 128 times oversampling)
A TO D DELAY:	0.8 ms @ 48 kHz
DYNAMIC RANGE:	>103 dB (unweighted), >106 dB(A)
THD:	-95 dB (0.0018 %) @ 1 kHz, -6 dBFS (FS @ +18 dBu)
FREQUENCY RESPONSE:	10 Hz to 20 kHz: +0/-0.2 dB
CROSSTALK:	<-80 dB, 10 Hz to 20 kHz typical -100 dB @ 1 kHz

ANALOG OUTPUTS

CONNECTORS:	XLR balanced (pin 2 hot)
BY-PASS:	Through relay
IMPEDANCE:	40 ohm (balanced)
MAX. OUTPUT LEVEL:	+26 dBu (balanced)
FULL SCALE OUTPUT RANGE:	-4 dBu to +26 dBu (balanced)
D TO A CONVERSION:	24 bit (1 bit, 128 times oversampling)
D TO A DELAY:	0.57 ms @ 48 kHz
DYNAMIC RANGE:	>100 dB (unweighted), >104 dB(A)
THD:	-86 dB (0.005 %) @ 1 kHz, -6 dBFS (FS @ +18 dBu)
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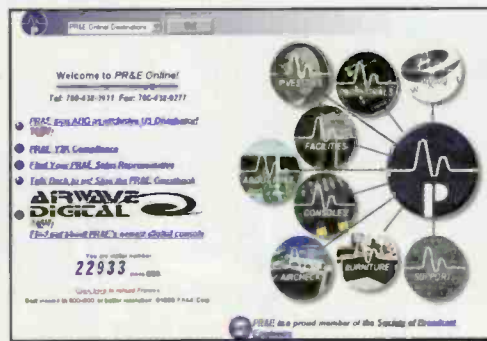
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REMOTES

Surround Sound Experiments

by John Voci,
with Jim Donahue and Antonio Oliart Ros





Photo by Lincoln Russell

(Above) Patrons flock to Boston's Symphony Hall to hear the Boston Symphony Orchestra perform live and to experience the hall's ambiance firsthand. (Opposite) The BSO on the Symphony Hall stage.

WGBH-FM's surround broadcast takes one orchestra's sound beyond its symphony hall.

For 48 years, Boston's WGBH-FM has broadcast the Boston Symphony Orchestra's concerts live. The station debuted in 1951 with a live BSO broadcast from Boston's famed Symphony Hall. Today, the broadcast series continues, with live concerts from Symphony Hall as well as from the BSO's summer home at Tanglewood in Lenox, MA.

Hallmarks of quality

Since the early days of broadcasting the BSO, many area audiophiles have held WGBH-FM's live broadcasts in high esteem because of the quality of the music and the sonic purity of the transmission. For many years, it was a purist's medium. Minimal compression was introduced into the feed, and production techniques included trans-

mitting hall ambiance during intermission — production values that seem archaic in the current competitive radio environment. Today's broadcasts remain demonstrative of how good FM can sound. WGBH-FM's engineers constantly strive to balance sonic purity and audibility in "real-world" listening environments.

Today, a fiber optic link provides a video format PCM encoded feed from Symphony Hall to WGBH-FM's studios, where the signal is decoded and reformatted as AES/EBU digital audio. From WGBH-FM, the 20-bit signal is relayed to the transmitter on a 13GHz video microwave, one advantage of being co-located with WGBH-TV. A small amount of compression is added to boost the quiet passages, but otherwise the signal remains relatively clean

and unprocessed from the concert hall to the transmitter.

Experiments with sound

Besides being a hallmark of WGBH-FM's classical music programming, the BSO broadcasts are an area in which WGBH-FM engineers have experimented with new techniques in an effort to capture the legendary sound of Symphony Hall for radio listeners. The late William Busiek, WGBH-FM's BSO engineer from 1951 to 1991, pioneered the productions of the BSO. In 1955, prior to FM stereo, WGBH-FM collaborated with other area FM broadcasters to present the BSO in stereo, with each station transmitting one channel of the stereo signal.

The radio concerts had such a large, devoted following in the mid-1950s

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Photo by Steve J. Sherman

The goal of the surround broadcast was to capture and re-create the acoustics of the BSO performing in Symphony Hall.

that Zenith Corp. was inspired to produce a tabletop radio, appropriately called "The Symphony." In the mid-1970s, WGBH-FM worked in conjunction with its commercial classical counterpart, WCRB-FM, on experimental quadrasonic broadcasts. For

these broadcasts, one station would transmit the front microphones while the other station transmitted the rear array. Listeners with two tuners and four speakers could experience quad. The quad broadcasts lasted approximately one season, since the medium was obviously impractical for listeners and broadcasters.

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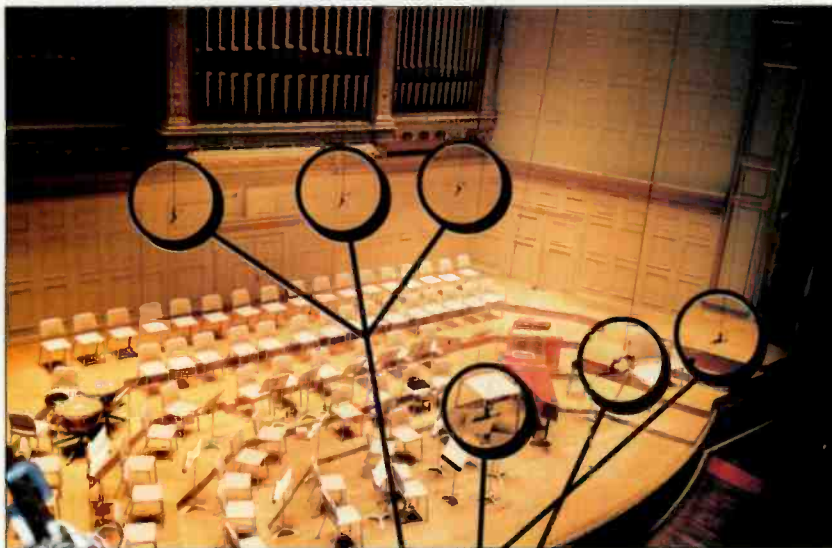
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Multichannel production

In December 1998, WGBH-FM returned to an earlier chapter in its history. The station once again experimented with multichannel production for two live concerts: a BSO performance on Friday, December 4, and a broadcast of Handel's *Messiah* by the Handel & Haydn Society on Sunday, December 6. WGBH-FM engineers Jim Donahue and Antonio Oliart Ros were joined by Tomlinson Holman of TH Corp., one of the leading proponents of 5.1 audio. The experiment incorporated WGBH-FM's live stereo broadcast with both a Dolby Surround Pro Logic broadcast and a 5.1-channel recording session. The Friday show was a live stereo broadcast and a test of multichannel production techniques. The Sunday show was a 5.1 recording session and a Dolby Pro Logic encoded broadcast.

