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THE RADIO TECHNOLOGY LEADER
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ON THE COVER:
It's part art and part science, but it's all radio. Finding the right sound from an audio processor requires careful consideration and mind processing
Cover design by Michael J. Knust.

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Currents Online

Selected headlines from the past month.

SBE Swears in New Board and Officers, Presents Awards

The new officers of the Society of Broadcast Engineers—including *Radio* magazine Editor Chriss Scherer as president and *Radio* magazine Contributor Barry Thomas as treasurer—begin their one-year terms.

Cumulus to Acquire Susquehanna Radio

A private partnership of Cumulus Media, Bain Capital, The Blackstone Group and Thomas H. Lee Partners will acquire the radio business of Susquehanna Pfaltzgraff for $1.2 billion.

FCC Adopts Procedures for Kinstar Antenna Applications

The modified procedures eliminate the need to submit a proof of performance, current distribution measurements or a formula for the vertical plane radiation characteristic for nondirectional AM facilities.

Petition Seeks to Create Low Power AM Service

Five parties filed a petition with the FCC to establish a commercial, low-power AM (LPAM) radio service with antenna input powers up to 250W.

Rehr Named NAB President

David Rehr assumes his new duties on Dec. 5, 2005, after serving several years as the president of the National Beer Wholesalers Association.

SBE Relaunches Website

The new site, which retains the www.sbe.org address, features improved navigation, more functionality and modern Web design.

Broadcast Electronics Intros HD Radio to New Zealand

Transmitting from the Skytower in Auckland, the broadcast is under a special license from a division of the New Zealand Ministry of Economic Development.

Site Features

Currents Online Weekly E-mail

The *Radio* magazine headlines are delivered to your e-mail every Monday morning. Subscribe today for the latest radio technology headlines.

The DAB Answer Series is Online

The Insight to IBOC supplement in this issue covers a specific aspect of digital audio broadcasting. The last installment was in the May issue. The complete content of each issue is available online as well.

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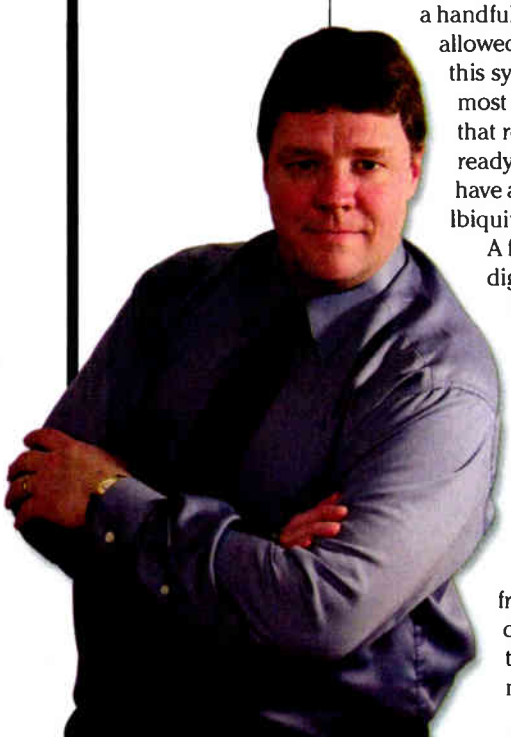
The current view

After spending about half of September and October on the road attending the IBC, NAB Radio Show, AES, the SBE National Meeting/BEE and some other events, I can return to some semblance of a normal routine; at least for a few months before the planning for NAB2006 begins. During each fall convention, I was able to talk with lots of people about many topics. One of the most common topics, not surprisingly, was HD Radio. The overall opinions were mixed: some hate it, some like it, many are not yet convinced.

The practical matter is that the HD Radio IBOC system is here. It's installed at many stations already. It's planned to be installed at many more.

Is it perfect? No. In reality the system is still being refined, but what is currently available has shown that it works. Like any new technology, there will be early adopters who set the course. For some, this means that they must keep pace or get out of the way.

So what about the other systems that have been mentioned? So far, Cam-D has a handful of stations, but we're still not allowed to learn anything about how this system works. FM Extra is the most recent, and the latest word is that receivers are supposed to be ready any day. Both these systems have an uphill struggle because of Ibiquity's head start.



A few times the idea of placing digital signals on new spectrum was suggested. Unfortunately, the time for this idea has long passed. Eureka-147 was proposed and rejected for this reason. With the TV transition to digital, some people are looking to the vacated channels. The problem is that Congress wants to see the revenue from spectrum auctions, and I don't know of any broadcaster that wants to begin bidding for new spectrum. In addition, there are louder pleas for spectrum for public safety and homeland security. Add to this the feeling in Congress that broadcasters horde too much spectrum already. We have to recast our image before new spectrum will ever be allocated to radio.

There is considerable discussion (and some unpleasant accusations) about surround for HD Radio. Most often, the debate is between the two basic methods used to provide a surround signal. I covered this during a session at the AES Convention. Like any decision, there are trade-offs between cost, implementation and listener return.

For many stations "good enough for consumer ears" may not be pristine and perfect, but it is a practical approach. The effort to pair an artistic stereo mix with a discrete surround mix may provide the more faithful reproduction of the original, but the reality is that few stations will want to dedicate the resources into doing this right now. This may change when the amount of surround material with a corresponding stereo downmix increases.

I'm still putting my money on multicasting being the catalyst for HD Radio, mainly because of the additional revenue stream. While some broadcasters may choose to place yet another sterile and safe format on the additional channels, those who are willing to make a small investment in creating the additional stream will reap the rewards.

The ultimate use of surround would be to place it on multicast streams. If the reduced bit-rate channel can support surround, it makes perfect sense.

The future readiness of consumer hardware is an ongoing concern. If I buy a radio today, what's my option for future capabilities short of buying a new receiver? Cell phones and media players are all software-based. Updates can be loaded as needed. The HD Radio receiver needs to follow this example. Doing so will be a departure from the current method, because that means my car receiver will be more like a PSP or a PDA than a hardware device. I realize that this presents its own challenges to manufacturers, but it is the way that technology is heading.

The HD Radio rollout is here. The time to design a dream system is behind us. We're already working on enhancements to HD Radio.

Chriss Scherer, editor
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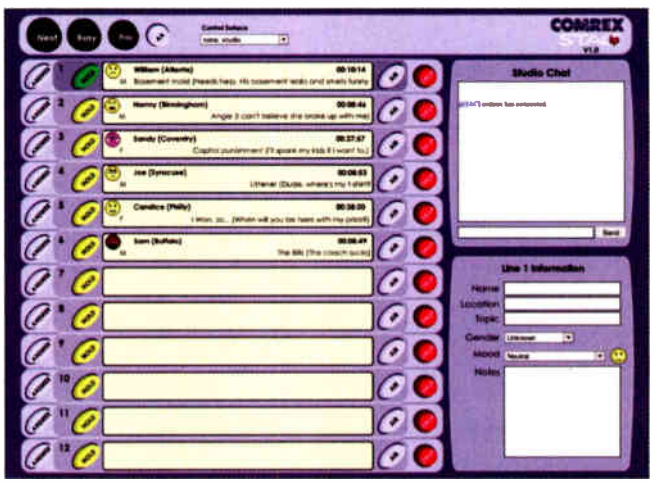

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The mystery of negative towers

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

Ever since the beginning days of directional antenna usage design, operational engineers have been confronted from time to time by towers that do not behave normally. This situation is probably far less frequent today than it was 25 to 30 years ago. Certainly it is better understood and more easily handled. Back in the '60s and '70s when a group of radio engineers got together it was not unusual to hear at least one engineer complaining about a negative tower.

Today there are probably fewer negative towers in operating directional antenna systems thanks to the all-powerful computer, but they still exist. In the early days of directional antenna design the designer was usually pretty tired after four or five weeks of work on a Burroughs comptometer. When he found a combination of towers and phases and currents that would produce the desired pattern, he probably didn't look any further.

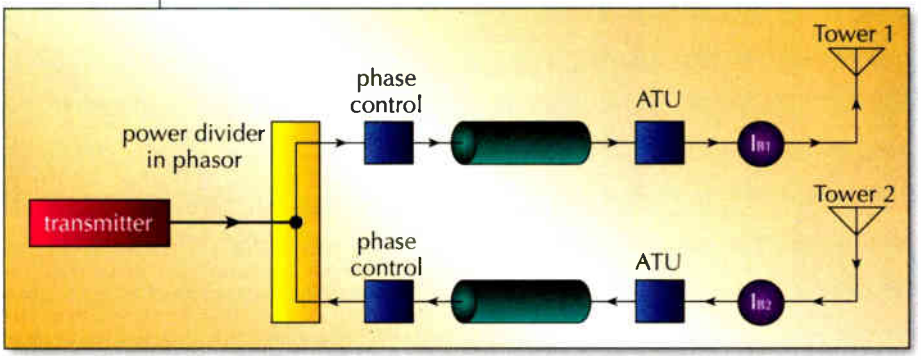


Figure 1. Block diagram of a negative tower system. Note the direction of power flow in tower 2.

Today with a computer program that will iterate until the cows come home, development usually continues until the overall best solution is found. As a result, fewer wild towers are found in modern DA designs and many older systems have been reworked so negative tower problems have been eliminated.

Nevertheless, there are still many original DAs in use that have problem towers whose operating base resistance may swing from positive to negative depending on weather conditions and changes in the mutual impedance of the system. Once the secret of these negative towers is understood they are just as easy to handle as regular towers.

What's normal?

Engineers are generally accustomed to towers that have a normal base operating impedance; for instance 35 +j90 ohms. If we feed current into this tower we radiate an electromagnetic signal. But suppose the sign were -35+j90 ohms; what then?

Such a tower would radiate some RF power and try to get rid of the remainder in some other manner. If, as is more usual, the resistance is on the order of only a few ohms, the operating resistance would probably alternate between positive and negative values, and the DA parameters would go in and out of limits as the weather changed, or something else changes the mutual impedance of the array. Fortunately negative towers, which are caused by combinations of mutual impedance, current and phase, only occur in directional antenna systems. The base operating impedances are determined by the operating parameters required to produce the desired pattern in the directional antenna.

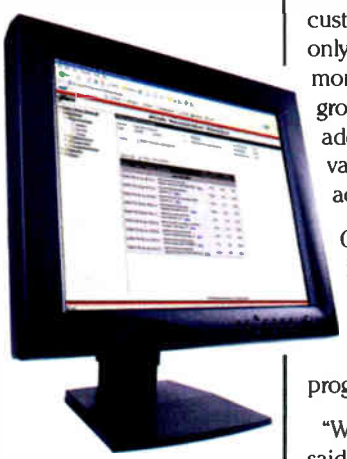
What exactly is a negative tower, and what does it do that is so different from a normal tower? The best definition is a tower with a negative base operating resistance. This means that instead of radiating power it will take power from the field produced by the other towers in the array. This power could be dissipated in a suitable resistance but the Commission will not allow that in most cases. The power that is absorbed from the other antennas must go somewhere, so why not feed it back, in correct phase and magnitude, into the power divider, i.e. the phasor? This is certainly more efficient than dissipating the power in a resistor.

For example

Let's assume that we have a two tower DA system with a licensed power of 5kW. Let's also assume that we need a dent in one side of the pattern with a reduction of 500W in that direction. We could actually drop a wire from one of the guys (in effect another tower), connect a suitable reactance and resistance in series between the tower base and ground and reduce radiation in that direction by 500W. The value of this resistance can be calculated so that 500W is removed from the radiation pattern in the

Shrinking Revenues?

dMarc's new revenue solution gains momentum



RevenueSuite's Online Control Console keeps you informed.

The chase for new revenues has exasperated radio execs for what seems like years, yet some are now starting to see light at the end of the tunnel. RevenueSuite, a newly launched revenue-on-demand program from dMarc is finding revenue streams where none existed before.

