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20 years of *Radio* magazine: September 1994

Cover photo courtesy of Nautel.

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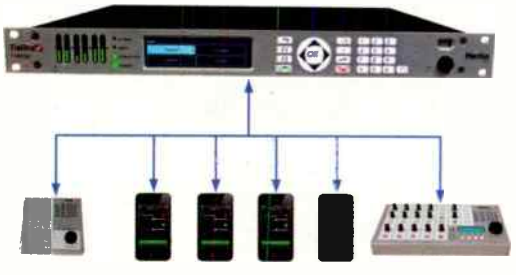

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Sinclair Broadcast Group to Purchase Assets of Dielectric

Sinclair Broadcast Group has entered into a definitive agreement to purchase the assets of Dielectric from SPX Corporation. SPX announced it was closing Dielectric, manufacturer of broadcast television, radio and wireless antennas, transmission lines, and RF systems, in April 2013.

Commenting on the transaction, David Smith, President and CEO of Sinclair stated, "Dielectric has supplied more than two-thirds of the TV industry's high-power antennas, and its name is synonymous with expert engineering and quality products. We feel fortunate to have this opportunity to acquire the Dielectric intellectual property and assets related to our most critical infrastructure. This acquisition was a logical choice given our in-house RF engineering expertise and our ownership of Acrodyne Services, which installs and services broadcast transmitters and mobile DTV upgrades. Further, if and when a spectrum repack occurs, Dielectric will be there to support that effort."

Carson Daly Will Discuss Radio, Record Label and Artist Collaboration at 2013 Radio Show

CBS Radio's Carson Daly will moderate a panel on the relationship between radio, record labels and artists at the 2013 Radio Show, jointly produced by the National Association of Broadcasters and the Radio Advertising Bureau. The session will take place on Sept. 18 at 10:15 a.m. at the Radio Show in Orlando.

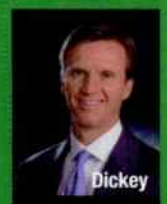
"Radio, Record Labels & Artists: Creating a Powerful Partnership" will address how radio, record labels and artists can collaborate and collectively grow their businesses. The session will offer insights and tips on how the three parties can work more effectively together and explore solutions. Panelists include Steve Bartels, president and COO of Island Def Jam Music Group, and veteran programmer John Dimick, senior vice president, programming and operations, Lincoln Financial Media.

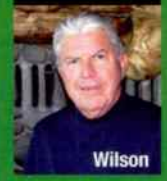
2013 Radio Show Leadership Breakfast Explores Opportunities in Radio

The National Association of Broadcasters and the Radio Advertising Bureau announced the panelists for the 2013 RRadio Show Leadership Breakfast, titled "Opportunities in a Changing Economy." The event will be held Sept. 19, 7:15-9 a.m. at the Rosen Shingle Creek Hotel in Orlando.

The Leadership Breakfast will feature a panel discussion about expanding opportunities in Radio for acquisitions and revenue in a growing economy. Panelists include Lew Dickey, CEO of Cumulus Media; Mary Quass, CEO of NRG Media; Jeff Warshaw, CEO of Connoisseur Media and Larry Wilson, CEO of Alpha Broadcasting and L&L Broadcasting.

The panel will be moderated by Lew Paper, a partner with Pillsbury Winthrop Shaw Pittman, and will be preceded by opening remarks from Marci Ryvicker. Ryvicker monitors developments in broadcasting and other media industries as managing director, senior equity analyst, for Wells Fargo Securities.





Tieline Report-IT Updates

Tieline Technology released Report-IT Enterprise v2.0.5 for Android devices, which includes support for audio and metadata ingest into Netia Radio-Assist file management systems. The company also released Report-IT Enterprise v3.2.5 for iOS, which includes support for Netia Radio-Assist file management systems. The release also includes full support for the low-delay Opus algorithm and integration of the Netia iSnippet editing application into Report-IT.

Conventions

The 2013 Radio Show openend a limited number of hotel rooms available at the Rosen Shingle Creek.

The 2013 CBI National Student Electronic Media Convention, held at the Hyatt Regency San Antonio from Oct. 31 - Nov. 2, opened show registration.

The 2014 NAB Show call for speakers has opened. The deadline for proposals is Oct. 18, 2013.

Honors

The National Association of Broadcasters board of directors met for the summer and selected Charles Warfield as NAB joint board chairman and re-elected Don Benson as radio board chair.

Society of Broadcast Engineers Chapter 14 presented a special award to Brian Szewczyk recognizing his efforts to assist broadcasters in the Connecticut region.

FIND THE MIC AND WIN!