WGBH-FM engineers constructed a temporary 5.1-channel control room in the Deutsche Grammophon room, a basement room in Symphony Hall built in the early 1970s by the German

REMOTES



Seven microphones as arranged for WGBH-FM's stereo broadcasts of the BSO. Ten more mics were added to this setup for the surround production.

record company so it could record the orchestra. Working in the hall can often be a technical challenge, as little has changed to accommodate recording and broadcasting since the hall was built a century ago.

Hanging additional microphones and running 400 feet of cable from the stage to the basement was a logistical nightmare. With support from TH Corp. and equipment loaned by Equity International, Dolby, Troisi and Parsons Audio, a multichannel production center was constructed around two Yamaha 03D consoles and B&W Nautilus 803 and 805 monitors. At the heart of the setup was a 20-channel Benchmark microphone pre-amp and DA. This custom-built system powers, amplifies and distributes up to 20 channels to four locations using pristine pre-amp circuitry. Split one went to the WGBH-FM broadcast booth as a backup in case of a failure in the multichannel control room. Split two went to three PCM 800s located in the DG room. Split three went to a Yamaha 03D for the 5.1 mix. Split four was a spare. One Yamaha 03D created the surround feeds, and a second allowed the engineers to monitor the mono, stereo, Pro Logic and six-channel mixes.

Because WGBH-FM's stereo broadcasts have been praised for their beau-

ty and spacious quality, WGBH-FM's engineers decided to retain the standard BSO microphone configuration for the two shows and to supplement the existing setup with accent and ambiance microphones specifically for the surround production (see Tables 1 and 2).

A delay was added to several of the microphones to account for the time delay between the various microphone positions. Holman and Donahue burst a series of balloons in the hall to approximate the time discrepancy between the various microphones' signal arrival time.

For the Friday show, Donahue and BSO producer Brian Bell produced the live broadcast from WGBH-FM's facility on the third floor of Symphony Hall. Ros worked with Holman and his associates Fritz Koenig and Chris Kyriakakis on the 5.1 mix in the DG room. For the *Messiah* broadcast, the engineering assignments were switched, with Ros in WGBH-FM's third-floor booth, while Donahue made the 5.1 recording and fed the Dolby Pro Logic version to WGBH-FM for broadcast.

Refined multichannel audio

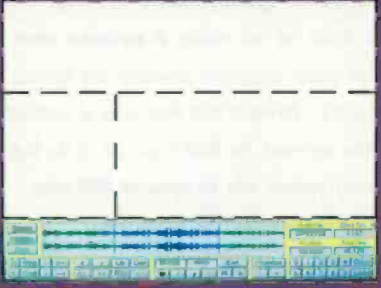
The biggest challenge for the production was balancing the needs of the stereo broadcast with those of the surround production. The compatibility of stereo techniques with those for the surround production was a central concern for the engineers. Despite adding microphones to the usual BSO pickup, there was insufficient isolation to create discrete images for the surround channels.

The standard microphone setup works well for stereo. However, in retrospect, it would have been preferable for the surround production

Quantity	Microphone	Location	Pan Position
2	B&K 4006	Center Stage Spaced 18" and Splayed	Mid L and R
2	B&K 4006	Outriggers	L and R
3	B&K 4006	Chorus and Percussion	L, C, R
1	B&K 4006	Bass Accent	C
1	EV 20	Announcer	C


Table 1: Typical microphone setup for a stereo broadcast of the BSO.

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REMOTES

Quantity	Microphone	Location	Pan Position
2	Schoeps Cardioid	Wind Accent	Slight L and R
1	Neuman KM 84	Timpani Accent	Slight L
1	Neuman KM 84	Harp Accent	Slight L
2	B&K 4011	Hall Ambiance, Facing Rear	Surround
2	Schoeps Omni	8" Spacing at Proscenium	L and R
2	Earthworks QTC1	Hall Ambiance	L and R

*30 percent of the signal was fed to the front speakers and 70 percent to the surround channels.

Table 2: Additional microphones used for the surround broadcast.

to employ a different microphone configuration to direct specific sources to individual speakers and to treat the orchestra and the hall as distinct sound sources. This approach is contrary to traditional stereo production, where the combined pickup of direct and diffuse sound by omnidirectional microphones creates the sense of ambiance and space. For surround, using more directional microphones and isolating sources would have enabled the engineers to create a more enveloping multichannel experience and a better sense of the ambient space of Symphony Hall.

An additional artifact created by the omnidirectional microphones was the presence of out-of-phase information in the Pro Logic's monaural surround channels. Because this out-of-phase information contained some of the direct sound of the orchestra, the sense of envelopment in the surrounds was decreased. A solution to this problem would be to hang a coincident pair of microphones specifically for the surround channels. A pair of low-noise, high-output microphones with the phase inverted would be ideal.

In addition to enhancing the sense of space, a rear-channel coincident pair would have given the WGBH-FM engineers better control over the relationship of the announcer's level to the hall ambiance. During the broadcast, when lowering the hall ambiance for the narration, the surround channels tended to disappear. Having a coincident pair and controlling the rear channels better would have increased the hall ambiance in

the surround speakers and decreased it in the front speakers — a technique that would have created a more natural surround experience during the announcer's narration.

Besides the technical considerations for the live concert, planning how the preproduced elements sound in surround is important. For Friday's concert, WGBH-FM engineers decoded the stereo transmission to determine how a typical broadcast would sound when decoded in Pro Logic. The stereo feed was fantastic, but in Pro Logic odd artifacts and insufficient discrete surround information resulted in an unengaging surround experience.

The compatibility of stereo techniques with those for surround production was a central concern for the engineers.

An unanticipated sonic effect occurred during the introduction to Friday's performance, a 30-minute prelude featuring prerecorded interviews and archival BSO recordings presented by WGBH-FM host, Ron della Chiesa. As the source material shifted from mono to stereo, the image dramatically collapsed to the center channel. For one recording, there was an inexplicable spectral change. Although the latter may have been the result of a faulty Pro Logic decoder, this collapse emphasized the necessity of reviewing all elements of the production and determining how to equitably distribute surround information for all aspects of the broadcast. Sunday's *Messiah* was more successful, with a better balance between the stereo and Pro Logic broadcasts and fewer unusual artifacts.