Offered exclusively to Scott Studios and Maestro customers, RevenueSuite has been on the market only a few months, yet it is already syndicated into more than 250 stations. That makes it the fastest growing new revenue solution in the industry. An additional several hundred radio stations are in various stages of review and/or pre-installation, according to dMarc management.

One of the early adopters is Nassau Broadcasting Partners, headquartered in Princeton, NJ, and serving multiple markets in the Northeastern U.S. Nassau recently committed all 55 of its market-leading stations to the RevenueSuite program.

"We give RevenueSuite a resounding thumbs up," said Nassau's Senior Vice President of Engineering Tony Gervasi. "It's performing exactlyas dMarc said it would. The best part about it is that we literally set it up, turned it on, and it operated seamlessly with our Scott Studios (SS32) systems, generating revenue. Prior to installing it group-wide, we put it through numerous performance tests. We found that RevenueSuite was easy to install, highly intuitive, hands-free and reliable. Now it's up and running, generating revenues across our network of stations."

Other managers report liking the fact that, once RevenueSuite is installed, it requires virtually no traffic management or operational maintenance. "After you close the logs for the day," said dMarc President Ryan Steelberg, "the RevenueSuite program begins to fill unsold and designated avails automatically without the need for station overhead or local trafficking. You can turn it on, and the system will run autonomously while providing real-time revenue reports and local control through a simple-to-use web-based interface. The RevenueSuite program is made available to any Scott Studios or Maestro enabled station." ■

For more information on RevenueSuite, check out the company's online site at www.dmarc.net.

required direction. That, my friends, is exactly what a negative tower does although in this case it is operating as a parasitic—that is, an undriven—element.

That would be an attractive solution for a simple DA pattern requirement. Unfortunately, the FCC does not allow this solution to be used, although one or two such installations have been permitted in the past. One that I know of personally was 50kW WWWE Cleveland (originally WKYC and also called WTAM). The station had a Franklin antenna with a drop wire suspended from a guy in the required direction. As originally designed the drop wire element was included in the three tower DA's system and was designed to be driven by the phasor.

However, it proved difficult to reduce enough power in the desired direction. So the drop wire base was disconnected from the phasor system and a series-dropping resistor used to reduce radiation toward the Canadian

Modern computing power makes it easier to find the best solution to designing an array and not just the first one.

co-channel station. This station had been purchased from WKYC, and later it moved the transmitter to a more suitable site with a simple vertical radiator.

Figure 1 is a diagram of a two-tower array in which the number two tower has a negative base operating resistance. Power flow for tower one is normal from phasor to antenna one. However, the power flow for tower two is in the reverse direction. The whole system between tower two base and the phasor is designed to accept the power abstracted from the field of tower one and combine it with the transmitter power in the phasor in the correct phase. It's important to realize that the amount of power radiated by tower one must be sufficient to produce tower one's effect on the pattern. At the same time it must supply sufficient power for tower two to return the correct amount of power to the system. This means that tower one's power will be greater than the nominal power of the station.

Design of the phasor is inevitably bound up with the design of the directional antenna system. During the latter process the consulting engineer adds up the phase shifts introduced by the components between the antenna and the power divider. These values are adjusted to produce the desired phase at each antenna. If during this process someone discovered that a tower with a negative base operating impedance will be required, then he will make another computer run to find a more convenient antenna design.

If it becomes necessary to use a negative tower a change has to be made in the equation for the phasing system. The power that the negative tower will absorb from the array has to be fed in parallel with the correct phase and magnitude back into the power divider system of the phasor.

To do this the transmission line system must present a negative impedance to the tower. In effect the ATU is located in the phasor, line matching must be created and any system tweaking must be performed at the phasor. In essence, the negative tower becomes a generator that must be properly connected to the main generator (the transmitter) with correct phase and impedance so that power taken out of the array is returned in the phasor power divider.

Another factor to consider when dealing with a negative tower is the impact of the regenerative effect of the negative tower feeding power back into the system. Because of this regenerative effect the system Q can become high, sometimes with considerable effect on the bandwidth, which may vary unstably. A point of interest—as the feedback voltage is increased, as the system comes into tune, the I_{CP} current will increase because a negative resistance in parallel with a positive resistance results in a larger resistance value than the positive alone.

E-mail Battison at batcom@bright.net.

Burroughs photo courtesy of David Freeman at thepcmuseum.net.

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FM Auction 62 postponed

By Harry Martin

With fewer than 10 days before upfront funds were due for the forthcoming FM auction, the FCC postponed Auction No.62 until Jan. 12. The auction of 171 new FM channels was originally scheduled to begin on Nov. 1. The last-minute postponement has chilled the enthusiasm of many would-be bidders. Even non-participants may recall that the last FM auction, Auction No. 37, which was scheduled for Spring 2001, also was postponed at the last minute and was not ultimately held until Fall 2004.

The FCC reported that the delay in Auction 62 will last only two months. It blamed the delay on the hurricanes in the Gulf Coast area and the need to allow bidders there to better prepare for the auction.

Short-form applications (Forms 175) already had been filed before the FCC announced the postponement. The FCC plans to release by mid-November a list of all such applications received by the Aug. 12 deadline.

The Sept. 30 deadline for correcting any errors in short-form auction applications (Forms 175) and the submission of upfront money has been extended to Dec. 2. Only applicants who submitted applications by Aug. 12 will be allowed to participate in the upcoming auction.

Ownership interests affect bidding credits

The postponement of the FM auction provides an opportunity for would-be bidders to reassess their bidding strategies. And those who take advantage of that opportunity should consider a recent FCC decision concerning the loss of bidding credits where the bidder's position changed after the deadline for Forms 175.

The Commission's bidding rules provide that applicants with no other media interests are entitled to a 35 percent bidding credit. Under the credit procedure, eligible entities pay the FCC 35 percent less than their winning bids. Bidders who hold one-to-three media interests are deemed to be entitled to a 25 percent bidding credit.

The purpose of the bidding credit policy is to encourage new entrants, or those with few interests, by giving them a financial advantage.

Auction participants are required to disclose their other media holdings—and, therefore, their eligibility for bidding credits—in their short-form application (FCC Form 175), which are filed several months in advance of the auction. But, the fact that a party's application may seem to reflect entitlement to a credit does not necessarily mean that, when the time comes to pay up, the credit will still be applicable.

In that decision an applicant's Form 175 application showed that it had no other media interests. But that was only as of the date the application was filed. Shortly after the Form 175 was filed, the applicant closed on its acquisition of another media interest. As a result, the FCC reduced the applicant's bidding credit from 35 percent to 25 percent.

The applicant argued that the FCC's auction policies provide that bidding credit eligibility is to be based on media ownership at the time the auction applications were due. The FCC rejected this argument because it had previously clarified in other rulings that an auction applicant's bidding credit status is not frozen at the time auction applications are filed, and can be lost or reduced after the filing date if attributable media ownership increases.

Martin is immediate-past president of the Federal Communications Bar Association and a member of Fletcher, Heald & Hildreth, Arlington, VA. E-mail martin@fhhlaw.com.

Dateline:

Dec. 1 is the deadline for radio stations, LPFM stations and FM translator stations in Connecticut, Massachusetts, Maine, New Hampshire, Vermont and Rhode Island to file their 2005 license renewal applications. Full-power radio stations also must file their biennial ownership reports and EEO program reports with their renewal applications.

Dec. 1 is the start date for pre-filing renewal announcements for radio stations in New York and New Jersey, in anticipation of the filing of their renewal applications on Feb. 1, 2006.

Dec. 1 is the deadline for radio stations in Alabama and Georgia to file their biennial ownership reports.

Dec. 1 is the deadline for radio stations in the following states to place their 2005 EEO public reports in their public files and post them on their websites: Alabama, Colorado, Georgia, Massachusetts, Maine, Minnesota, Montana, New Hampshire, North Dakota, Rhode Island and South Dakota.

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THE NAB RADIO SHOW

By Kari Taylor, senior associate editor

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Flexstar HDX-FM: This exciter provides real-time adaptive correction technology that offers noise reduction and transmitter and antenna linearity to provide a clear signal to the listener. The unit also features adaptive group delay equalization; secondary auto-switching of AES3 and composite inputs; and hybrid/straight FM outputs for the split-level combining method, which enables the implementation of FM HD Radio using a station's existing FM transmitter and antenna and offers an 10 percent reduction in operational costs over high-level combining.

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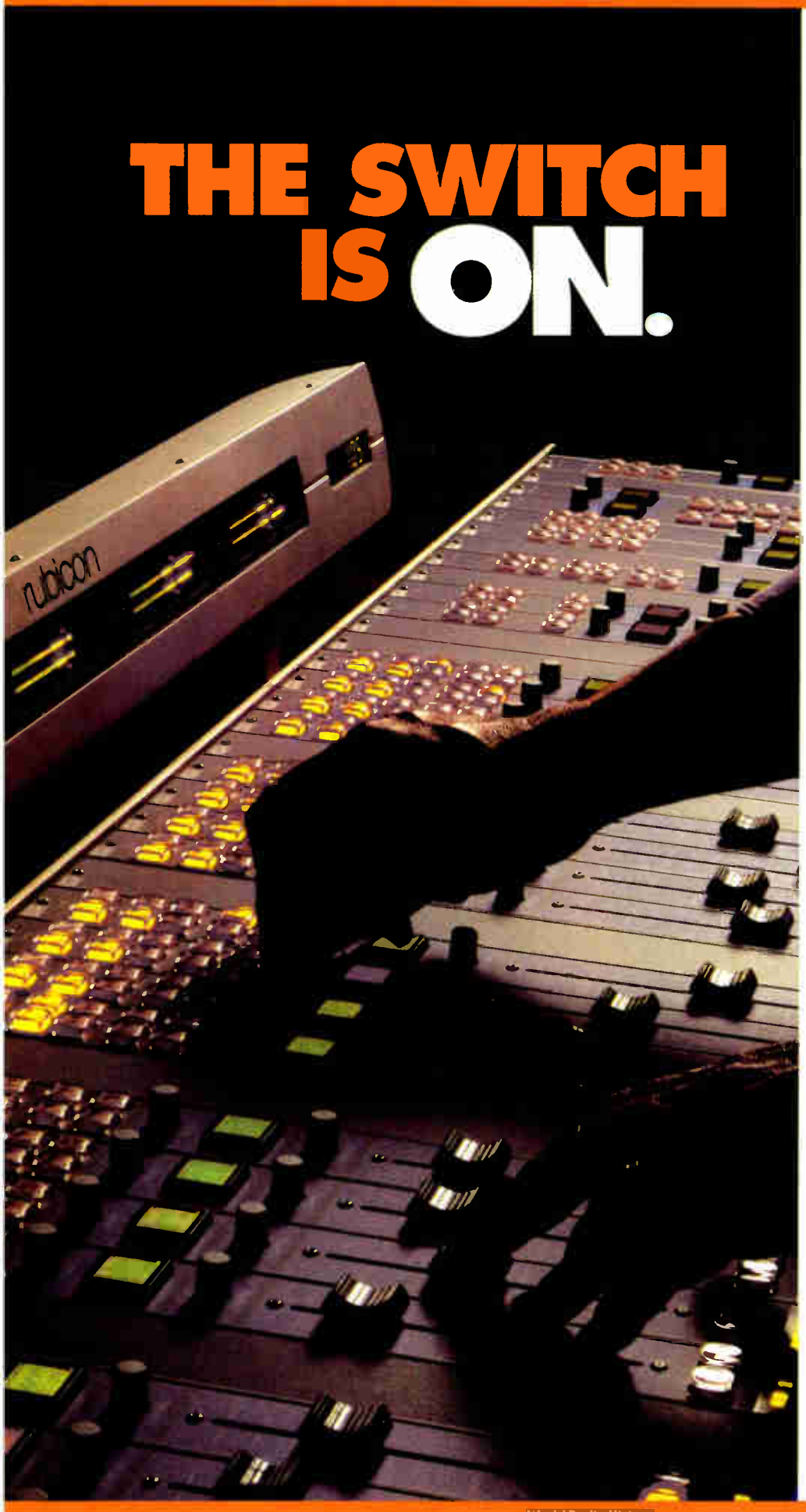

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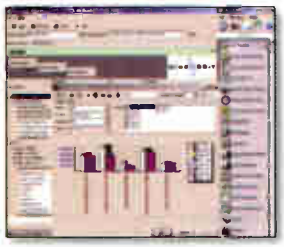

Trafficking software
Wide Orbit

WO Traffic for Radio: WO Traffic offers centralized management of traffic and reporting from one location for multi-station groups, and tracks market history and conditions. WO Traffic for Radio can handle multi-station, multi-location, one terminal or 800+ users on a single database, real time inventory, real time reports, HD Radio multi-channels, electronic invoicing, EDI, Internet and NTR revenue streams and podcasts. The software also includes several sales-oriented features like proposal writers, self-contained contact management, sales force automation and Sarbanes-Oxley compliant reporting tools.