Tell us where you think the mic icon is placed on this issue's cover and you could win Hosa HDC-800 headphones. Send your entry to radio@RadioMagOnline.com by August 10. Be sure to include your guess, name, job title, company name, mailing address and phone number. No purchase necessary. For complete rules, go to RadioMagOnline.com

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VIEWPOINT

The New Form of Radio Imitates, Well, Radio

Radio is what we do. It's been around, well, forever in our minds. Or at least all our lives. Over that time, radio has seen an ongoing rise of competition: TV and then video were going to "kill the radio star." Then it was personal consumer technologies like the Walkman, CDs and media players, and later on satellite radio. Now the phone has become an everything device that you can also occasionally use as a phone. But radio as we know it has continued. There are some radio broadcasters who want to believe radio will continue as it has for nearly 100 years. They believe technology advances aren't necessary. What we have works just fine. Another group is looking to the future and watches every move by SiriusXM, Pandora, Google, Apple and all the other content providers and technology developers. Part of this development includes HD Radio. And while some think HD Radio has no future at all, it's wise to at least look at what HD Radio offers to stay relevant with the current competition.

With all the various technologies around us, it's hard to predict what the next step in portable consumer entertainment and information will be. There are so many elements to consider that can make or break a system, format or technology with consumers. Our big advantage in radio is that it's been around a long, long time, and the receivers pretty much all work the same. Hand someone a new radio and he can hear something he likes in seconds. Offer him a stream or hand him a smartphone and he might have to install an app, or download a codec (although that's not the struggle it used to be with early streaming). On top of that, there are the bandwidth or data requirements or restrictions.

Radio has just been easy for the listener.

But the new competition is getting smarter. And I'm not just talking about Apple, Google, Pandora or another single entity. The various players are coming together.

At the recent Consumer Electronics Week in New York, the Connected Car Conference touched on the simplicity that radio broadcasters have known for years: In-car listening is a valuable space. Drivers and passengers are essentially a captive audience. And car manufacturers have been struggling to provide the mobile entertainment consumers want with in-car systems.

Linking a smartphone to the dash has been one way to do it. Another has been the proprietary in-dash system itself. But there are many options, and that's the problem from their point of view.

The best solution right now seems to be embedded apps right in the car. These bring more content directly to the car rather than steering (no pun intended) the driver's attention away from the smartphone. It's still some time off, but from the CE Week panel it's been seen that data plan carriers AT&T, Sprint and Verizon are interested. (Side note: Data plan carriers? We used to call them phone service providers.)

The specifics of pricing and general system design have to be worked out. But some of the quotes I read all say the same thing: The apps need to look like AM and FM radio to a driver.

Imitation is the highest form of flattery. And like I said earlier, everyone knows how to use a radio.

Give them time. They will build it. And radio will have to continue to keep current to stay relevant. But aside from a few companies, such as Emmis and Clear Channel, radio in general seems disengaged from critical conversations with consumer electronics manufacturers, auto manufacturers and regulators at events such as the Connected Car Conference. Radio needs to be engaged rather than coasting in idle.

Chriss Scherer | Editor

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Tower Safety Review

by Jeremy Ruck, PE

It was once said that "working safely may get old, but so do those who practice it." This is certainly true in our industry. Depending on which list you examine the danger rating of tower work floats. The minor differences in rankings between lists are merely semantics, as tower work is still regularly ranked in the top 10 most dangerous occupations. Although station personnel do not always have the same level of exposure as our friends who work at the heights, you are nevertheless exposed. Since we are all ultimately on the same team, safety truly is a cheap and effective insurance policy.

Typically tower crews are on the payroll of somebody else, and function as a subcontractor of the station licensee. This provides a certain degree of insulation for the licensee, but not entirely. Over the past several years courts have realized that the licensee, who acts as a general contractor, may not have control over the means and methods of the work being performed. Certainly you have the ability to order work stoppage, but actual control over the work goes deeper than that. If the licensee, or its representatives, retains supervision such that the contractor is not free to work in his own way, then you are definitely on the hook for whatever happens. As a result, it would make sense to extricate yourself from the day-to-day operations. While suggestions can be useful in getting the job done right the first time, offer them as suggestions and not demands or requirements.

Presumably before you even get to this point, you have taken numerous preliminary steps to ensure to the best of your ability that safety at your site will not become an issue. First and foremost, know your contractors. Most station engineers will be familiar with several companies that provide tower work at varying skill levels. Always hire the crew that is commensurate with the task at hand. For instance, hiring a crew that specializes in tower painting to install rigid transmission line may not be the best choice.

I have found most crews are like other professionals: They take pride in their work, and the top tier crews are really and truly craftsman despite the fact that they sometimes have colorful personalities. Their commitment to their trade, and especially safety, will be evident by the equipment and vehicles they use, and the condition in which they maintain the worksite. Careless maintenance and storage of tools, a safety hazard in itself, may sometimes indicate that safety is less of a priority than it should be.

In addition to the equipment, what sort of training has the tower crew provided for its employees? Has the company just provided its own on-the-job training, or has it sought outside certification? The former can sometimes perpetuate bad habits, whereas the latter, which does require an investment, hopefully mitigates the potential of safety problems downstream. Regardless of the method, employers are responsible to provide or accept appropriate training.