Both concerts were exciting, and the experience of multichannel

REMOTES

production was informative. The 5.1-channel production of the BSO's performances of Barber's *Second Essay*, Previn's *Piano Concerto* and Beethoven's *5th Symphony* was spectacular. The production earned praise from the engineering crew and the BSO staff — who had the opportunity to experience the rich sound of Symphony Hall and the BSO's superb playing in six channels of audio. The *Messiah* was equally dramatic, and WGBH-FM's Pro Logic debut broadcast was a success. The engineers simultaneously provided good stereo and an enjoyable surround experience for home-theater listeners.

Although the 5.1-channel production was exciting and has future



(L to R) Chris Kyriakakis, John Voci (seated), Jim Donahue, Tom Holman.

applications for DVD and DTV, bandwidth limitations make it impractical for radio in its present analog and proposed digital forms. If DAB proponents would consider multichannel audio in the development of future radio systems, radio could ensure its audio preeminence over television for generations to come.

In the future, WGBH-FM intends to experiment with different microphone techniques and to concentrate on improving the compatibility between stereo and surround. WGBH-FM will continue to explore multichannel production and broadcasting with its next project, refining the use of Pro Logic

and exploring Lexicon's Logic 7, a discrete surround system that can be encoded onto two channels.

Through the years, WGBH-FM's BSO broadcasts have attempted to reproduce the excitement of the live concerts. With the improvements in multichannel audio, we are getting closer to simulating the concert experience. But presently, the best seat in the house is still somewhere in Symphony Hall.

John Voci is operations director of WGBH-FM and is currently building two new public radio stations serving Cape Cod and the islands of Martha's Vineyard and Nantucket.

Jim Donahue is a recording engineer at WGBH-FM, Boston, and is also WGBH-FM's BSO engineer.

Antonio Oliari Ros has numerous classical and jazz recording credits and is a recording engineer at WGBH-FM.

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Field Report

Comrex Vector POTS codec

By Steve Fluker

In the past few years, technological breakthroughs have given us tremendous improvements in audio quality using POTS (plain old telephone service). Telephone lines are easy to come by, inexpensive, and can be ordered anywhere. Over the years, engineers have attempted to find ways to make the telephone line sound better. The first generation of improvements was the single-line frequency extenders. While impressive in their day, they really didn't solve the problem. More recently, two- and even three-line extenders were introduced. Though both offered the audio quality stations were looking for, multiple lines were needed to make them work properly. Also, broadcasting from out of town would result in a high long-distance phone bill.

Codecs are the latest generation of boxes to improve audio quality on telephone lines. Codecs convert the audio into digital data and use complex algorithms to compress that data so it can be transferred over a single telephone line. On the other end of the line,

10kHz bandwidth over a single telephone line. The Vector has an increased bandwidth of 15kHz. The difference is immediately noticeable.

The second major breakthrough is that the Vector maintains its 15kHz bandwidth even if the phone line isn't perfect: The unit maintains full-quality bandwidth when the phone-line connection drops to a rate as low as 24kb/s. (Other codecs decay to about 7kHz at that speed.) The Vector will provide 7kHz quality down to a data rate of 14.4kb/s. This speed is easy to achieve and still beats the quality of an RPU wireless link. At Cox Radio's Orlando stations, we can almost always get a 24kb/s or better connection and take advantage of the full 15kHz quality. The Vector cannot be connected to a cell phone; cell phones use highly compressed digital data and cannot support the unit's data bandwidth output.



Performance at a glance

- 15kHz audio bandwidth on a single telephone line
- Full bandwidth maintained, even with connections as low as 24kb/s
- Four built-in operating modes
- Built-in mixer with three inputs and one Aux input
- Built-in headphone amplifiers with mix-minus and local audio mixing
- Weighs only 3 pounds
- Detachable power cord

another codec decodes the data and converts it back to audio. These codecs do a great job of transmitting broadcast-quality audio over a single line. However, until now, they required a nearly per-

fect connection at 33.6kb/s to produce the best sound. As the connection decayed, so did audio performance. As we all know, perfect phone lines can be hard to come by.

A new generation

Comrex has introduced a new generation of POTS codec. It's called the Vector, and it has changed the standard of our remotes at the seven Cox Radio stations in Orlando. Though the Vector works much like the previous codecs, it has proved to be much more stable. The first improvement is its wider bandwidth. Previous codecs provided a

also provides a 300 baud data channel. This mode offers good stability, even on a poor or changing connection. The HotLine mode allows connection with the HotLine, another Comrex codec. The final mode is the Plain Telephone mode. This mode provides a standard telephone connection when the line will not maintain a modem connection.

The unit is available in two models: One is a portable model used in the field; the other is a rackmount model designed for the studio end. The field unit comes with a built-in mixer that allows three input connections — two microphone and one mic/line selectable. There is also a fourth mic/line-level input, which can be used for a local cue channel or a fourth on-air channel, as well as a line output that can even feed a PA system. All inputs and outputs are standard balanced XLR connections. Each input channel also has its own headphone output and its own level control, so talent can control their headphones separately.

Both the field and rackmount models have easy-to-read LCD menu-driven displays and LED VU meters for easy setup. The display menus make it easy to program auto

Operation

The Vector has four built-in operating modes. The Music mode gives you the full 15kHz bandwidth quality. Typically, we keep the system in this mode. The Voice mode offers a 7kHz bandwidth for any connections of 14.4kb/s or higher. At higher rates, this mode