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Solid state media recorder
Nagra

Ares-M: This solid-state recorder captures audio at up to 24-bit/48kHz and operates over a range of -20 to 60 degrees Celsius. It measures 5" × 2" × 0.8" and it weighs less than 250g. The recorder offers a USB 1.1 connection. The equipment's sampling rate is 32kHz to 48kHz. It features an internal omni-directional mic and a stereo mic and line input, as well as an internal speaker for playback. Its signal-to-noise ratio is greater than 90dB A-weighted. The device also offers built-in audio editing, automatic record start, menu-setting templates, markers and online software updates.

615-726-5191; fax 615-726-5189; www.nagraaudio.com; mail@nagra.com

Hi-MD portable recorders
Sony

MZ-100, MZ-10: The MZ-M100 features 1GB storage capacity with each Hi-MD removable Mini Disc, a six-line large organic electro-luminescence display, includes an ECM-DS 70P stereo microphone, and MDR-EO931 ear bud headphones for improved field monitoring. The unit records from multiple sources: mic-in jack, a USB port for uploading material to Mac or Windows PC. It comes with an extended capacity rechargeable internal battery. The MZ-M10 also features 1GB storage capacity, ECM-DS stereo mic and ear bud headphones, and a five-line LCD display.

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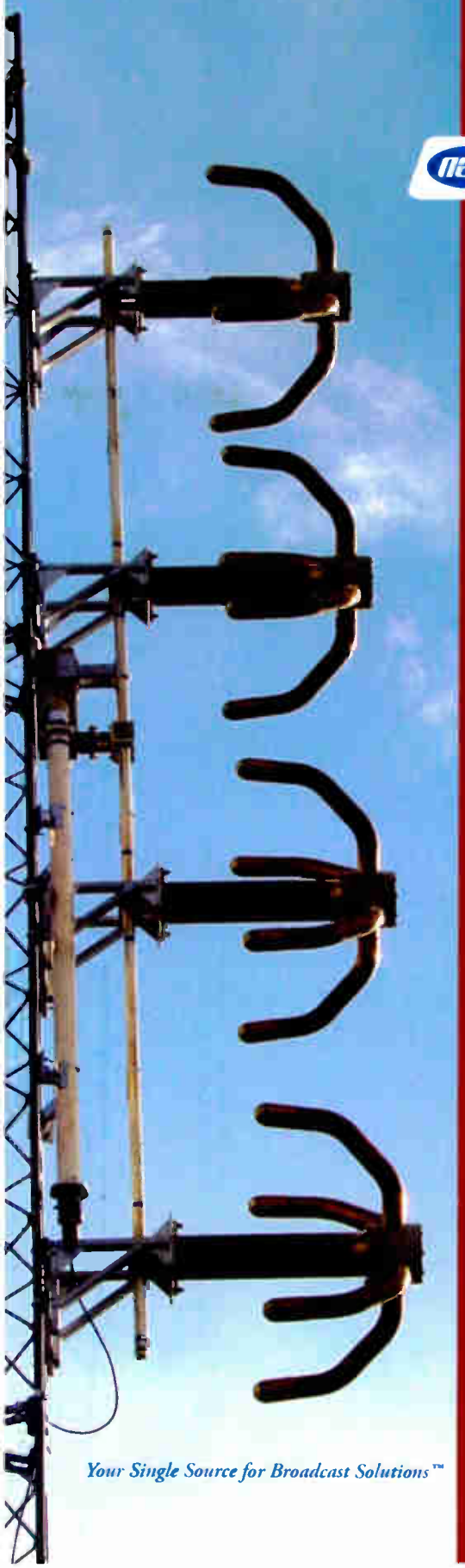

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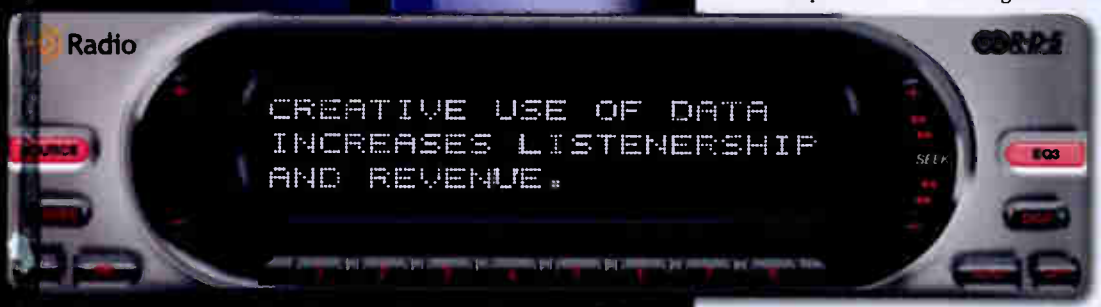
Data & Audio Storage

Broadcast Electronics The Radio Experience

A system of hardware and software, The Radio Experience provides data for use with RBDS, HD Radio and webcasts. It is designed to manage all radio data requirements and integrates with the various systems in a station.

The Now Playing feature, which is available in a standard and Now Playing Plus version, feeds station branding, program information, traffic and weather and content-associated text ads and promotions. Now Playing provides program-associated data (PAD) text management for FM RBDS, HD Radio main and secondary channels and station websites. Now Playing Plus adds an Internet connection to the The Radio Experience Data Center. Both software packages include a utility to multiplex multiple RBDS data signals into a RS-232 stream to conserve STL bandwidth. This can be extracted at the transmitter site using The Radio Experience RDI Accelerated RBDS Generators or third-party RBDS equipment.



The Radio Experience handles the data that is displayed on RBDS and HD Radio receivers.

On the hardware side, the RDI 10 and RDI 20 RBDS generators can simultaneously feed RDS data to two analog transmitters and an HD Radio exciter. One RS-232 data channel can be looped through multiple RDI units, with each encoder configured to pull data from an appropriate channel.

The Now Playing software updates a station's website.

The RDSX RDS Upgrade is an add-on board for Inovonics or Audemat-Aztec RBDS generators to add the data channel multiplexing capability and TCP/IP connectivity. ■

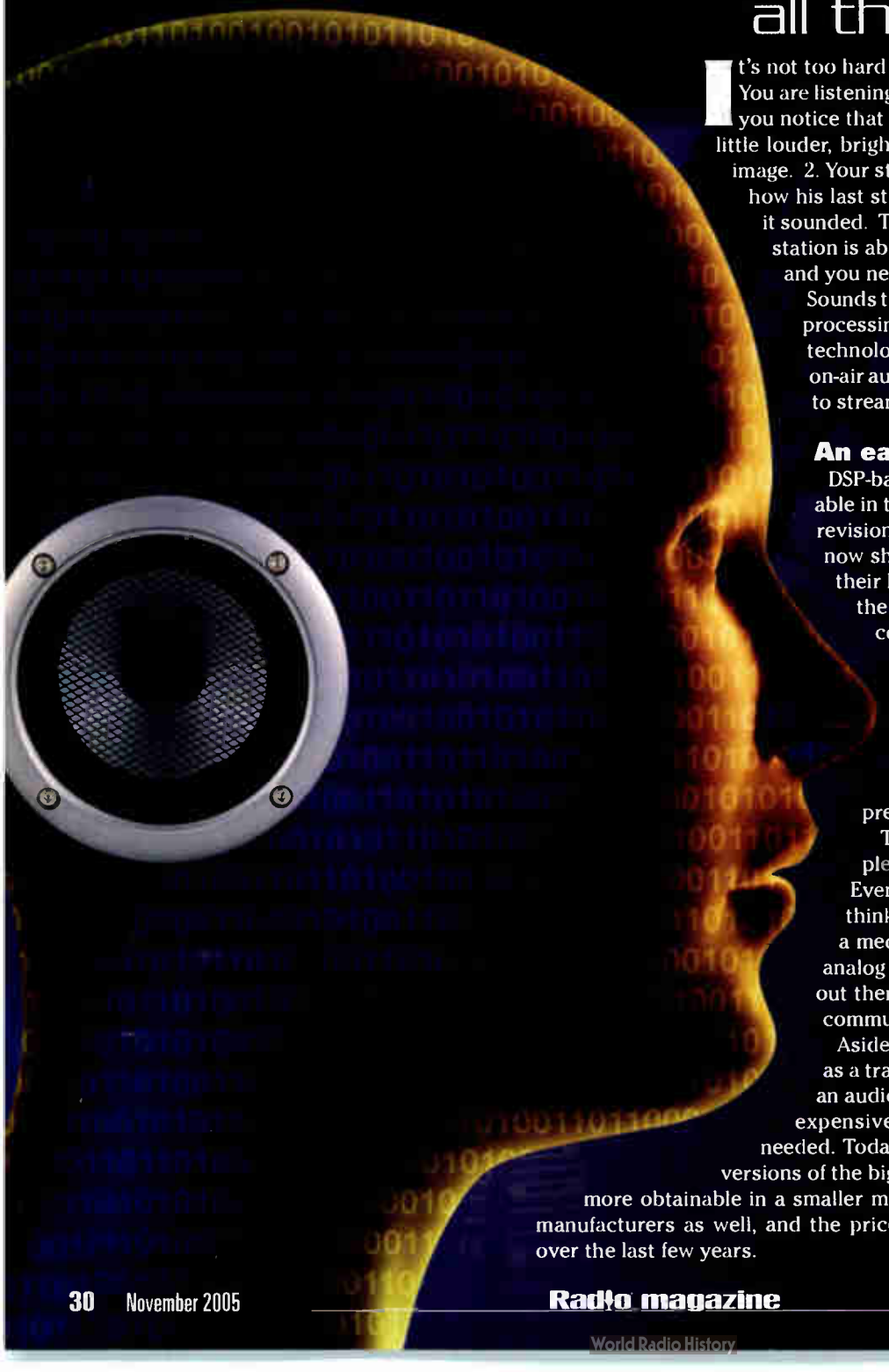
Introduced in 2004, the *Radio* magazine Innovative Product Awards were developed to honor excellence in new product development in the radio industry. The awards demonstrate the talent and commitment of the people in every aspect of development at each company, from concept through sales. The entrants were listed in the 2005 *Radio* magazine Buyers Guide that was included in the December 2004 issue.

Manufacturers submitted products in several categories, and the winners were selected through an online form by you, the *Radio* magazine reader. The results were tallied at the end of February, and the winners were presented with their awards at NAB2005. Over the next few months, we will profile each of these winning products. The 2005 Innovative Product Award entries will be listed in the *Radio* magazine 2006 Buyers Guide, which will be released in December.