MAKE A PLAN

How robust is the safety plan in use at the site? If the contractor cannot provide you with a recent written copy of his safety plan, then the plan does not exist despite what is said to the contrary. One of the key elements of a plan is the safety meeting held each day at the start of work. Even if the work taking place is old hand, there is no excuse for not reviewing the hazards that may be faced that day. Such

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meetings keep the concept of safety in the front of the mind. As the licensee representative, you should make it a point to attend most, if not all, of the mandatory safety meetings.

While the tower crew will typically address safety issues for its employees, there are numerous things that need to be covered by the licensee or its representatives. The most common item that comes to mind is that of RF safety. Ensure that your RF safety plan is current before the crew arrives, and that it is rigidly enforced. Do not create deviations from the plan without concurrence by your consulting engineer. Similarly, do not allow the tower crew to play loose and fast with the safety plan. If it is too cold that night to work, then so be it. The days of hugging antenna elements to keep warm should be well past us by now.

Also on this list is tower maintenance itself. Just like regular maintenance on a vehicle keeps it in top shape, regular maintenance on towers keeps them in top shape. Absent from acts of God and other disasters, they will perform well for many years. Owners who invest in their towers only when a crisis or citation occurs should not be surprised if one day no crew will climb their structure.

Tower safety is also not limited to areas above grade. To work on the tower you have to first get to it. As tools and equipment tend to indicate the professionalism of a tower crew, the condition of your site reflects on you and your owner. If your site looks like a golf course, is clean and well maintained, then one can infer that all issues including safety are a priority. Conversely, the AM array that appears ripe for designation as a National Forest or Superfund site may indicate carelessness on your part.

Although there are numerous standards and laws in effect, it is important to remember that some of these merely provide minimum requirements. When we are dealing with the lives of others, and the livelihood of many, cutting corners should never be considered an option. The reality is, the few dollars potentially saved on the front end, can come back as an albatross on the back end. It truly is better to delay a project slightly, than to allow work to move forward that could result in damage to your facility, or worse injury or death to workers, yourself included.

In the end, much progress has been made over the years quantifying and mitigating the hazards associated with tower work. That being said, broadcasting in all of its technical phases is inherently dangerous work. While tower work may retain one of the top spots in the most hazardous occupation rankings, we should all strive to ensure that it does not displace fishing or logging. That is one area where a lower ranking is preferable, and that is where strict adherence to safety procedures will do its part.

Ruck is the principal engineer of Jeremy Ruck and Associates, Canton, IL.

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FCC Frames LPFM Window

by Lee Petro

As anticipated, the FCC announced the filing window for the submission of applications for new low power FM stations. The window will open on Oct. 15, 2013, and will close at 6 p.m. on Oct. 29, 2013. The FCC also announced the availability of the new FCC Form 318 so that potential applicants can review and get prepare for the filing window.

In my April 2013 article, I discussed the eligibility and selection process for new LPFM facilities. Briefly, the FCC will permit applications only from local nonprofit educational organizations, tribes or tribally controlled organizations, state or local governments, or a non-government entity that will provide public safety radio services solely on a noncommercial basis. The FCC established a point system to resolve mutually exclusive applications (i.e., applications that propose service to the same area). Finally, only one application may be filed by non-profit organizations, unless it is a tribal applicant, or proposing a public safety-only service, when two applications may be filed.

The Public Notice announcing the October LPFM filing window provided additional information that requires close attention to ensure that applicants do not see their proposals rejected:

Filing Requirements. The new FCC Form 318 is available online, and it is vital that all applicants and their engineering consultants review the application and instructions before submitting an application. Based on experiences from the 2007 NCE FM Filing window, one of the most likely reasons for the dismissal of LPFM applications will be the failure of applicants to submit complete and accurate evidence establishing the applicant as "eligible" and demonstrate its satisfaction of the requirements under the point system.

For example, to be eligible, the applicant must submit information regarding its incorporation, and nonprofit educational organizations must provide information establishing the educational purpose of the proposed programming, and supply supporting information (e.g., programming schedules). To support an award of credit under the LPFM point system, the FCC will require documentation for each of the categories (e.g., to obtain local main studio credit, the FCC will require an exhibit specifying the address and telephone number of the proposed studio).