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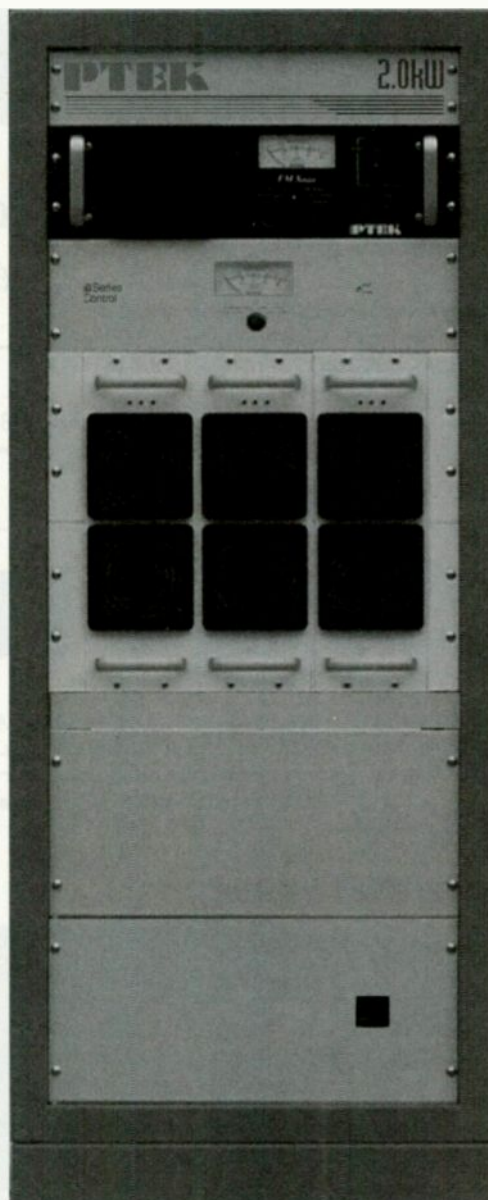
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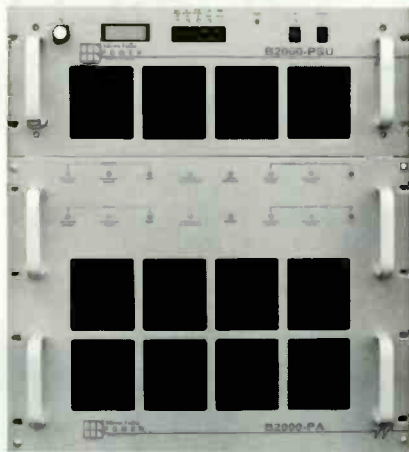
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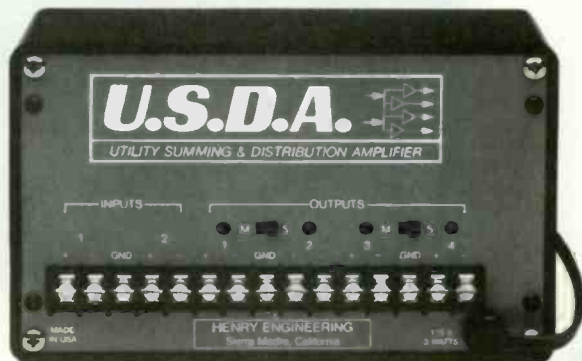
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Field Report

speed dials with up to 35 digits and pauses, which works well for international or credit-card calling. If more digits are needed, the Vector can be dialed using an external telephone or dialer. There is a one-button last-number redial for repeated connection to the same number. The menus also allow users to set up the maximum data speed for the modem connection. However, the Vector will connect at the most stable speed it can find, up to that maximum setting. If, while using the system, the data speed becomes unstable, the data rate can be manually reduced without losing the connection. The audio will mute briefly while the change is made. Changing the data rate or operating mode on one end will automatically change it on the other end. The 2RU studio model uses the menu for audio input selection and output adjustments from -10dB to +4dB settings.

AC power for the rackmount Vector is a standard IEC power cord with an internal supply. The portable unit is powered by an external supply, which will run on 120 VAC or 240 VAC. So that you don't take up extra physical outlet space, Comrex has eliminated the wall wart and uses a standard power cord to a separate supply box, which then feeds the Vector. There is no internal battery capability for the Vector. However, an independent company manufactures a battery pack that will work with the HotLine or the Vector. Comrex strongly recommends that you contact them for the details on this battery pack and not attempt to use an untested battery source. Otherwise, damage to the unit may occur.

Addressing technical difficulties

Audio delay is one downside of today's codecs. Because of the data compression, transmission and subsequent decoding the conversion from analog to digital requires, there is a time delay from the transmit to the final reception of the sound. The headphone feed output on the unit has a built-in mixer, allowing the announcer to listen to the mix-minus feed and mix the local audio from the microphone for the headphones.

There is no additional equipment to purchase or connect. The system comprises the transmission box, mixer and headphone monitor — all in one small, lightweight package. The unit even has a built-in peak limiter to prevent digital overload distortion. The Vector also carries a contact closure over the connection to the studio, so the DJ in the field can remotely start a stop set or song back in the on-air control room.

Breaking news barriers

One of our first tests of the Vector was to broadcast WDBO-FM's entire morning talk show. The broadcast was located in an open field on the side of a road, where we covered the launch of the Discovery space shuttle. We wanted the show to focus on the crowd that had gathered at this field along the intercoastal waterway to watch the launch.

One challenge with broadcasting from these launches is that, since so much RF is floating around, you have no idea

Connect Speed	Music Mode	Voice Mode	HotLine Mode
9.6kb/s	5kHz	5kHz	n/a
12kb/s	6kHz	6kHz	4.5kHz
14.4kb/s	7kHz	7kHz	5.4kHz
16.8kb/s	7kHz	7kHz	5.6kHz
19.2kb/s	11kHz	7kHz	5.8kHz
21.6kb/s	12kHz	7kHz	6.5kHz
24kb/s	15kHz	7kHz	7kHz
26.4kb/s	15kHz	7kHz	8kHz
28.8kb/s	15kHz	7kHz	8.6kHz
31.2kb/s	15kHz	7kHz	9.3kHz
33.6kb/s	15kHz	7kHz	10kHz

The Vector's high-end response varies with actual modem connect speeds. This table lists the high-end responses for the Music, Voice and Hotline modes.

if your RPU will work. Since most signals were turned on only minutes before the launch, there was no effective way to test in advance. With the Vector, we knew we would stay on the air even if the amount of RF interference climbed to an unacceptable level.

The telephone company ran a wire along a fence to provide us with a phone line in the middle of the field. The system worked so well that it sounded like we were in the studio playing background sounds to simulate an outdoor environment.

With the Vector, we have also been able to extend the range of remote broadcasts for WHTQ-FM. We can now broadcast live from anywhere, including the beaches that used to be out of the range of our RPU systems. In the past, we'd either turn down business or use a cell phone, which just didn't provide the quality we wanted. With the Vector, we were able to provide full-quality coverage from Biketoberfest and the recent races in Daytona Beach.

The Vector allows quicker and less-complicated setups at remote sites and gives us better quality audio, compete with IFB. 🎧

Steve Fluker is the director of engineering for Cox Radio's seven Orlando radio stations.

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 or consulting company.

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

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Field Report

Klotz Vadis D.C.

By Dave Halik

At Mercury Radio, we broadcast four stations: WEDG-FM, WHTT-AM, WHTT-FM and WGRF-FM. We also serve as the network headend facility for the Buffalo Bills football games. Thanks to the Vadis D.C. system, we are able to produce all of the mix-minus configurations needed to simultaneously broadcast the Bills' ISDN feeds as well as perform all of our regular station broadcast requirements, which may sound like a pipe dream to most people.