When the sound matters

By Doug Irv

Great sound is always important, an the right on-air processor can mak all the difference



It's not too hard to imagine the following scenarios. You are listening to the radio on your way to work, a you notice that your new format competitor sound little louder, brighter, dynamic and with a better ste image. 2. Your station's new program director tells how his last station used processor X and how great it sounded. Then he asks what is used here. 3. Your station is about to embark on an HD Radio project, and you need processing for the digital portion.

Sounds to me like it's time to shop for new audio processing. With that in mind, let's look at where technology has gone over the last few years with on-air audio processing. Much of it is applicable to streaming audio processing as well.

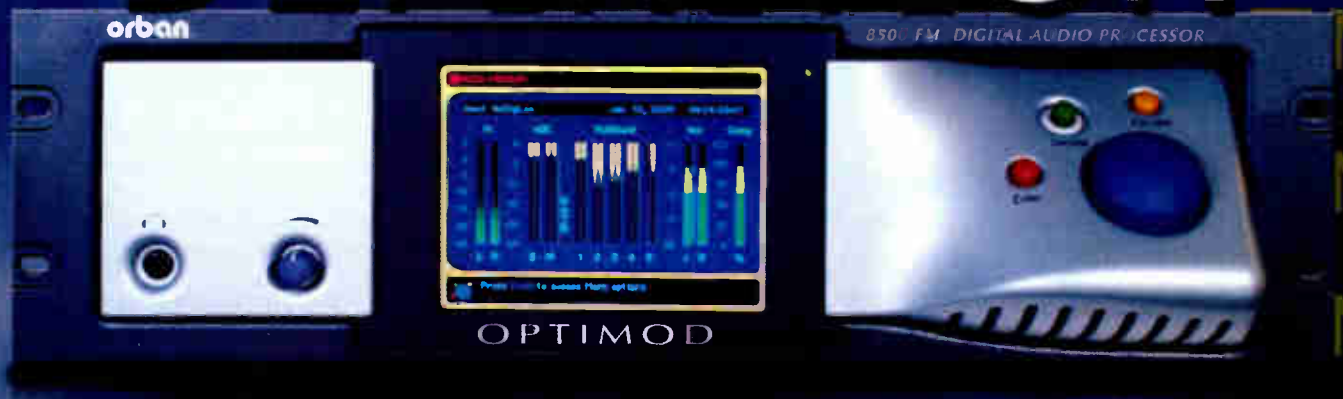
An early start

DSP-based audio processing first became available in the early 1990s. Not counting software revisions along the way, most companies are now shipping at least the third generation of their DSP hardware. I mention this because there are so many classic, older analog processors still on the air. The advantages to DSP-based processing are manifold, but those that seem most important to me, such as look-ahead limiting and the ability to remotely control and adjust the units via RS-232 or Ethernet, completely outweigh an prejudices I ever harbored.

Today's DSP audio processors co pletely blow their old counterparts aw Even if you disagree with this idea—if yo think that analog is the only way to go fo a medium that is, after all, an old-fashioned analog technology—there are new products out there for you, too. Even they have digital communications interfaces, though.

Aside from the really big-ticket items, such as a transmitter, an antenna or a new console, an audio processor used to be one of the most expensive capital items that a radio station needed. Today there is a trend toward less-expensive versions of the big flagship products, which are perhaps more obtainable in a smaller market scenario. There are quite a few manufacturers as well, and the prices of audio processors have dropp over the last few years.

HIGHER DEFINITION



Introducing Optimod-FM 8500

Orban's new flagship and the next step beyond the 8400, the new, all-digital 8500 offers major improvements: twice the sample rate, twice the DSP horsepower, and built-in HD Radio™/digital radio/netcast processing with 20 kHz bandwidth.

The 8500's competitive sound takes 8400 version 3.0 sonics to the next level. The 8500 will import and run any 8400 preset, so anyone with carefully customized 8400 user presets can upgrade to the 8500 without missing a beat. For HD Radio broadcasters, a built-in, defeatable 8-second analog-channel delay lets you use the 8500's built-in stereo generator and patented "Half-Cosine Interpolation" composite limiter to maintain full loudness on your analog channel.

All processing structures have about 4 milliseconds less delay, making headphone monitoring even easier for talent. For the most critical off-air monitoring requirements, you can even use one of the new "ultra-low latency" presets with only 3 milliseconds of delay.

Ethernet is now built-in. Of course, you can also control the 8500 via modem, serial connection, GPI, external RS-232-interfaced automation, or internal clock-based automation with Internet time sync—the 8500 is always easy to integrate into your facility, regardless of complexity. And we've retained the 8400's famous ease-of-use that makes it easy for you to brand your sound by creating your own custom presets—even if you're not an audio processing expert.

Ready for higher definition?

No matter what your audio processing challenges may be, Optimod-FM 8500 is ready when you are.

orban crl www.orban.com

DSP is everywhere, and Omnia (top) and Orban use a great deal of it in their flagships processors.

Down to business

Omnia's flagship processor 6EX (or 6EXI) offers the modern features that you would expect. Its processing engine is totally DSP-based. Some of the basic features are a six-band limiter with adjustable crossover points; a built-in, DSP-based stereo generator with a composite clipper; and the now-ubiquitous Ethernet connectivity. The 6EX provides a simultaneous processing path for HD Radio; and the 6EXI option includes a diversity delay that allows the user to avoid the delay line built in to HD Radio exciters, thus completely isolating the analog transmission from the HD radio equipment.

Omnia also offers a less-expensive, DSP-based FM audio processor called the Omnia-3. Its sibling, the Omnia-3net, is specifically built for streaming audio applications. Finally, if you have delved or are about to delve into streaming audio, you may want to consider the Omnia A/X, a software-based processor that runs on a computer and works in conjunction with Windows Media, Real and MP3 streaming encoders.

Omnia offers AM processors as well, including the 5EX and the 5EX+HD. These share many of the same features with their FM brothers, such as AES inputs and outputs, DSP-based processing and Ethernet connectivity.

Orban has a new flagship product: the Optimod-FM 8500. Again, its processing functions are completely handled by DSP, including the AGC, multi-band processing, stereo encoding and composite clipping. It also has a parallel processing path for digital radio included as a standard feature, along with a built-in diversity delay. Communications with the 8500 can be performed with simple contact closures from a remote control or automation system, via RS-232 or via its TCP/IP interface, which comes standard.

The Optimod-FM 5300 is a new product that includes many of the same features as its more expensive, bigger brother the 8500. It is a DSP-based five-band processor all in one rack unit, with the same communications means standard.

Orban also offers the Optimod-PC, which is a professional sound card designed specifically for streaming media applications. On-board DSP performs the typical audio processor functionality: AGC, multi-band, EQ and look-ahead limiting. It also can function as a

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mixer, because it has one stereo analog input, two AES-S/PDIF inputs with sample rate converters and one .WAV input.

And finally, Orban offers Opticodec-PC, which is encoding software that makes use of MPEG-4 AAC/AAC Plus encoding technologies. It's available in multiple versions and able to run on all the standard platforms.

Analog audio is alive and well in the Aphex Model 2020 MKIII.

Orban has a new AM processor as well, the Optimod-AM 9400. This is essentially two processors in one. Each section shares the input AGC and stereo enhancement, but then the two different paths—one for digital and one for analog—diverge into specific processing chains. Analog and digital ins and outs are standard, along with Ethernet connectivity.

You might want to think about getting rid of that plate-modulated transmitter while you're at it...I know it's an old classic, but you're never going to see a modulator balance adjustment accomplished via TCP/IP.

If you simply will not buy the idea that DSP-based audio processing is the best thing since sliced bread, I have good news. Aphex offers the 2020 MkIII, which carries out the processing functions (leveling and multi-band AGC) strictly in the analog domain. Pre-emphasis limiting and stereo generation can be added as options, as can the digital input and output. Remote control of the device is possible via RS-232.

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On air processing and processing accessories

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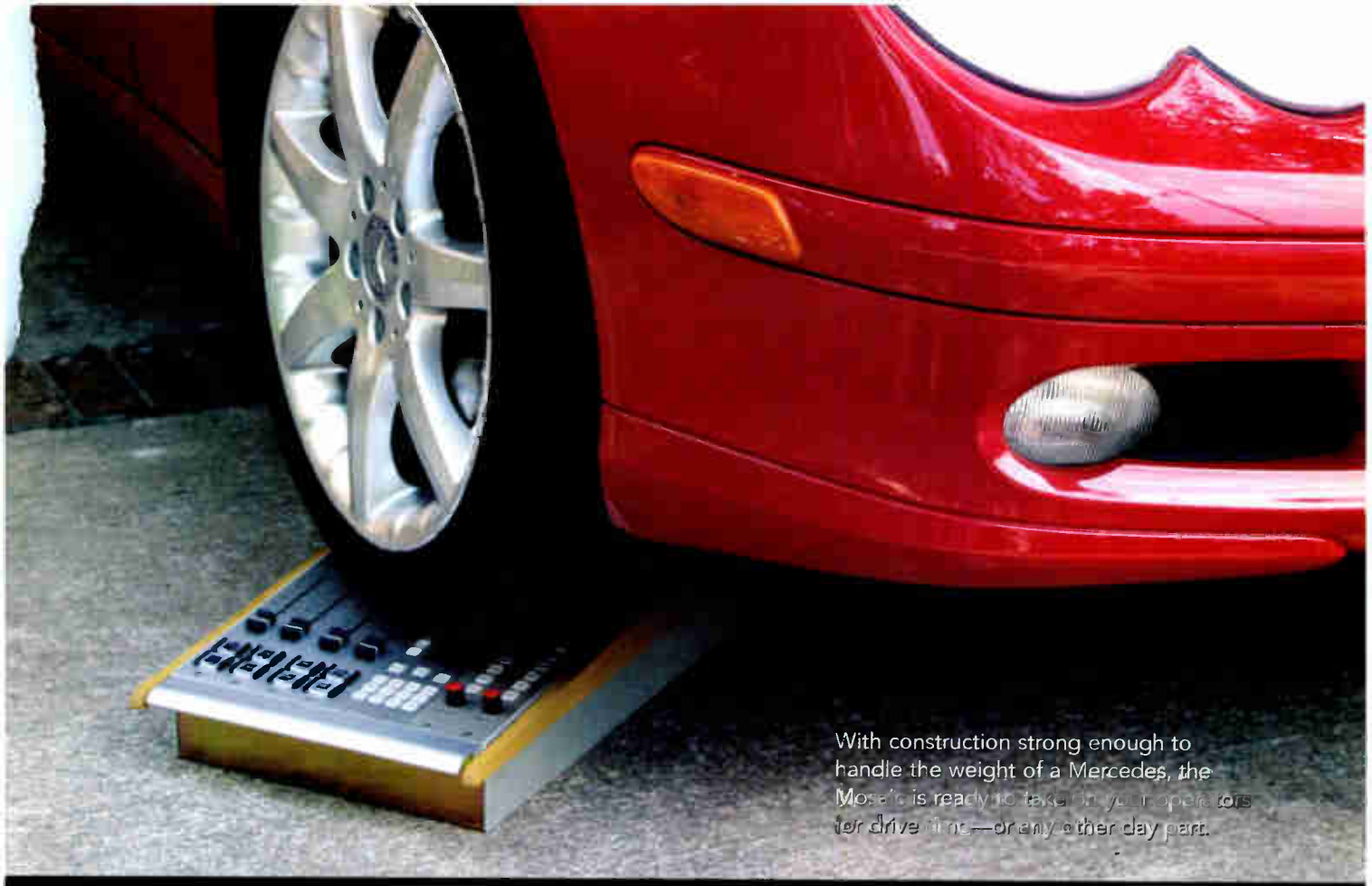

Stands up to Drive Time.