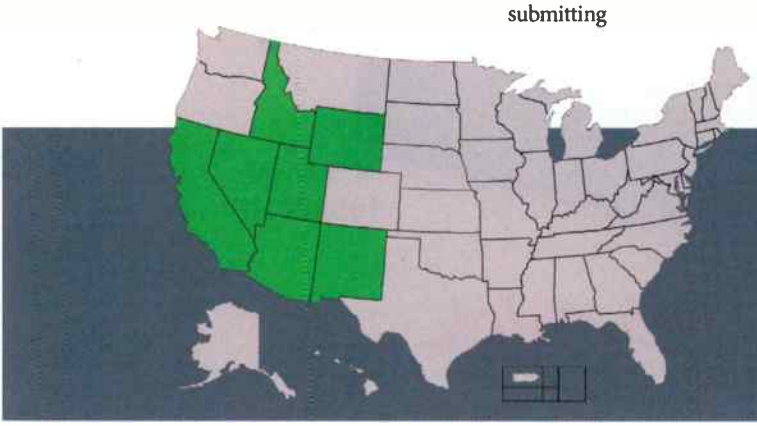
Another critical factor is the accuracy of the engineering section of the application. On several occasions during the 2007 NCE FM window, applications were dismissed for errors contained in the Tech Box portion of the form. The information in the Tech Box (i.e., channel, tower coordinates and height, power) is used by the FCC staff to establish mutual exclusivity, and, in some instances, the FCC staff rejected post-filing window amendments to Tech Box applications to correct tower coordinates or channel number designations.

Interference Protection. The FCC made clear that all LPFM applications must protect pending broadcast applications filed for full-power FM, FM translator, FM booster stations, along with those applications filed for television stations operating on channel 6, that were filed prior to June 17, 2013. However, the selection of June 17, 2013, as the snapshot date is noteworthy, and may be problematic for other licensees and applications.

In particular, the FCC is currently receiving settlement proposals and technical amendments in connection with the resolution of the 2003 FM translator snafu (discussed in June 2013 FCC Update). These submissions are due by July 22, 2013. One possible reading of the LPFM PN, though, would imply that any technical amendments submitted after June 17, 2013, do not require protection from the subsequently-filed LPFM applications. On the other hand, the FCC may have been attempting to ensure that these applications (as amended) *are* protected, but just did not make clear that the amendments to the pending applications are entitled to the same protection. Hopefully, the FCC will issue future clarification on this point.

In any respect, the key takeaway from the Public Notice is that all prospective applicants should start preparing ASAP for the filing window. Such preparation includes identifying and retention of engineering consultants, gathering organizational materials, and consideration of the local programming (if any) that the proposed facility may provide. It's been 13 years since the last LPFM filing window opened, and it is not likely that another opportunity will exist after the October filing window closes.

Petro is of counsel at Drinker Biddle & Reath, LLP. Email: lee.petro@dbr.com.



DATELINE

July 1: Stations in Arizona, Idaho, Nevada, New Mexico, Utah and Wyoming continue running license renewal post-filing announcements on July 1 and 16. Stations in California continue running license renewal pre-filing announcements July 1 and 16.
July 10: Stations place issues/programs lists for 2Q2013 in public inspection file.
Aug. 1: Stations in California file License Renewal Application and EEO Program Report, and noncommercial stations file Ownership Report (323-E). Commence running license renewal post-filing announcements, continuing on Aug. 16, Sept. 1 and 16.

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ROC YOUR WORLD

The new ROC console from Logitek

When Logitek introduced its first ROC console back in the 1990s, it marked a revolution in audio console design. One of the industry's first router-based digital consoles, the original ROC boasted simple wiring and access to multiple sources at each fader.

Over the years, the router-plus-console Networked Audio concept has become the standard in console architecture. Although the original ROC was retired years ago, Logitek has continued to develop systems for both TDM and AoIP audio networking. The new ROC takes the best of the original design and pairs it with the latest technology and styling.

Available in multiples of 6 faders (up to 24), the ROC is housed in an attractive tabletop enclosure. Durable Penny & Giles faders, OLED source indication and intuitive controls make the ROC a natural for on-air, production rooms or even in temporary studio setups. Two monitor feeds, front panel headphone connection and user-assignable softkeys will please even your fussiest operators.

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HD Radio: Proving Performance

By Doug Irwin, CPBE
DRB AMD

The effects of a low Modulation Error Ratio, how is it measured and what you can do to make it better

In February 2010, iBiquity released a paper on techniques for measuring the quality of IBOC transmissions. A quality-metric known as MER (Modulation Error Ratio) was introduced by the National Radio Systems Committee as a standard. If you don't read the entire document, it's important to note that stakeholders in the United States have agreed to this methodology.

After three years we are now seeing the introduction of MER metering for IBOC transmitters. Nautel recently made this available for its NV and NX series transmitters; Continental also has MER metering in its current HD Radio exciter, the 802Ex FM/HD. Nautel recently presented a webinar on its MER techniques.

According to information presented in the webinar, Nautel has implemented the FM MER technique described in the iBiquity paper in its NV series transmitters. There's no standard for AM, however, so Nautel has implemented what it refers to as a textbook standard methodology for its AM transmitters MER measurement.

So what are the implications of a low MER value, and how is MER measured? Conceptually (at least) it's pretty straightforward. Recall that the IBOC subcarriers are in groups (or partitions) consisting of both QPSK (for the data) and BPSK for the reference carriers. See Figure 1.