Recently, we installed our third console in the on-air control room of WEDG-FM. Our three Vadis D.C. audio consoles control the facility's Vadis digital audio master router in Mercury's central wiring area, all of which are integrated using fiber optic technology. The first Vadis D.C. was installed in the fall of 1997 in our digital production studio. The second



Performance at a glance

- Mechanical VU or LED meters
- Handles various digital I/O formats
- DSP modules available
- Instant recall of individual setups
- External GPI

was installed in July 1998 in the aux/production studio that serves as the network headend for Buffalo Bills' NFL football game broadcasts.

During the Bills' home games, we use three broadcast modes: pre-game, game and post-game. ISDN feeds come from three different locations: the home stadium, the field house and CNN Atlanta. Before the Vadis, I had to wire special mix-minus setups, and they would perform only one function. With the unit, I can program console setups and mix-minus configurations with minimal keystrokes.

Recalling the console's operating modes, associated mix-minuses and input sources with associated logic commands is done by pushing a button. As soon as our operators pushed one button and saw the mode change instantly, they realized the power of this system.

Proven performance

Though purchasing the first console was going out on a limb, by the time we needed the second console, the Vadis was a shoe-in. And our technical staff was pushing us to buy the third console. Everyone here realized the capability of this system and knew the capabilities it would bring to our stations.

Frames can be added as needed. Of all the units

currently installed around the world, no Vadis system has reached its limit in terms of the maximum number of inputs and outputs, according to the manufacturer. However, up to 1024 inputs and 1024 outputs can be *switched* at one time.

System configurations can be as basic as one controller. It is possible to install a single controller in each room,

and all can be operated in the traditional, analog model. One frame can handle up to 21 modules of any flavor. These can be input, output, monitor or DSP cards.

Frames are connected via a proprietary fiber optic communications system. Audio is routed over a fiber optic or coaxial network between frames. These can be connected in typical star or

ring topologies. System control routing is done over CAT5 cable. For a two-frame/control surface system, there will be one or two fiber optic cables, a CAT5 cable run between frames, and a CAT5 cable run to each control surface. Multiple copper pairs are no longer necessary.

The central control computer can be used to access each frame and will store copies of frame software and system software. As additional needs arise, new software can be installed. The software update can be done without losing audio through the router frame.

Networking

What most impressed me was the systems' networking capability between the consoles and the integrated master router. Essentially, that is why the systems are so successful for us. This product allows the digital networking of consoles with each other and the master router.

Before the installation of the Vadis system, we would not have had the physical space necessary to produce all of our remote broadcasts. Now, with just the press of a button, we can reconfigure the systems for any number of remotes.

One source connected anywhere on the system is available to all locations without any rewiring necessary, thanks to its fiber networking. And with this system, there's no need to buy a separate routing switcher. This unit changes the concept of routing. With just a few fiber connections, it looks nothing like a traditional wire-laden audio router.

Many facilities are designed as stand-alone systems.

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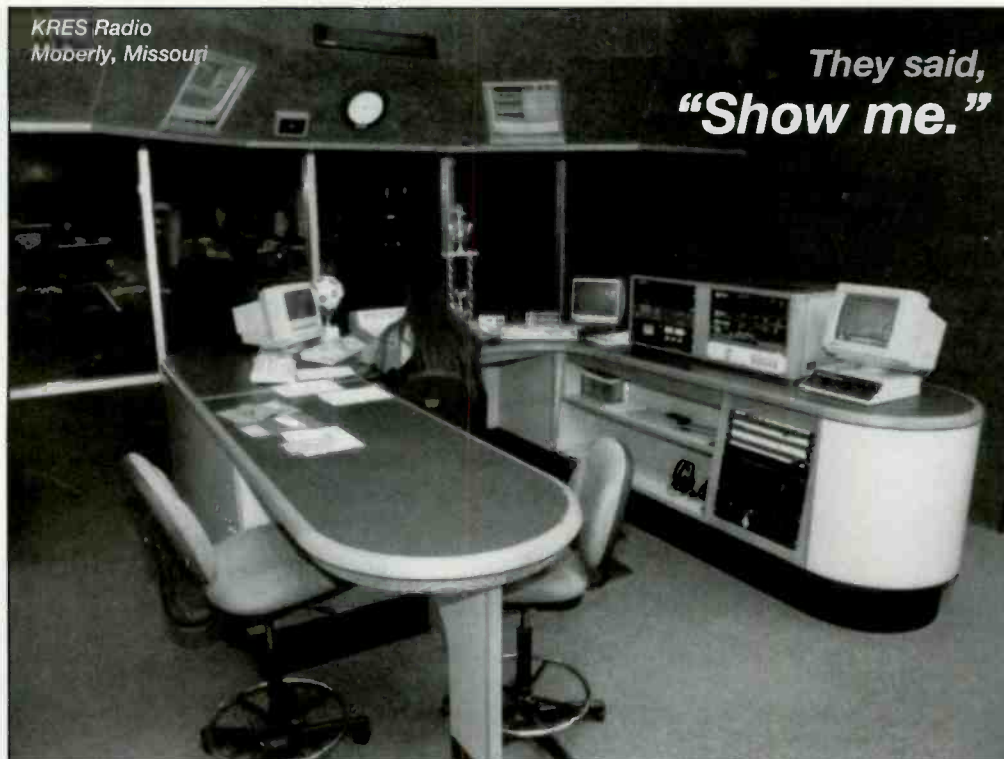
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Coming in the
April issue of

BE Radio

Radio Online

Streaming audio primer • The Web for profit
The .bwf file format

Digital Exciters

The audio can be fully digital and so can part of the FM exciter. See how they work and what is available.

Facility Showcase: WPLN, Nashville

Take a look at this NPR affiliate's facility.

Antennas, part 4: A look into the ATU

ALSO:

**Currents, RF Engineering,
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FCC Commissioners voice LPFM concerns

FCC Commissioner Harold W. Furchtgott-Roth voted against the FCC's Notice of Proposed Rulemaking regarding LPFM because the proposal, as it stands, would loosen current interference protection standards for FM stations in order to shoehorn LPFM stations into the FM band. Furchtgott-Roth assails the elimination of third- and second-adjacent channel safeguards as an incursion on the rights of current licensees, the value of their licenses, and the ability of listeners to continue to receive existing stations.

"Were the NPRM limited to consideration of service based on the maintenance of the interference rules now set forth in our regulations," writes the chairman, "I could thus have supported its issuance."

He also notes that, even if second- and third-adjacent channel protections were completely eliminated, little new service would be created in the major urban markets.

Commissioner Michael Powell voted for the proposal but issued a separate statement stressing his concerns about interference to FM stations and the impact of LPFM on terrestrial, particularly IBOC, digital radio.