When your listenership is at its peak and your operators are going full throttle, it's nice to know the Mosaic digital console from Logitek will stand up to heavy use. The Mosaic was designed with extra-rugged panels and frame, which lets you relax even if someone starts getting a little rambunctious with the board. Its sturdy design, easy-to-use controls and advanced features ensure the versatility and operation you need for your facility.

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BOB&TOM make BIG plans

By Scott Fenstermaker

When we completed building the WFBQ-FM control room in July 1994, we thought that the space would provide more than enough room for the Bob & Tom Show, the station's morning show. At 325 square feet, it was a huge room. It was at least as big or bigger than most on-air studios at the time. But when the morning show was syndicated one year later, it didn't take long for Bob Kevoian, Tom Griswold, Kristi Lee and Chick McGee to use all the space we gave them—and more. Ten years and more than 150 affiliates later, we look at the next generation Bob & Tom Show studio. It's brand new and immense, but no one has the guts to say it will be big enough.

This isn't just an on-air studio, it's a broadcast suite. An additional 5,000 square-foot wing was added to the Clear Channel Radio facility in Indianapolis. Dedicated exclusively to the Bob & Tom Show, the space is comprised of six offices, three news and production rooms, live music performance and mix rooms, a green room for show guests, a central computer server room, an electrical distribution room and the on-air studio.

Laying plans

Design of the new facility began in early 2003. One issue we faced was that the show desperately wanted its own studio. In sharing a studio with Clear Channel's WFBQ-FM, items like headphones, CDs and novelties sent in by listeners would sometimes be moved or lost over time. The obvious solution was to put the Bob & Tom Show in its own network studio, but we just didn't have the floor space available for that kind of move. Our problems were solved when local management decided to add additional space to our existing building to provide the much-needed office and cubicle capacity for the general staff. We decided to include the new Bob & Tom Show area as a separate part of the building. It would have its own secured entry points and would be able to operate independently of the rest of the facility.

As we began the design process, we gathered as much input as possible from the show team and kept them in the loop as the design and construction progressed. While some of their suggestions were offered more for their own amusement and were less than useful (such as a retractable roof and a stripper pole in the middle of the air studio), we were able to incorporate some of their ideas and preferences into the final design. As with many broadcasters, the members of the Bob & Tom Show are creatures of habit. Moving them from the studio in which they had been working for more than 10 years was going to be a challenge for everyone, but we were determined to make the transition as smooth as possible by keeping the show involved and updated as the project went along.

The primary concern in designing the new control room was to fix the problems that existed in the old studio. Measuring nearly

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570 square feet, the new studio easily solves the problems of lack of space found in the old studio. We also reduced the amount of wasted counter space in the old room where the layout was basically a circle with the four show members each spread out around it. A crawl space was built underneath to let us get in to install wiring interconnect blocks. Two guest positions were set side-by-side for the near constant stream of comedians, celebrities and show regulars, but there was little extra space if one of the guests played a guitar or if there was an electronic keyboard setup on the counter. For all of our new studios, we asked Harris to design and build the broadcast furniture using its Smoothline custom furniture. In the air studio, we splurged a little and added a solid-surface countertop. Aside from the aesthetic value, Corian is much more durable than a standard Formica-type top, plus minor scratches that inevitably appear in a broadcast studio can be easily removed.

The performance studio regularly hosts musical guests. The performance studio control room can also handle some light production duties when necessary.

The Harris furniture designers took our many badly drawn design ideas, written and verbal notes, and the room design specifications, and were able to come up with a spectacular furniture package that met virtually all of our needs. The design is roughly in the shape of a hexagon with the back corner open. This fits the shape of the room nicely as we designed all the studios with non-parallel walls for acoustic purposes. To improve on the old furniture design, we added four guest positions (instead of the two we had) for a total of eight microphones. There is plenty of walking space around the outside of the furniture, and the middle of the hexagon is completely open, which allows us to put the cable access panels and conduits inside the back of the furniture where they won't be seen. This design also provides lots of open space to work without interfering with the show members and guests. As an interesting aside, Harris says the Bob & Tom Show air studio furniture package is the largest single piece of furniture it has ever built.

Two are better than one

One of the more unusual aspects of the Bob & Tom Show is that the hosts use two broadcast consoles. Bob runs the main console that mixes the mics for Chick, Kristi and the four guests as well as his own. Tom has his own smaller console and plays most of the pre-recorded parody songs, wacky bits and flashback segments of

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previous shows. In this control room we chose the Harris Pacific BMX Digital 30 for Bob's main console. For Tom, we installed the sleek Radio Mixer Digital (RMXD) 12-input console. The two RMXD consoles we installed were the first two production units Harris released. The output of Tom's RMXD 12 feeds an input on Bob's BMXD 30, but both of them can turn that input module on or off as needed. Both of these consoles interface directly with the facility's Sierra Automated Systems audio router and the Prophet Systems Nexgen Broadcast Automation system, helping to make the installation straightforward. Harris engineers also did a great job of redesigning the headphone distribution system so that show producer Dean Metcalf could talk to the room (through an external speaker) or into individual headphones from his adjoining studio.

The layout of the studios surrounds the control room with the news room, producer's room and the performance studio. All these rooms have unobstructed sight lines into the control room. This allows any of the show members to visually communicate with Metcalf or a band that is playing in the performance room. The news and producer rooms also are furnished with furniture from Harris, and Metcalf's room is also equipped with a Harris Pacific analog Radiomixer, Audicy digital editor and miscellaneous processing and recording equipment. He also has a desktop

Growing pains

by Chriss Scherer, editor

When I visited the Bob & Tom Show studios, I had a chance to talk to Tom Griswold about the new facility. As you can imagine, he was pleased with the new arrangement.

I asked him if there were any unexpected problems that arose from moving into the new space. He told me that the first week of being in the studio had the usual obstacles of learning the new systems, but most everything went well, except that he and co-host Bob Kevoian noticed that after the first week there was still something odd happening on the creative side that no one could identify. While the attention to show preparation was as high as ever, some portions weren't as smooth as they had been in the past.

After reviewing some shows someone realized that the one thing that they wanted in the new studio—space to move—was working against them to some degree. In the old studio, everyone was close together. In the new studio, there was space between them. The show members were compensating for the larger space by doing what is natural when you talk to someone across the room: they were raising their voices. Even though they were using mics and wearing headphones, the natural response took over.

Once this was realized, the show eased back into its regular routine and the members allowed their voices to relax, which restored the flow and interaction that they enjoyed when they were literally side-by-side.

Insight to IBOC

November 2005 Part of the *Radio* magazine DAB Answer Series

Effective
surround monitoring

By Alex Kosiorek

During the past few years, I have seen the topic of surround sound grow from a small topic to one of prominence at radio and audio engineering conferences. It is considered by some to still be in its infancy, but with others it has taken flight. Certainly, we are still at the beginning stages of surround and it will continue to evolve. In radio broadcasting, there are still many factors to be resolved. However, no matter where you are in the conversation, we all need to understand the basics of how to produce, distribute and broadcast surround sound for it to be successful.

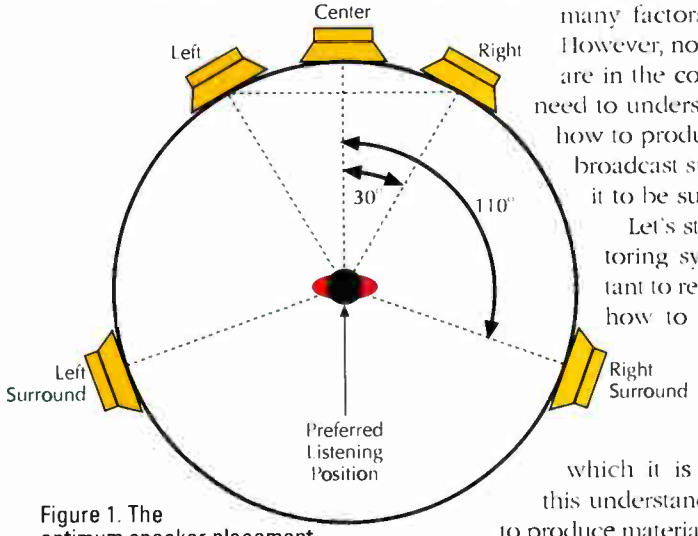

Figure 1. The optimum speaker placement as recommended by the ITU.

Let's start with the monitoring system. It is important to review and ascertain how to setup a surround sound monitoring system appropriately for the medium to which it is applied. Without this understanding, it is possible to produce material that won't exhibit the full benefits of surround or won't translate well.

Listening environments

First comes the speaker placement, which in home theater systems will be all over the map. Inconsistency is guaranteed. Room dimensions and speaker placement will be different in every household. The consumer will set up his system to fit his physical and aesthetic environment. The speakers themselves are unknown variables. Home theater systems use five or six satellite speakers, ranging from less than four inches to full-range (two- or three-way) speakers. The front speakers may be of different size and quality than the rear speakers. Correspondingly, the accompanying subwoofer can range from six to 18 inches. However, it is assumed that most consumers will acquire a system with smaller satellites and a subwoofer. Regardless, it is unlikely that many consumers in this environment will have a consistent sweet spot.

The automobile is a sharp contrast. Though the physical environment may not be ideal and is smaller than the home, the speaker placement is much more consistent. The advancements in automobile speaker design and amplification systems also make the sweet spot more consistent. An interesting similarity between home theater systems and the automobiles is that the size of the speakers and subwoofer become uncannily similar. Although the subwoofer can and will vary in size in the vehicle, it can produce low frequencies with more ease because of the size of the environment.

In most cases, the surround content will be music, talk and sports, not movies. Therefore, we will immerse the consumer in a sound field where

MPEG Surround for HD Radio

By Shawn Hopwood
senior director of licensing
Coding Technologies

Flash back to the early 1960s. All radio is mono and sounds like it is coming to you through string and tin cans. Suddenly a new technology arrives on the scene—FM, and it blows your mind. Not only does the music leap right out of the speakers, but it sounds as awesome as your hi-fi, thanks to stereo broadcasting. It took awhile to catch on, but today, 40 years later, no one would even think of broadcasting FM music in mono. Stereo is the obvious choice for broadcasters and for consumers.

Today, a new shift is just beginning. Stations are experimenting with a variety of ways to broadcast surround sound over the air. Although the shift from stereo to surround sound will take a few years to transpire, in much less than 40 years, the idea of stereo broadcasting for music will be just as foreign as mono is today. And just as FM was the driver for stereo, HD Radio will be the driver for surround sound.

Radio broadcasts are a perfect candidate for an upgrade to surround sound. With most radio listening happening in cars, and most of today's cars carrying at least six speakers, the rendering infrastructure is nearly in place. Additionally, the ongoing series of evolutionary changes in radio during the past couple of years, from analog FM to satellite radio

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Inside

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Surround

the sound will be heard all around him coupled with localized events. This is different than movie mixing, where the sound usually has a central focus toward the front with a less immersive experience.

The consumer's listening environment and the content play a role in how a monitoring system is set up in the control room. A radio surround monitor setup will be different than that for film mixing. Knowing that, a few things can be said for how to produce content for surround. The first is that neither a mixing engineer nor those monitoring broadcasts should be locked to a sweet spot. The other is that the mixing engineer or broadcaster should listen on a quality monitoring system and a consumer-grade system. These should be radically different from one another in size and quality.

System setup

In an ideal situation, surround will be monitored in a room with appropriate low-frequency absorption and without two walls that are the same length. Consult an acoustician who is aware of all the variables of surround-sound monitoring. Because budgets and other constraints may not allow an ideal room to be constructed, at least pay attention to room reflections. Make every effort to minimize first-order reflections from any given monitor. Also, use as much diffusion as physically and financially possible. Reflections, especially first-order, mask problems and even create audible problems that don't originally exist. Furthermore, consumers will not have any particularly dependable pattern of first-order reflections in their environments, so we don't want reflections in our monitoring environment to create an anomaly that could result in an exaggerated problem to the consumer.