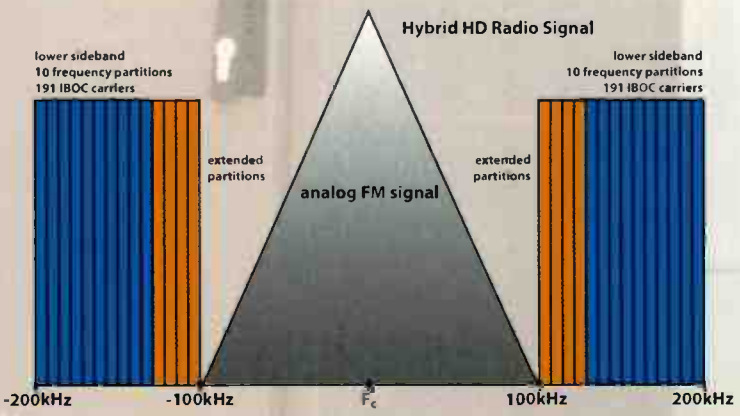

Figure 1. The FM HD Radio specrum.

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Key Features & Specs

- Standard 87.9MHz -108.1MHz tuning range in 100kHz steps.
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In an ideal situation, when QPSK carriers are demodulated the result would be perfect placement inside the constellation, resulting in easy error-free detection, (Figure 2). In the real world though, when the QPSK carriers are demodulated they show up close to the right (reference) spot, but not exactly right on.

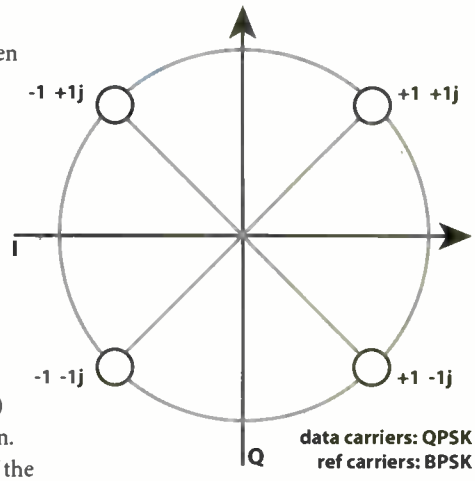

Figure 2. The QPSK constellation showing error-free detection.

MER measures how off the actual readings are from the reference points, as Q1 through Q4 show in Figure 3 after demodulation.

The farther off the readings, the more difficult it is for the receiver to correctly detect the signal. If they are too far off then they can't be detected well, resulting in bit errors. Too many bit errors leads to a total failure of the demodulation and decoding process.

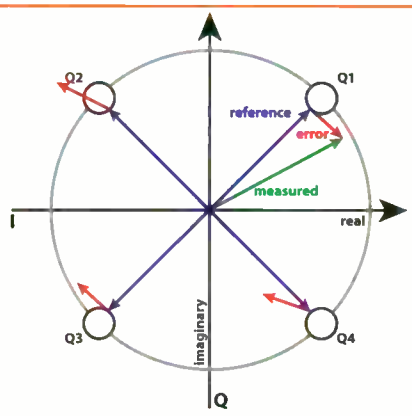

Figure 3. MER example

Modulation error ratio:

$$MER(dB) = 10log_{10}\left(\frac{P_{reference}}{P_{error}}\right)$$

Error vector magnitude:

$$EVM(\%) = \sqrt{\frac{P_{reference}}{P_{error}}}$$

It is interesting to note that peak-to-average power reduction actually generates noise in the constellation, but that particular noise ultimately has little effect on the ability of the receiver to properly demodulate the data. David Hershberger, senior scientist for Continental Electronics, wrote in his paper "IBOC Signal Quality Measurements" that "Peak-to-average (PAR) reduction algorithms may introduce enough deliberate distortion to digital signals that the effects of a transmitter on MER are obscured. Special measurement methods can separate the effects of a transmitter from that of PAPR reduction." And further: "The PA(P)R reduction noise is large compared to other OFDM systems. A textbook evaluation of MER ... will result in the PA(P)R reduction noise dominating the measurement. For this reason NRSC has proposed several modified MER measurements which result in metrics which are closer to the true system performance." Both the Continental and Nautel implementations of MER effectively subtract noise generated by PAR from the measurement results.

The Nautel implementation of MER uses an RF sample from the transmitter output to derive the MER. (It's the same sample used for the adaptive pre-distortion.) The measurement is fairly granular in that it allows you to see the MER of each partition (or group of subcarriers) and therefore how each partition is being affected by some external influence. Some examples will demonstrate this.