DVD-Audio Disc specifications approved

The steering committee of the DVD Forum has approved version 1.0 of the DVD-Audio Disc specifications. Major characteristics include available sampling frequencies of 48kHz, 96kHz, 192kHz, 44.1kHz, 88.2kHz and 176.4kHz. Bit resolution is supported in 16 bit, 20 bit and 24 bit. Up to six channels are available for multichannel recording, with a maximum transfer rate of 9.6 Mb/s.

In two-channel stereo, more than 74min of recording time are possible on a single-sided/single-layer disc, even at the highest-quality mode at 192kHz/24 bit. With multichannel modes, even 96kHz/24-bit, six-channel recording can be included with more than 74min of playback time.

Chancellor considers move to sell

In an effort designed in part to drive up the price of its stock, Chancellor Media announced in January that it was considering the sale of all or part of the company. Chancellor is the largest radio station group owner in the U.S., and Clear Channel Communications, the country's third-largest radio owner, is a leading candidate to buy the entire company.

When Chancellor announced the move to sell, its stock rose to \$54.75 per share. As of this printing, the price is a more affordable \$47.87 a share.

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The logo for NAB99 features the letters 'NAB99' in a bold, blue, sans-serif font. The 'A' is stylized with diagonal lines, and the '99' is also stylized with a similar pattern.

NAB99 sessions of special interest

One of five new sessions debuting at NAB99, "Webcasting and IP multicasting" will be held on Wednesday, April 21. Part I of the session will cover how the audio and video quality of Webcasting has improved with the development of enhanced software, faster modems and improved Internet connections. Part II will introduce and demonstrate IP multicasting and show what must be done to deploy this technology as a viable service to reach different markets.

"Y2K: The final challenge," another NAB session, will provide essential checklists for compliance. In addition, a panel will explore the broad dimensions of what is known to date about the Y2K challenge, what progress the industry and the government have made, and what critical milestones remain in efforts to achieve a Y2K compliant society.

1998 technical Grammy awarded

Each year, a technical Grammy is awarded to a company or individual that makes an outstanding technical contribution to the recording field. This year, the honor went to Georg Neumann, creator of the first mass-produced condenser microphone as well as a series of microphones considered among the best in the industry.



Neumann M 147

The Recording Academy's Technical Committee recommends possible recipients, and final approval is made by the National Trustees.

The first technical Grammy was awarded in 1994. Past winners include Dr. Thomas G. Stockham Jr., Ray Dolby, Rupert Neve and Sony/Phillips.

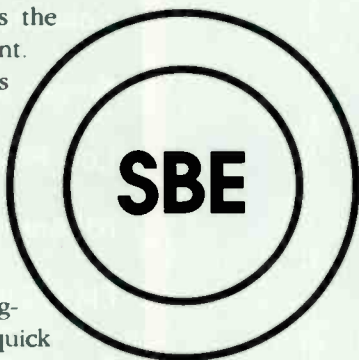
EAS patent issue addressed

The National Weather Service issued a statement on February 4 regarding Quad Dimension's U.S. patent. The patent in question concerns the central technology in the Emergency Alert System and was granted after a PTO re-examination of the art submitted by the NWS. The NWS believes that the PTO did not consider prior information and is thus preparing a second re-examination request to overturn the QDI patent. The NWS will submit evidence that the government has documented, pre-existing rights to the technology that is the subject of the patent.

Further, the NWS has stated that the QDI patent may have a negative impact on stations, which are required by the FCC to implement EAS.

Though the FCC recognizes the need for a quick resolution to the patent matter because of the complications it may cause, Chairman Bill Kennard will not modify the agency's EAS rules during the review of the patent. He feels doing so would decrease the effectiveness of the EAS.

The SBE recommends that broadcast engineers consult with their station's intellectual property or communications lawyers before taking any action on the correspondence received from QDI.



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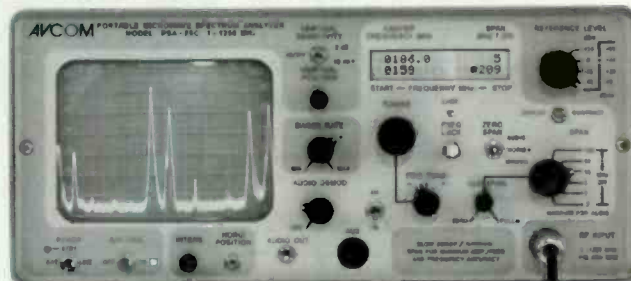
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AVCOM's newest Portable Microwave Spectrum Analyzer, model PSA-65C, incorporates a microprocessor and attractive multifunction, backlit LCD, with an expanded frequency range from less than 1MHz to over 1250MHz, for the amazing price of \$2930.

AVCOM's new PSA-65C is a low cost general purpose spectrum analyzer that's loaded with standard features including FM audio demodulator, AM detector and digital frequency lock. The PSA-65C covers frequencies thru 1250 MHz in one sweep with a sensitivity greater than -95 dBm at narrow spans. The PSA-65C is ideally suited for 2-way radio, cellular, cable, satellite, LAN, surveillance, educational, production and R&D work. Options include new 1250 MHz frequency extenders, BNG-1000A tracking (noise) generator, log periodic antennas, carrying case (AVSAC), and more.



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Business

Orban and **Enco Systems** have combined the features and technology of their respective products, the Orban AirTime and the ENCO DAD-PRO32 Digital Audio Delivery System. The new product will be marketed under the ENCO DAD-PRO32 name and will be compatible with audio inventory of the Orban AirTime system. **Harris Corp.** will assume exclusive worldwide marketing, distribution and systems engineering for the combined system.



▲ **Maxell Corp. of America** is increasing its current U.S. facilities by more than 30 percent. Much of the new space will be occupied by the leading media products company's sales, marketing and engineering staffs.

Also, Maxell's Professional Media Products Group has launched a new Web site. See their products at www.maxellpromedia.com.

Gepco recently completed the installation of all recabling components for Giants Stadium, East Rutherford, NJ. GEPCO, the exclusive supplier for all recabling components for the project, worked in conjunction with integrator Diversified Systems and National football league consultant SportVision Systems.

OnRadio has been chosen as **Arbitron's** latest partner in its streaming media measurement initiative. The alliance will enable Arbitron to provide the industry with third-party audience measurement, which will help facilitate ad revenue for

OnRadio and its affiliates.

OnRadio has also partnered with Infospace.com to provide local content, including entertainment and events, yellow pages directories, five-day weather forecasts and area hotel listings.



▲ **LEDtronics** has moved to a new building, located at 23105 Kashiwa Court in Torrance, CA. With more than 63,000 square feet of space, the new facilities offer more than three times the manufacturing space as well as a host of other improvements.