Let's address the monitor types. As I said before, install at least two surround-monitoring systems. The main system should be a professional, full-frequency system. The other should be a consumer-grade home theater system. We will address the professional system from this point forward, with the assumption that the consumer system will be placed along side the professional one, matching speaker placement and levels.

All the monitors in a surround sound system should be direct radiator speakers (not dipoles). All the monitors should be of the same make and model and provide the fullest frequency response possible. Some believe that the rear monitors do not need to have the same frequency response as the front monitors. While acceptable with the first generation of surround delivery systems, modern delivery methods and media provide full frequency response to all monitors. The selection of the correct monitors may be limited by budget, but remember, the monitoring system is most crucial, so invest wisely.

Monitor placement has some complex elements, but there are some simple rules to follow:

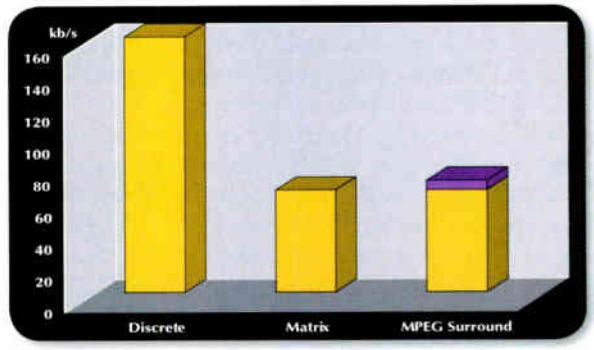
- All monitors should be the same distance away from the ideal listening position (generally six to nine feet).
- The monitors should be at the same height as the listener's head.
- The monitors should be on stands.

MPEG Surround for HD Radio

continued from page 1

and IBOC, has made radio aficionados receptive to another upgrade to their listening experience.

There are three main techniques that can be used to broadcast surround sound over the HD Radio system: discrete, matrix/watermark and MPEG Surround. A discrete system discretely encodes 5.1-channel programming on the IBOC signal, possibly using a 5.1 channel version of the already deployed HDC codec.This technique, similar to the Dolby Digital audio distributed on DVD soundtracks, is not feasible, however, because of the bandwidth limitations in HD Radio. Even with minimum quality, discrete 5.1 encoding would use up all the available bandwidth on the IBOC channel, eliminating the possibility of multiple programs or data services. At a minimum, discrete coding would require computationally expensive downmixing inside the radio for stereo-only environments, complicating implementation.



The bandwidth requirements of the various surround transmission systems.

Matrix systems, such as SRS Circle Surround and Dolby Pro Logic, use matrix encoding to encapsulate a surround signal within a stereo signal.The L-R energy of the stereo signal is used to carry the surround sound information over standard stereo infrastructure. This allows matrix-encoded surround sound programming to be transmitted on the analog and digital portions of an HD Radio signal. When such a signal arrives at a radio with a matrix decoder, the stereo signal is upmixed for 5.1. Also, because the stereo signal is already the basis of transmission, the program can play back in a stereo-only environment with no modifications.The downside of matrix techniques is accuracy. Due to the inherent limit on the amount of information that can be transmitted using matrix techniques, the quality of the surround mix cannot match the original 5.1 channel mix. Also, by encoding the surround sound as part of the stereo waveform, it does not take full advantage of the digital information path offered by HD Radio.

MPEG Surround is a compromise between the discrete and the matrix methods. It provides the ac-

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The *DAB Answer Series* is an ongoing series of supplements that cover the technology of digital audio broadcasting.

Insight to IBOC - a supplement to Radio *magazine*, November 2005,

HD Radio News

by Mark Krieger, CBT

AES Cincinati Holds Surround Tests

The Cincinnati chapter of the Audio Engineering Society (AES), in coordination with Sonic Arts and Cincinnati Public Radio's Corbett Studio, has completed listening tests to determine the cross-compatibility of several surround sound encoding and decoding systems proposed for HD Radio.

Specific systems placed under test were the Neural Audio 5225 Upmix and Downmix, Dolby DP563/564 using Dolby Pro Logic II, and SRS Labs Circle Surround Digital encoder/decoders.

The test data is being analyzed, and results will be used to direct further research into HD Radio surround coding techniques.

NRSC Releases Standard Revision

The NRSC's DAB Subcommittee convened during the NAB Radio Show in Philadelphia to adopt a revision to the NRSC-5 IBOC standard. Part of this action included a key decision regarding supplemental audio service (multicast) channel IDs.

The new version of the IBOC standard, called NRSC-5-A, expands on the original document released last April with the inclusion of an advanced data services transport protocol. Advanced data services are those data services not necessarily associated with audio programs, such as traffic information or subscription data services, and will be supported in NRSC-5-A using the Ibiquity Advanced Application Services (AAS) transport specification. The revision paves the way for the NRSC to consider standards and recommendations regarding advanced data service applications.

DRE Ships First FM Extra Receivers

Digital Radio Express (DRE) has begun shipping sample quantities of its FM Extra receivers. The receivers allow reception of high-speed digital subcarriers that can transmit over conventional analog or HD Radio hybrid broadcast signals using the company's proprietary digital encoders.

The sample receivers will be offered in test markets that have at least one FM Extra signal on the air, and will begin at $99 for a basic receiver. The receivers are configured for mobile or tabletop operation.

BMW to OEM HD Radio Receivers

If you're planning on buying a new car, you'll be able order it with a factory-equipped HD Radio digital audio system—provided that it's a 2006 BMW Seven series model.The announcement marks the automaker as the first to offer HD Radio receivers in its products. BMW has not yet released the price of the option.

Surround

The monitors should be positioned to give the listener the most pleasant and accurate surround experience possible. The movement of any monitor, even by a few inches or degrees can radically change how the sound is perceived.

For the most part, 5.1 (five main speakers and one subwoofer) will be used for radio broadcast, so that will be the setup addressed here. The ITU-R BS 775-1 recommended setup for small or midsize rooms as shown in Figure 1 says the following:

- The center monitor should directly face the listening position.
- The front left and right monitors should be 30 degrees off center, angled slightly towards the listening position.
- The rear speakers should be 110 degrees off center, angled toward the listening position.

Don't alter the front angles as the 30-degree spacing for the front also provides excellent stereo monitoring when the surrounds are not used. However, when it comes to the rears, I concur with The Recording Academy's Producers and Engineers Wing's recommendations, which suggest extending the rear speakers beyond 110 degrees for certain program material. About 110 degrees is appropriate for surround mixes to make the listener feel like he is in the audience, such as a classical recording. However, with some of the popular recordings where the listener is placed in the middle of the ensemble, an extended angle of the rear monitors (e.g. 120 degrees) provides a more immersive and dramatic experience. The key is to find a rear angle that works for the particular format and room and stick with it.

Subwoofer placement often depends on the room configuration. Locate the subwoofer in the front of the surround sound field and at least a foot away from a wall. Placing a subwoofer in a corner is not advised, as extreme bass build-up will occur.

Time to align

Alignment of the monitoring system includes bass management and overall level control. To monitor in surround successfully, you need a surround monitor controller, such as those from Blue Sky, Tascam, Martinsound and Audient. Some consoles, including those from Yamaha and SSL, have built-in surround monitor controls. Added features of some of the more elaborate controllers include the ability to monitor several 5.1 sources at once and to switch between stereo and surround. Use a device that can raise and lower the gain of the entire monitoring system universally. A decent controller includes bass management controls, separate LFE control and independent monitor level adjuestments.

Note: LFE and bass management are not the same. This is confusing because they both affect the subwoofer. The subwoofer channel or low frequency effects (LFE) channel—the key word being effects—is a dedicated playback channel that is part of the playback functions of recorded media such as SACD or DVD. Be careful when using the channel in production or surround encoding. The LFE control is often mistakenly used for bass management.

Multicasting.

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Management has decided to multicast. Which seems like a terrific idea — until you consider just how little bandwidth each channel will get. How will the sound of your station(s) survive these shrinking bitrates? Omnia can help.

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Bass management is a separate function in monitor controllers and even some consumer systems. Bass management is the playback feature where bass frequencies are taken from the five main audio channels and redirected to the subwoofer. This is used because some main monitors are unable to produce low frequencies. If bass management is used in a professional system, set the crossover frequency at 80Hz, as this is the most common crossover used in consumer systems and reduces localization of the bass frequencies.

It is time to align the levels of the surround monitors. The goal is to have all the monitors playing back at the same level. First, determine if you need bass management. With smaller two-way monitors, bass management should be used (or at least consult the monitor manufacturer).

Once that choice is made, the easiest way to calibrate the system is with an SPL meter. Choose a reference playback level. Most meters calibrate at 80dB or 85dB (I'll use 80dB for this example). Set the SPL meter for C-weighting, slow response, and position it at the central listening position. Face the meter forward when measuring the front monitors, and face the meter toward the rear for the rear monitors. Turn the subwoofer channel off for now. Play pink noise (at house reference level) and direct that signal to each speaker, one at a time. Adjust each monitor until the SPL meter averages 80dB.

Adjusting the subwoofer can get tricky. If you are not using bass management, direct low-pass-filtered pink noise (80Hz is recommended) to the LFE channel only. Set the gain on the subwoofer so that the SPL meter registers about 4dB above the level of the main monitors (84dB). Then add full frequency response pink noise to the front left and right speakers. The SPL meter should read no higher than 5dB above reference. If it rises more than that, the subwoofer may need to be turned down.

If bass management is used, a simplistic solution is available, although it is best to follow the guidelines for bass management calibration that came with the monitor controller. Send the pink noise to one of the front monitors. Then turn off that monitor off (you may need to disconnect it). You should hear the low frequencies coming from the subwoofer if the bass management system is properly engaged. Set the level of the subwoofer so that the SPL meter averages about 6dB lower than the main speakers. After that is complete, listen to some familiar commercial recordings and adjust the subwoofer accordingly.

For some in-depth resources, I suggest the Recording Academy's Producers and Engineers Wings Surround Sound Production Guidelines (grammy.com/pe_wing/5_1_Rec.pdf). Another resource of information is www.5dot1.com. Next time I will address some surround recording and mixing basics, the art and aspects of down-mixing and other general surround practices. I will also provide a detailed comparison of all of the different surround encode/decode systems proposed for HD Radio, including detailed test results of each system.

Kosiorek is the audio recording and mastering engineer at the Corbett Studio at Cincinnati Public Radio.

MPEG Surround for HD Radio

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curacy of discrete encoding while preserving the stereo compatibility and bandwidth efficiency of the matrix encoding. Borne out of a collaboration between Agere, CodingTechnologies, Fraunhofer and Philips, MPEG Surround is a compression technique in the process of being standardized by the Moving Picture Experts Group. The goal of MPEG Surround is to provide a scalable, digital system to transmit high-quality surround sound in a way that is backward compatible to stereo. At the highest level, MPEG Surround adds digital information to a stereo mix, enabling reconstruction of an original 5.1 surround audio with little bandwidth overhead. The nature of the MPEG Surround technology allows it to scale in quality proportional to the amount of bandwidth allocated to the surround signal. Quality in this case is measured by the ability of the encoded signal to accurately reproduce the original 5.1 channel audio signal sent into the encoder. While the nominal operating bit rate for MPEG Surround on HD Radio would be around 6kb/s, MPEG Surround can scale all the way up to full transparency.

A multi-program HD Radio station would likely allocate 64kb/s out of the total 96kb/s to the main stereo program, then add 6kb/s MPEG Surround to achieve a full 5.1 surround sound broadcast. By tuning the encoder even further the stereo bit-rate could even be pulled back a bit thereby reducing the surround sound overhead to be almost negligible. MPEG Surround provides surround sound to a stereo broadcast with room for extra audio programs or other digital broadcast services.