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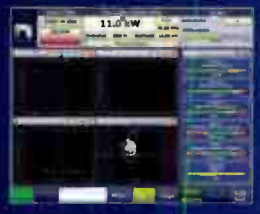

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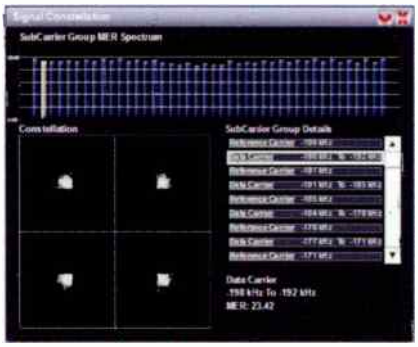

Figure 4

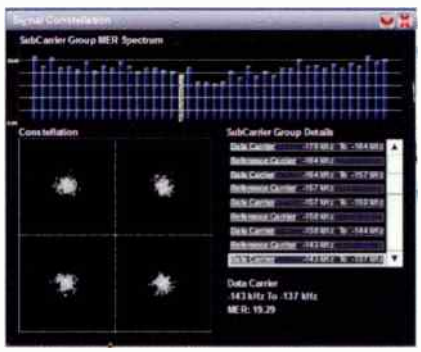

Figure 5

In Figure 4, we see a partition fairly far removed from the center frequency, with a high MER. In Figure 5, we see a partition closer in, with somewhat of a lower MER.

Low MER can actually decrease the coverage area of the IBOC transmissions, and especially for AM (according to the webinar) it can make the receivers in the field take longer to lock on the IBOC data, as Table 1 shows. Interference from MER and noise add linearly at the receiver. A standard Exgine signal has MER of 17-18dB using iBiquity PAR.

An MER of 14dB or better is the standard for what is considered acceptable by iBiquity.

The MER of the inner partitions can be negatively affected (i.e., reduced) by components in the analog transmission as well. Stations using the MP3 mode (which you would use to broadcast HD3 for example) could inadvertently have their HD coverage compromised to some extent by the inclusion of high frequency SCAs. Figure 6 (next page) shows this.

Note that the MER for the inner partitions degrades as the baseband is loaded with more signals. A stereo subcarrier alone will affect IBOC quality. Traditional subcarriers primarily affect the MP3 partition, but can affect the MP1 as well.

Data Carrier MER	Reduction in Service Contour
24dB	0.05dB
22dB	0.09dB
20dB	0.14dB
18dB	0.22dB
16dB	0.31dB
14dB	0.48dB
12dB	0.74dB
10dB	1.13dB
8dB	1.79dB

Table 1. The effects of MER on FM reception.

Harris Broadcast will add MER measuring capability inside its new line of Flexiva exciters and transmitters after the introduction of the Generation 4 Exgine this coming December.

Broadcast Electronics provides an MER output via its IP interface for its VPe system; however, the company is still in the process of verifying how it compares to the NRSC standard (derived from the iBiquity paper). It is also in the process of developing software to verify MER per the NRSC standard, which is independent of the modulation equipment.

Aside from the more complex high-level measurements taken at the transmitter site, you will need devices at your studio location (or some other spot where reception is

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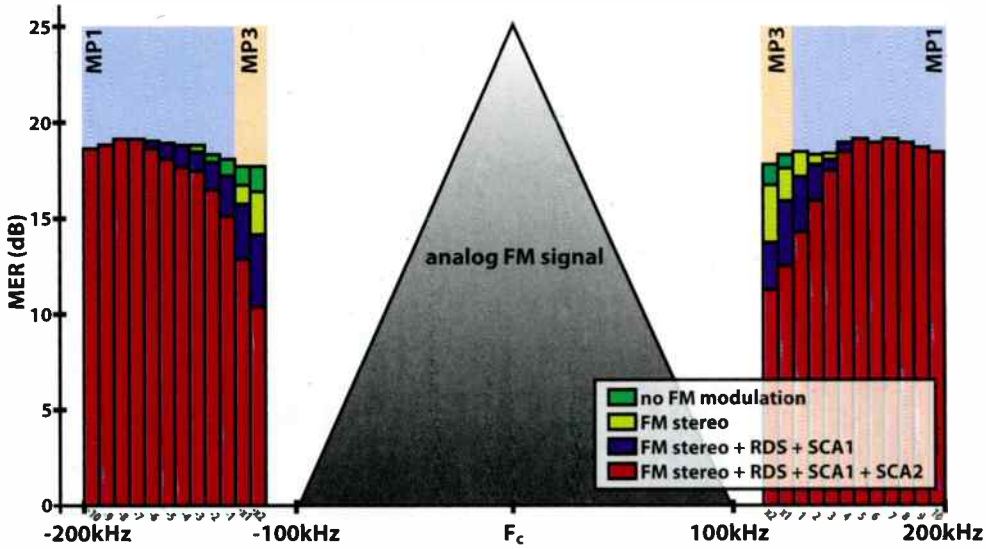

Figure 6. Effects of increased modulation index.

optimum) to keep track of the day-to-day aspects of your IBOC transmissions. Fortunately there are quite a few devices available.