▼ **Holiday** has announced a new customer-support program, titled "EMF Safety Services," to assist customers who need to manage electromagnetic field environments. The offering covers education and informational seminars to help explain EMF concerns and relevancy as well



as field and technical support for customers who need assistance evaluating and interpreting site measurements. For more information and to receive a copy of Holiday's free brochure on the program, contact the company at 612-934-4920.

Globecomm Systems is offering a free copy of its new brochure on WorldSpace Processed Feeder Link Stations to any radio broadcaster who wants information about distributing programming via the WorldSpace Digital Direct Satellite Radio System. To obtain a copy of the brochure, call 516-

231-9800 or e-mail Globecomm at info@globecommsystems.com.

A new eight-bay sidemount internal-fed **Jampro** Rototiller antenna was recently installed in San Paulo, Brazil, for Mix 106 FM.



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People

▼ Telex Communications has announced its new executive management team. (Pictured clockwise L to R) **John Pallaschi** is president of the



Telex

Speakers and Microphones Group, **Glen Cavanaugh** is president of the Multimedia/Audio Communications Group, and **Dan Dantzer** is president of the Electronics Group. **Ned Jackson** was recently named president and CEO.

Columbine JDS has announced the promotions of several top executives. **Doug Rother** has been promoted to president. The new chief operating officer is **Mike Oldham**, and **Mark Eagle** is the new executive vice president.

John Pedlow has been appointed to the position of president and chief executive officer of Broadcast Electronics.

Tom Jordan, vice president of U.S. regional sales for Leitch, has been chosen for the SMPTE executive post. He recently completed a year-long term as the society's secretary/treasurer.

George Longwell has been chosen as OnRadio's national sales manager for WBIC and WTEM in Washington, D.C. **Phil Hall** has been chosen as vice president of programming for the company.

Dr. George Waters, formerly of Scientific-Atlanta, has joined International Communications Products as director of engineering.

► **Jim Jameson** has been named president of Dynatech subsidiary, Industrial Computer Source. Jameson was previously the president of Elcom Service Group.

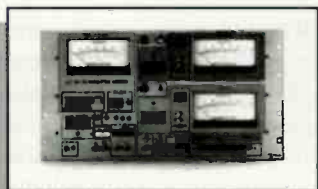


Jameson

Richard McKernan has been appointed to the position of recorder sales manager for Euphonix. McKernan will oversee sales of the R-1 multitrack hard-disk recorder.

Harris Corp. has promoted **Chuck Maines** to radio district sales manager. He will serve the states of Alabama, Louisiana, Mississippi, Tennessee and the northern panhandle of Florida.

Meeting The Broadcaster's Present And Future Needs



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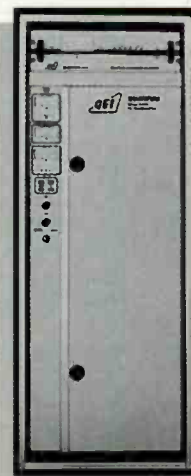
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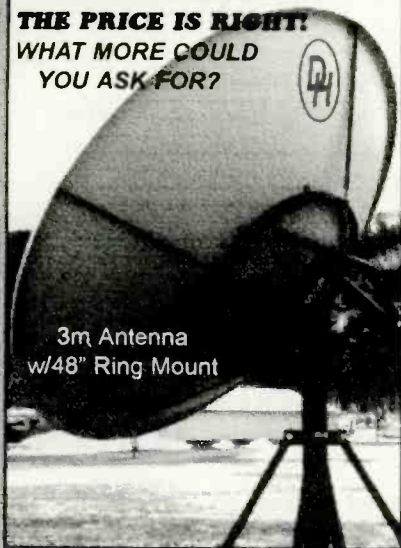
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Online Survey

Staffing for tomorrow

By Chriss Scherer, editor

The face of radio continues to change. Radio is and will continue to be a business based on technology. Despite this, technical staffs are not always the primary concern for owners and managers. In radio's beginnings, there were large technical staffs, because equipment needed constant attention. A transmitter operator would man the transmitter for eight hours. Some of this time may have been spent polishing the meters or waxing the cabinet. As equipment became more stable, the size of the technical staff decreased. In some cases, staffs reached the bare minimum, with only one engineer for several stations. That engineer may also have been a contractor instead of a full-time employee. (For a look at how contract engineers can survive consolidation, see Contract Engineer-

ing, "Navigating consolidation," p. 8.)

With consolidation happening almost everywhere, the tide is turning, and the size of the technical staff is growing again. Our first survey question asks how many stations are in your market group and how many full-time people there are on the technical staff. The answers to this question varied.

Most engineers responded that one engineer per radio station was a good number. Based on the responses we received, this appears to be true when there are four to six stations involved. Groups of fewer than four stations typically reported one or two engineers. Market groups with more than six stations tended to top out at about six. Granted, market groups with more than six stations are not as common as the other groupings.

It's certainly no secret that computers are a vital part of radio. As with many things around the station (telephones, copiers, plumbing), the computer became the responsibility of engineering. Computer usage has also grown, and the skills needed to maintain multiple machines and a network are a different than those radio engineers previously needed. More and more engineering staffs are now including someone whose primary responsibility is computers.

Survey question ▼

Do you currently have an individual on staff whose primary responsibility is computers (IS, IT, etc.)?



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The next survey results will appear in the May/June issue.

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5 KW	FM	1983	Harris FM 5K
5 KW	FM	1967	Collins 830E
5 KW	FM	1967	Collins 830E
10 KW	FM	1962	RCA BTF 10D
20 KW	FM	1970	Harris FM20H3
25 KW	FM	1981	Harris FM 25K
25 KW	FM	1981	Harris FM 25K
1 KW	AM	1979	Harris MW1A
1 KW	AM	1978	Collins 820D1
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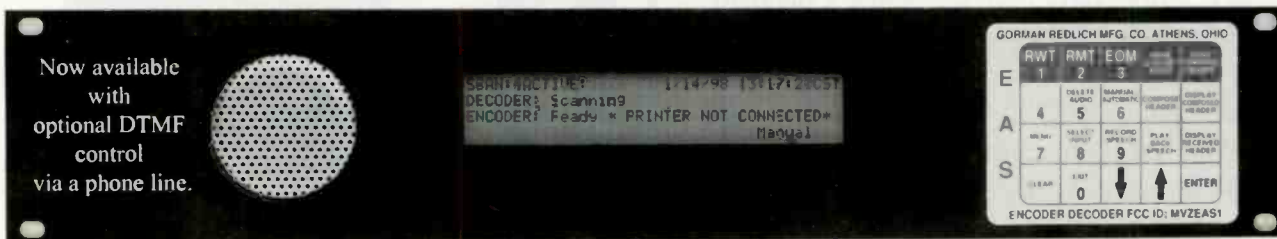
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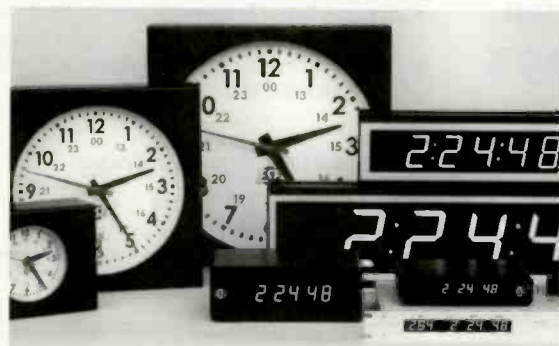
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BE Radio GALLERY