Diffculties loom

But making the move to surround will not come easy. A major concern for broadcasters is studio and broadcast infrastructure. Regardless of the technique chosen—matrix, discrete or MPEG Surround—modifications will be required to enable the studio to take full advantage of surround sound. While the matrix method can be transmitted and manipulated using a stereo infrastructure, libraries, play-out systems, consoles and studio links may require upgrades.

For new surround facilities, there are two main techniques being considered to handle the transition. The first is shifting to a full IP audio infrastructure provided by a system like that from Axia. In an IP audio system, audio is transported over twisted-pair or fiber networks, and controllers can be configured and ganged on the fly. The second is a dedicated system that creates a parallel path for the MPEG Surround information by adding boxes that interface to the various stereo AES buses. Both methods can easily handle stereo or surround sound.

The Moving Picture Experts Group is in the process of defining and standardizing MPEG Surround with a final specification scheduled for mid-2006. Hardware implementations will be available shortly thereafter.

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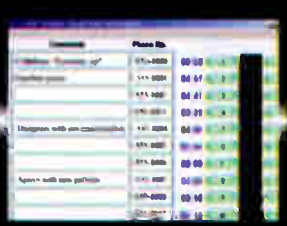

Assistant Producer enables talk show production via LAN or WAN. Status Symbols, Caller ID support, instant messaging and caller database are just a few benefits. Supports touchscreens, too.

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BOB&TOM

controller extension from the facility-wide Telos 2101 phone system. Broadcaster's General Store provided the audio equipment throughout the facility.

One of the recurring problems we had in the old studio was the number of musical guests we had on the show. When a band would come in, fitting three to five musicians with their guitars, amps and sometimes a full drum kit into the limited space was nearly impossible. It was uncomfortable for the band and it was difficult to set up because there were only a few minutes in each local commercial break when the band could move equipment and sound-check. All these problems have been eliminated with the construction of the performance studio. This is a moderately sized studio (about 21 x 15 feet) designed specifically for live music production.

The production studio prepares show elements and the promos for the station affiliates.

The adjoining mix-down room has a 24-channel Mackie 24/8 mixer, Furman HA6 headphone amp system, and basic processing and effects equipment. The performance studio is adjacent to an outside entrance at the top of a loading ramp to ease the load-in and out process for the bands. By not having to move any equipment into the control room, the bands can set up, perform a sound check and rehearse at their leisure without bothering the flow of the on-air broadcast. Restrooms and the guest green room are just outside the performance room, so food and beverages are conveniently located nearby for band members and crew.

To handle the heavy production requirements of a nationally syndicated show there

Equipment List

360 Systems Instant Replay
Audio-Technica AT4033A
Denon DN-961FA
Digidesign Digi001, Pro Tools 6.4
Dixon NM-250 MKII
Electro-Voice 7100
Electro-Voice RE-20
ESE clock system
Fostex DS-8, RM-1
Furman HA-6AB
Harris BMX Digital, RMX Digital, Smoothline
JBL 4401A, Control 1
Luxo mic booms
O.C. White mic booms
Otari MX-5050BII
Panasonic SV-3700
Prophet Systems Nexgen
SAS 32000, 64000
Sony 7506, MDS-E12, PCM-R500
Symetrix 420, 528E
581E distribution amp
Tascam 112 MKII, CD-450, CD-RW2000
Telos 2101, One, Zephyr, Zephyr Xstream

is also a dedicated production studio located just down the hall from the main studio. This room is built around the second Harris Pacific Radiomixer Digital console in the facility. This one is the 20-input version. While there are two guest positions designed into this production studio, one of the advantages to having an on-air studio that is only used for the live morning show broadcast is that the show members can stay right where they are after the show and voice their production elements for affiliates. This helps to keep a consistent sound between the live and produced elements of the show at the affiliate end, which is difficult to do when voice work is done in multiple studios.

Sounds good

From an engineering point of view, I have always had a problem with spending a lot of time and money designing and building a studio that has good acoustic properties only to have the air staff and program directors come in and hang posters, dry erase boards, CD racks and other items. Obviously, there is a need for some of these things, but the negative effect they have on the sound of the room is dramatic. To alleviate this problem as much as possible, we hung acoustic sound panels on the studio walls. Each panel measures 2'×4' and are one or two inches thick. The placement of the panels in each studio was determined by a computer program based on the design of the room and furniture locations. In addition to dramatically reducing sound reflection from the walls, the panels have the added benefit of taking up wall space so some of those posters and bulletin boards can't be installed. We also had the Bob & Tom Show logo printed on the panels, which not only adds some identity to the rooms, but also looks good on camera when a TV crew shoots the show.

Besides news and sports audio cuts, this news/network production room is used for the "Best of" shows and daily one-hour "Bob & Tom Extra" shows.

While I know you can never say never, I think I can safely say this will be the last new studio that Bob & Tom Show will need. Without a doubt, this construction project was badly needed, but it also has provided them with plenty of room for themselves and their staff, all the necessary equipment and accessories, and a solid technical foundation on which to continue the growth of their network.

Fenstermaker is the chief engineer of the Bob & Tom Show and the Clear Channel stations in Indianapolis: WFBQ-FM, WRZX-FM and WNDE-AM.

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Eventide BD600

By Michael Kernen

Eventide is the originator of the digital profanity delay. Some of the first examples of this technology still haunt the Greater Media Detroit equipment archives. The Eventide BD955 units were single-channel, 2RU systems that could run as a master and slave for use in a stereo environment. They also possessed the unique capability to catch-up after being dumped, something that no tape loop ever could do. I never used that delay to its full potential because ramping was so slow and quite often objectionably audible. Also, the early delay unit possessed only seven seconds of delay, meaning operators had to be good and lucky to keep callers' foul tirade from finding its way on the air.

Performance at a glance

- Word clock input
- AES3 and analog I/O
- Multiple dump operations
- 80 seconds of delay
- Panic feature for audio fill after full dump
- Optional extended remote control
- Micro delay adjustment
- Parallel remote control

Considering the technology of the day (1977), Eventide's BD955 was a fine machine that found its way into many air-chains. In the post wardrobe-failure United States of today, we find ourselves wanting much more from a delay unit. If the FCC's policy and enforcement is not enough, many stations are forced to install delays to meet compliance with corporate mandates. Since Ms. Jackson's solar-clad protuberance was exposed the world over, several delay manufacturers found themselves in the enviable position of not being able to churn them out fast enough. These days delays offer superlative audio performance, nearly inaudible ramping, and some other cool features like the on-the-fly edit provided by a press of the cough/sneeze button and the ability to be dumped in steps so as not to leave the airchain with an unsafe amount of delay.

Progress made

The advancement of this technology is largely possible because of the reduction in scale and power requirements of random access memory. Eventide's latest product has enough for 80 seconds of stereo audio to be watchfully metered through in a bucket brigade fashion—first in first out. That would have taken a serial/parallel chain of some 22 of the original Eventide delay units.

In addition to building a state-of-the-art profanity delay, Eventide has looked to the future for its flagship model and included a precision delay mode that allows their BD600 to be used as a synchronization delay for use in HD Radio applications. This compelling new feature, called Micro Precision Fixed Delay, allows the station to separate the analog audio path from that of the digital. If you have HD Radio installed you no doubt recognize the advantage of having a stand-alone delay product to handle the digital time alignment. Since very early in the installation of HD Radio at my stations, I realized that having the stations' analog signal running through a PC (which the HD Radio signal generator undeniably is) made me a restless sleeper. You are just one CPU hang away from dead air. Another downside to that is the Ibiquity-designed delay internal to the signal generator can't profit from the years of experience gained developing delays that Eventide obviously possesses. That means that ramping in and out of delay is either agonizingly slow or clearly audible. Additionally, with the IBOC signal generator operating at minimum delay, a skip is still heard when taking the HD Radio signal generator in and out of the analog audio circuit. By contrast, the Eventide BD600 can slide itself inline and ramp up to a precision delay setting and then back again without anyone being the wiser.

Put into use

There are a number of places where a delay can be inserted to accommodate the alignment for digital. The

Orban Optimod-FM 8500 includes a precision delay so that a user can accurately align the analog and digital signals. I've had success with the 8500 and found alignments as close as one sample (according to my friends at Ibiquity who possess a computer to measure such things). The 8500 seems like the perfect solution until you consider that it offers no way to ramp itself up or down, nor does it allow the user to choose distinctly different audio processing between the analog and digital streams. The Eventide BD600 placed at input to the analog stereo generator opens the possibility of processing the digital and analog signals differently and allows the station to make seamless transitions between time-aligned and non time-aligned operation.

Setup and operation of the BD600 is easy. The unit offers analog and AES3 digital connections as well as a word clock input and output. The BD600 comes in two flavors: one with basic remote control capability and one with an extended remote control. The latter includes a delayed parallel remote control loop-through that can be used to delay simple contact closure remote control commands by the exact amount that the audio is delayed, as well as a synchronized RS-232 loop-through useful for aligning RBDS generating equipment or automation equipment. Configuration is fairly straight forward after having a look at the manual.

I would have preferred the inclusion of a small LCD dot matrix display instead of the LED segment display for setup. The large LED, which is fine for display of the delay time, is forced to do double duty for setup operations and its displays are sometimes cryptic making it necessary to refer back to the manual for clarity.

Another Eventide innovation is the Compact Flash card slot used for storage of audio files, which the unit can playback while simultaneously building delay. Also offered is the ability to control the unit via an RS-232 serial connection to a computer, though no client software is offered.

On the whole, Eventide's BD600 is a terrific product that is ideal for HD Radio synchronization and profanity delay applications. I'll bet the producers of a certain football halftime show wish they would have had command of a dump button capable of censoring Ms. Janet.

Kernen is chief engineer of Greater Media Detroit.

Eventide

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Airtools 6100

By Robin Cross

At KCUR we produce two one-hour live call-in talk shows every weekday. When I started in January 2004, I was surprised to find that they operated with no profanity delay. I immediately suggested that we purchase and install one. Because we are an NPR station and had operated for nearly 20 years with no delay, it was thought that we weren't in real danger. Then the famous Superbowl half-time show occurred and people realized that the FCC fines could put a serious dent in our budget. Then my suggestion was taken seriously. We tried a software-based option. It worked OK, but was problematic in that it depended heavily on the stability of the PC hardware. We started looking for alternatives. There were two products available that met our requirements. We needed to keep our air chain all digital. We selected the Airtools 6100.

Performance at a glance

- 24-bit audio
- Remote controllable
- As many as 40 seconds of delay
- User-selectable delay algorithms
- Automation control interface
- AES3 and analog I/O

It is a 1RU device with an IEC ac cord. There is no wall-wart.

The front panel interface is easy and I would say almost intuitive. The alphanumeric and bar graph display works with three buttons and a knob. The three buttons are labeled Previous, Next and Home. These navigate through the circular, single-level menu. When the Home button is pressed this display reverts to a bar graph of the audio passing through the unit. The knob selects the various choices for each menu entry. There is a numeric display of the delay time. In addition, on the front panel are the familiar switches for Exit, Start, Cough and Dump. When any of these functions are engaged on the front panel or remotely via the DB-25 remote control and indicators connector, the appropriate switch flashes. A bypass switch is the last switch on the front panel. This is a mechanical bypass relay in case of disaster.

The rear panel is a busy place because of the 1RU form factor. Three TC89 time code BNC connectors, a DB-9 RS-232, an RS-485, the previously mentioned remote control and indicators DB-25, an automation DB-25, a BNC word cock in connector and six XLR connectors for stereo audio in and out and AES3 in and out are all on the rear panel.