Inovonics, while not new to the field, recently introduced an IBOC receiver with great features. The INOmni 632 (a 2013 *Radio* magazine Pick Hit) is a 1/3 rack-width FM and IBOC radio that will not revert to the associated FM in the event that it loses its assigned signal. If you have it set to an HD2 channel, it will mute when it loses the signal. (If you installed silence-sensors on older-style HD Radio receivers you know how important this is.) The 632 has alarm tallies for carrier loss, digital loss and audio loss in the form of open collectors. It has rear-apron balanced analog outputs for left and right audio in addition to an AES out. On the front panel you are given a display of the monitoring assignment, a quality indicator of the digital signal, and other PSD such as name, type, artist and title. Tuning and menu access are accomplished through a small jog wheel. Also found on the front panel is a headphone output so you can use one of the most important pieces of test equipment — your own ears.

The time-alignment between the analog FM and the digital simulcast (usually known as HD1) is an aspect of IBOC transmission that requires attention because in practice there are components of the transmission path that can generate slight changes in the overall delay of the system. The net effect on listeners can be anything from slightly annoying (time delay slightly out) to instant tune-out (time delay not set at all) as their radios blend back and forth from analog to digital.

To make this easier for those who deal with time alignment issues, DaySequerra has introduced the M4DDC Diversity Delay Control. This is a 1RU, stand-alone device (for use in both AM and FM IBOC systems) that features DaySequerra's TimeLock algorithm for automatic alignment of analog AM or FM audio and HD1. According to DaySequerra, TimeLock can maintain the time alignment down to one sample. The M4DDC has some other particularly useful features in addition to that: For example, it will generate e-mails corresponding to loss of time-alignment, Program Audio, Carrier, OFDM Lock or (optionally) LevelLock. It has five rear-apron tally outputs corresponding to those same conditions. The M4DDC has an embedded Web server that can serve as a remote confidence monitor since it will generate audio streams of the decoded audio and use common browsers for access. Additionally the unit has balanced analog outputs (via XLR) for the decoded audio that can also be set for split mode, with the digital simulcast audio on the L output and the analog audio on the R output. A headphone output on the front of the unit has access to the same audio.

Belar's FM/HD Radio product is the FMHD-1. This is a 2RU device that can be used as an off-air receiver or at the transmitter site, since it has two high-level RF inputs (one for analog and one for IBOC only). The FMHD-1 decodes the HD Radio signal and analog FM signal simultaneously displaying HD Radio status, data, time alignment, and configuration information, as well as total, pilot, L, R, L+R

World Radio History

and L–R metering and RF spectrums. On its front the unit has a 640x240 color LCD display and rotary-encoder for the user interface. It can monitor multiple audio streams with an optional second plug-in HD decoder, and its eight user-assignable analog audio outputs; three assignable AES-3ID outputs provide support for a wide variety of broadcast scenarios including multicasting of course. It has both RJ-45 10/100BaseT Ethernet and RS-232 computer interfaces: When used in conjunction with the Wizard for Windows software the FMHD-1 can be viewed remotely. The unit also provides four user-assignable relay closures used to indicate alarm conditions.

Audemat's GoldenEagle HD FM/AM is a monitoring system really suited for radio clusters. The GEHD will sequentially monitor a list of stations (up to 10) for performance aspects such as the analog RF and audio levels and RDS data, along with HD RF levels, audio levels, and time alignment. The GEHD supports SMTP and will send messages out regarding error conditions that it finds (all user-configurable, by the way). Error-condition logs can be generated as well, with results stored up to 30 days. The proprietary user-interface must be downloaded by an authorized user (with appropriate credentials) using standard Web-browsers; afterward the user-interface is installed on the user's computer. All configuration and subsequent monitoring is done with the U.I. It has balanced outputs (on XLR connectors) corresponding to the decoded audio as it scans through its (user-configured) presets, and it also supports streaming, so the remote user can listen in to any selected analog or digital signal. The GEHD also has the capacity for up to five (optional) GPIO boards — in essence it becomes a remote control in addition to a monitor. The user can schedule up to 10 daily recordings of audio that can be downloaded later for listening and analysis.

IBOC transmissions are a couple of orders of magnitude more complex than the AM and FM transmission schemes we've all become familiar with throughout our careers and for that reason the monitoring of said HD Radio transmissions is far more complex as well. There are many anecdotes in the trades about HD Radio not working and the vast majority are examples of misinformation. How many of these came from listeners' first impressions when they encountered a system that wasn't set up correctly? Whether or not you believe HD Radio has a future (I do) I implore you to make your best effort now to optimize your systems. 0

Irwin is RF engineer/project manager for Clear Channel Los Angeles. Contact him at doug@dougirwin.net.