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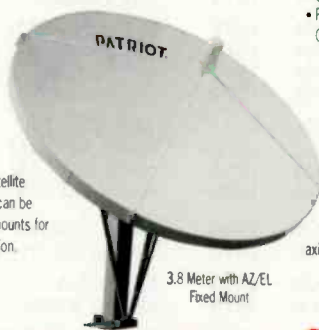
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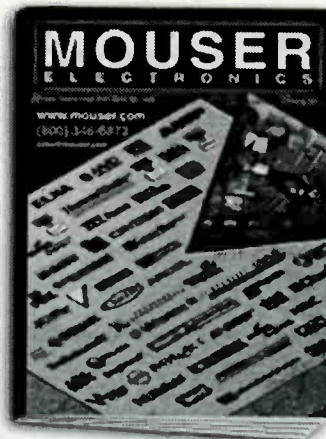
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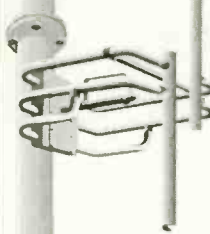
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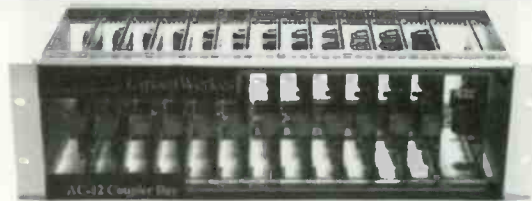
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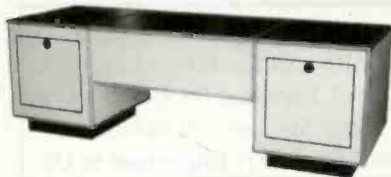
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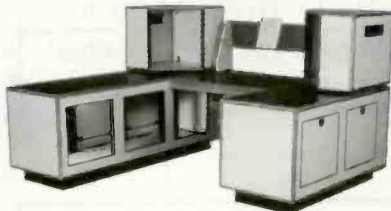
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Living in the past, part 1

By Skip Pizzi, executive editor

Radio isn't the only industry with merger mania of late. The first quarter of 1999 has already seen major media deals between AT&T and TCI, USA Networks and Lycos, AOL and CBS, and @Home and Excite. This follows earlier deals by Disney and Infoseek, AOL and Netscape, Web TV and EchoStar, and many others.

To varying degrees, all of these mergers share one important premise — they are “cross-media” deals. The players in each venture were strong in their respective media sectors, and their confluence was deemed a good business value. In some cases, the

products of one or both of the partners also were (or will be) changed or influenced by the deal.

Compare these arrangements with the continuing consolidation in radio, and one distinction becomes obvious: The current radio-industry activity involves radio-station owners acquiring *more radio stations*. While most other recent media mergers have taken a horizontal strategy, the radio industry continues on a strictly

vertical course.

If this were a portfolio-building strategy, financial advisers would call it crazy. Such nondiversification, particularly in an environment where other media companies are rapidly diversifying, poses a significant risk and is cause for concern.

Radio-station owners continue to see their assets as radio stations, not media companies. The relatively small degree of horizontal structure that once existed in local broadcasting — the radio/TV combo operation — has almost completely disappeared. Increasingly, radio stations are owned by companies with no other types of property, and with no significant alternate revenue source besides radio advertising. As long as traditional radio remains successful, this works well as a business strategy. However, if a downturn in radio broadcasting occurs, exposure to rapid corporate decline is likely.

Impending threats

The future is murky for radio. A two-pronged attack on its audience is massing on the horizon. One threat comes from soon-to-be-launched DBS radio services, while the other comes from the Internet. Although neither will likely

do more than nibble at the fringe for the next few years, the die is cast: Radio will have to share what it once exclusively owned. Over the next decade, the eventual effect on traditional radio listening could range from negligible to devastating.

If this were a portfolio-building strategy, financial advisers would call it crazy.

However speculative the prospects of these new competitors may be, radio's current vertical tendencies seem

ill advised. This is the time to hedge bets and strengthen the product. Instead, the radio industry is doing the opposite, piling everything onto a single horse in a high-stakes race. In some cases, multistation owners are simultaneously weakening their product by reducing its localism at a time when that very attribute may be the best defense against new, nonlocalized competition.

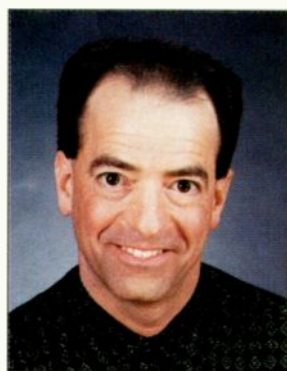
The radio industry's strategy of competition-by-merger was supposed to result in increased profitability. In many cases this has indeed occurred, but local stations often do not reap these financial benefits equitably. The highly leveraged positions of many owners means that much of the benefit from profits is diverted elsewhere, yet all stations quickly feel the pain of any losses. The failure of a few can bring down the whole house of cards.

Meanwhile, corporate inertia may be robbing the industry of its agility just when it is most needed. Radio has reinvented itself before, but it was never structured like it is today. Nor has it ever faced the type of potential threats that lie ahead. Radio's next reinvention may be required soon, and the industry may be too bloated or immobile to respond in time.

Saving grace

Radio's salvation may come from its bifurcated business model, incorporating both *content* and *delivery* components. Its nearly universal access to audiences at home, at work, in cars, or in between also has uniquely high value. But these attributes alone won't keep radio healthy forever.

Strategic alliances and aggregations across media types are the most advisable changes of direction for the U.S. radio industry today. The future will be different, both in its audience characteristics and its competitive landscape. Just *how* different remains to be seen, and radio needs to be better prepared for such eventualities. A reduction in the industry's highly vertical profile is a good first step toward diffusing current levels of risk.



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