The 6100 was easy to install and interface with our Enco DAD system. Contact closures from the DAD wired directly to the remote control and indicators connector. This allows the delay to be entered on a time basis programmed by the DAD system. We enter the delay 10 minutes before the talk show starts. This allows the algorithm to have a full six-seconds delay by the time the show starts. The 6100 can be set for any delay from zero to 40 seconds in 0.1 second increments. We selected the Gap Detect and Catch Up algorithm, which for our format was the most seamless. The choices are Gap Detect, Gap Detect and Catch Up, Continuous, and Pitch Shift. The best way to select the algorithm is in the air chain. We used the AES3

Air Tools

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inputs and outputs but also wired the analog input as a backup. There are four user programmable SPDT form C relay contacts available. For complete control, there is a description of the functions available, protocols and syntax in Appendix D of the users guide. Because this has an embedded processor this is one powerful unit.

Parameter	Setting
Input Source	analog or AES/EBU
Nominal Input Level	-10dBu, +0dBu, +4dBu, +8dBu
Nominal Output Level	-10dBu, +0dBu, +4dBu, +8dBu
Digital Input Sync	internal 48Hz, word clock, AES/EBU
Delay Time	0.0 to 40.0 seconds (in 0.1 second increments)
Dump Length	fifth, fourth, third, half, whole
Algorithm	gap detect, gap detect and catch up, continuous, pitch shift
Delay Ratio	10:1 to 40:1 *
Bar Graph Mode	pre-delay, post-delay
Automation Trim	±300ms from Early to Late in 30ms increments
Rear Serial Port	RS-232 (DB-9) or RS-485 (3-pin euro)
Serial Port Baud	9600, 19200, 38400
Unit Number ID	1 through 255
*- ratio controls the balance of delay build/exit speed vs. overall audio quality	

The Setup Menu options

Things that must be said

This is a professional unit and it has XLR type balanced connectors. It can be wired and the levels set for unbalanced wiring. It also uses AES3 connections. There is no provision for S/PDIF digital audio. The input source must be selected but the AES3 and analog outputs are always active. We used the analog output as the source to drive our mono analog line that backs up our T1.

With all the setup and connections, I cannot imagine a situation where it could not be configured. At KCUR it was easy to install and configure. Earlier versions of the firmware had some problems, but the latest version seems to be bug free.

There is an additional use for the unit. It can be used as the audio delay for HD Radio for the air chain. Because the delay can be set in 0.1 second increments, the delay can be precisely timed for the required HD Radio delay. This eliminates the need to route the AES3 audio through the HD Radio exciter.

We view this device as insurance. We hope that we never need to use it but we know that it is there when we need it.

Cross is the chief engineer of KCUR-FM, Kansas City.

New Products

By Kari Taylor, senior associate editor

www.beradio.com

Signal processing system
Sofratec

Monster FM: An integrated signal processing system, this processor offers a linear expander, a linear limiter, de-esser, a six band parametric equalizer and multiband compressors. It offers a frequency response of 30Hz to 15kHz±0.25dB and total distortion of 0.01 percent at 1kHz. Its total separation is greater than 85dB DIN. It provides gain riding to compensate for varying inputs levels, adjustable dynamic range control, loudness control, maximum level modulation and transparent peak limiting to prevent overmodulation. The system provides impedance of 10kΩ electronically balanced and sensitivity of -35dBu to +24dBu to produce 10dB gain.

+33-4-93019999; fax +33-4-93019971
www.sofratec.com; sales@sofratec.com

Mixer
Peavey Electronics

Sanctuary S-4: The newest member of Peavey's Sanctuary series of mixers works as a stand-alone four-channel rack-mounted mini mixer or can be linked with other S-4s for more channels. The mixer features the company's Automix

technology, an automatic priority and ducking scheme for minimizing off-channel noise and interference. The system also offers Mid Morph, a dual function cut and boost EQ designed for simplifying equalization settings.

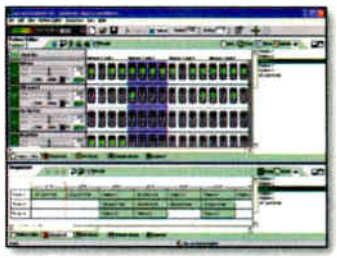
601-483-5365; fax 601-486-1486; www.peavey.com

Unidirectional mics
Roland

DR10, DR20: A dynamic microphone with a hyper-cardioid pattern, the DR10 and DR20 microphones provide a frequency response from 60Hz to 15kHz. A talk switch provides on and off control. The mics offer 130dB maximum sound pressure level (less than 0.5 percent THD). They include a hardshell carrying case with a mic clip and cable.

800-542-2307; fax 323-890-3701; www.rolandus.com

Loop generator
Acoustica



Beatcraft: A software drum sequencer and loop generator, this product includes a library of 265 studio quality, professional samples recorded from drum kits, percussion instruments and vintage drum machines and synthesizers. The system features resonant filters and audio effects wrapped in an interface with a 32-bit sound engine. It requires Pentium II-400, Win95/98/NT/2K/ME/XP, 128MB RAM and a file size of 8MB.

559-692-2224; fax 559-692-2214; www.acoustica.com

Status alarm system
Belar

Sentry 16: An audio and logic monitoring system, it continuously scans as many as eight audio or program channels and eight logic or status inputs to detect changes in station operating parameters. It combines single-point monitoring of critical audio channels and equipment status, flexible local and remote alarm capabilities, and a computer interface for remote interrogation. The system senses changes in audio program levels, phase reversals occurring in the audio chain and changes in equipment operational status. Unit control is provided via front-panel push buttons and a 16-character alphanumeric dot-matrix display and an RS-232 interface; alarm readout through 16 front-panel tri-color LEDs, the alphanumeric display window, dry SPDT contacts from two alarm relays, an open-collector external alarm output and the RS-232 port.

610-687-5550; fax 610-687-2686; www.belar.com; sales@belar.com

Compact Flash recorder
Marantz

PMD671: This device records to Compact Flash cards, has no moving parts and offers multiple recording modes, long record times (36 hours of stereo recording on a 1GB Compact Flash card) and long battery times (six hours with AA alkaline batteries). The recorder offers time-shift playback, XLR microphone inputs with phantom power, a built-in condenser microphone, RCA line inputs, USB 2.0 connectivity and an optional wired remote. The unit is capable of 24-bit/96kHz PCM recording and the 1GB Compact Flash card can provide 30 minutes of record time at high-resolutions.

630-741-0330; fax 630-741-0652; www.d-mpro.com; info@d-mpro.com

Looking to touch your listeners?

APHEX MODEL 230 MASTER VOICE CHANNEL

Introducing the Aphex Model 230 Master Voice Channel, the most powerful processor ever designed specifically for voice.

Voices will be bigger, more present, more intimate, more intelligible and more consistent. Its comprehensive complement of exclusive proprietary features brings these benefits to any voice – from a thundering bombast to a whispering waif – without changing its essential quality.

Every element of the Model 230 is superior to any other voice processor's similar function...

- The RPA™ tube preamplifier provides warmth, image and detail.
- The Easyrider® Compressor controls output levels without pumping or breathing.
- The Logic-Assisted™ Gate won't false trigger or cut off words.
- The Split Band De-esser effectively cuts sibilance without dulling.
- The Big Bottom® and Aural Exciter® add resonance, depth, presence and clarity.
- The parametric EQ takes care of any frequency anomalies with surgical precision.
- Post-processing insert point, -10dBV and +4dBu analog outputs, 24/ 96 digital outputs on AES3, S/PDIF and Optical, word clock I/O, and a cough switch with soft mute allow the Model 230 to be easily interfaced into any system.

So if you *are* looking to touch your listeners, you should be looking at the Aphex Model 230.

www.aphex.com

Genuine APHEX

Studio recording preamp
Mackie

Onyx 400F: A 10-channel, 192kHz-capable Firewire audio interface, the system's onboard DSP mixing matrix allows latency free headphone mixing and routing independent of the DAW software. Front panel controls include control-room output level, dual independent headphone outputs with dedicated level control, dual instrument inputs and four-segment metering for the mic inputs. The rear panel includes four

combo mic/line inputs, balanced TRS sends and returns for the first two mic inputs, four line inputs, eight line outputs, control room outputs, word clock I/O, MIDI I/O, S/PDIF I/O and two Firewire ports. The 1RU steel chassis features an extruded aluminum front panel with machined aluminum knobs.

800-898-3211; fax 425-487-4337
www.mackie.com; productinfo@mackie.com

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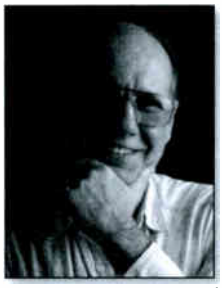
This month: Field Report, page 50.



Robin Cross
Chief Engineer
KCUR-FM
Kansas City, MO

Cross' career in broadcasting began at WMPS-AM/FM in Memphis in 1973. Since then, his career led him to KMBR-AM, Bismark, ND; KFDI-AM/FM, Wichita; WQAD-TV, Moline, IL; and WNIU/WNIJ, DeKalb, IL, before joining KCUR in 2002. His proudest achievement was building WNIJ from the construction permit to being on the air in 150 days.

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Written for radio professionals

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Sign Off

By Kari Taylor, senior associate editor

www.beradio.com

Do you remember?

In 1981 the UREI compressors and filters were a popular choice for controlling levels and creating special effects. The LA-4 was a single-channel, half-rack unit with a patented electro-optical attenuator. It offered selectable compression ratios, a large VU meter, adjustable output and threshold levels and stereo coupling.

The 1176LN was a peak limiter that featured adjustable input and output levels; individual attack and release time controls; selectable compression ratios; switchable metering; and stereo coupling.

The 1178 was a two-channel version of the 1176LN in a 2RU package. It featured tracking in the selectable stereo mode as well as selectable VU and peak reading meter ballistics.

The original designs of the UREI products have been duplicated by current manufacturers, and there are even some processing plug-ins to replicate the sound of the original devices.

Sample and Hold

Music Sales in First Half of 2005:

Direct downloads dominate

Source: International Federation of the Phonographic Industry, 2005. U.S. only.

That was then

The WOWO transmitter site, located in Roanoke, IN, was built and began broadcasting in 1953. This photo was taken sometime during the early- to mid-50s. The Westinghouse transmitter to the right is a 1953 Westinghouse 50 HG. This is actually a 100kW short-wave transmitter that was modified to accommodate the needs of WOWO at the time to produce the 50kW signal. Due to these modifications, the transmitter actually contains a backup modulator and RF section housed within the cabinets. When the transmitter is running, only half of the tubes in the modulator and RF cabinets are illuminated. The backup tubes can be put into service by changing a knife switch within each cabinet.

This is still the current WOWO transmitter site. This transmitter is still in place and operational and can be used should the need arise. Throughout the years, the transmitter has been affectionately known as George, named after George Westinghouse.

Also in the photo are several equipment racks containing audio and remote control equipment. In the foreground is a backup studio used in emergencies and during maintenance periods.

This Little Unit

Can Do BIG Things!

Our new AP-3 is the perfect HD Processor:

SETTING UP FOR HD RADIO?

The Vorsis AP-3 digital processor is the ideal tool to shape your sound exactly the way you want it —cleanly and efficiently.

Built around a multi-band compressor with complementary AGC, the AP-3 replaces a whole *rack* of dedicated units. VORSIS pre-conditions your signal (HPF, LPF, notch filter, de-esser, expander), then let's you apply 3-band AGC/compression *and* 4-band parametric EQ (signal chain reversible) before going through a final stage zero-overshoot peak limiter.

With real-time spectrum density readouts and full metering, our included PC graphic interface software makes operation of the AP-3 direct and easy, offering complete control of all audio parameters, presets, monitor functions, system settings and security—all through a single RJ-45 ethernet connection that lets you control one or many AP-3 units.

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