MORE ONLINE

iBiquity paper on MER
nrscstandards.org/SG/2646s%20rev02.06.pdf

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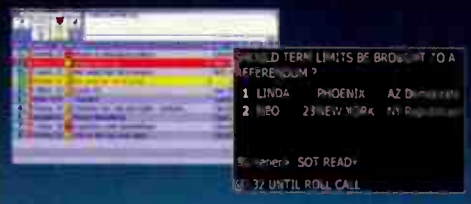
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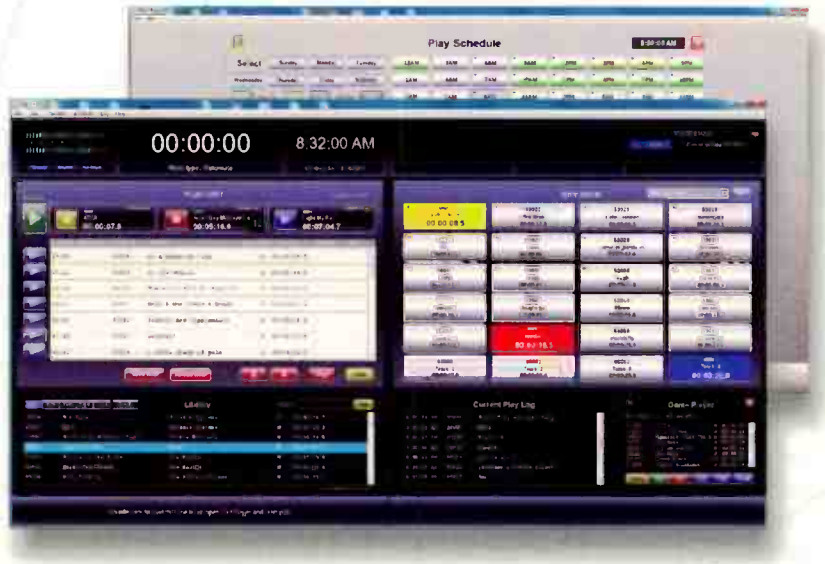

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Keep It, Pitch It or Part It?

by Doug Irwin
CPBE DRB AMD

I'll admit I'm a pack rat when it comes to keeping various RF items at the transmitter site. The time comes, though, when various items need to be tossed out (or as we say now "e-wasted"). Part of the reason for keeping stuff is its potential value in a pinch, right? Who knows when you might need a whatsit, after all. So let me suggest a compromise: Take a look at the items you have stashed, and see if they have valuable components that might be useful later on, and strip them out. Junk the rest. At least that will save you some space. Let's take a look at some examples.

I found a very old 950MHz STL transmitter switch controller recently that hadn't been used in years, plus its complement, the receiver switcher (1). We no longer use dual analog STL links so this equipment is obsolete. But still, do I want to ditch the best parts? The answer is no! The coaxial relay has lots of residual value. (Have you tried buying one lately?) The receiver power-divider is pretty much an off-the-shelf item but I kept it regardless (2).

Speaking of 950MHz power dividers: If you find one (3) at your site, keep it. This is another 950 MHz power divider. In reality it looks like a -3dB hybrid combiner. (Perhaps someone knows that for sure?)

Do you know what a cavity resonator is (4)? These are a couple of very small ones (small for 950MHz anyway). Just because you find them sitting around unused at one of your sites doesn't mean that they won't be useful one day — at some other site. Hang on to these. At some point you may need a filter in the 950 band (in a pinch).

Finally if you happen to see something like Photo 5 lying around, by all means keep it. This is a line-stretcher, or more commonly known as a trombone. It's a piece of transmission line (kind of like a mini hardline) and its physical (and hence electrical length) can be changed.

STILL MORE ON FILTERS

Speaking of electric length, a few months back I described how to use a piece of transmission line as a notch filter. I want to look at a very practical way to cut these to length. Refer to this formula: 2952/f(MHz) = ¼ wavelength in inches.

The next step is to determine the velocity factor of the coax you plan to use; multiply that by the previous result. For example, using 100.3MHz, and a transmission line with a velocity factor of 0.66, you come up with the result of 19.43". In practice you would T this filter off of your transmission line. How long is the center conductor pin inside the T connector? And how close do you really need to be to 19.43"? Here's a simple solution. Get the coax piece, cut it several inches longer than your calculations show is necessary. Next, you'll need a means by which you can measure the attenuation of this filter. Put a receiver of some sort on the frequency you want to attenuate, on the end of the transmission line coming in from an antenna or from some other source (like an RF signal generator). First, leave the filter section off the T connector. Make note of the receive level as a beginning reference point. Then, connect the 'filter' section of coax to the T connector. Re-measure your signal strength on the receiver. Snip a half inch off the end of the line. Re-measure the attenuation. Now you may want to move the RF source and the receiver down in frequency to find where the filter is currently tuned — great. That's like a reality check. Move up in frequency, take another snip off the line, remeasure. Clearly there may be quite a few iterations, but as you get closer to where your calculations show you ought to be, take a shorter and shorter piece off. Put a piece of heat shrink on the end of the filter line when you are done.

In practice I have found that you can achieve 30dB of attenuation with this sort of filter, but it has a very broad Q; it would be appropriate in notching out a local transmitter that is out of band, but still de-sensing your local receiver (as an example). Q

Irwin is RF engineer/project manager for Clear Channel Los Angeles. Contact him at doug@dougirwin.net.

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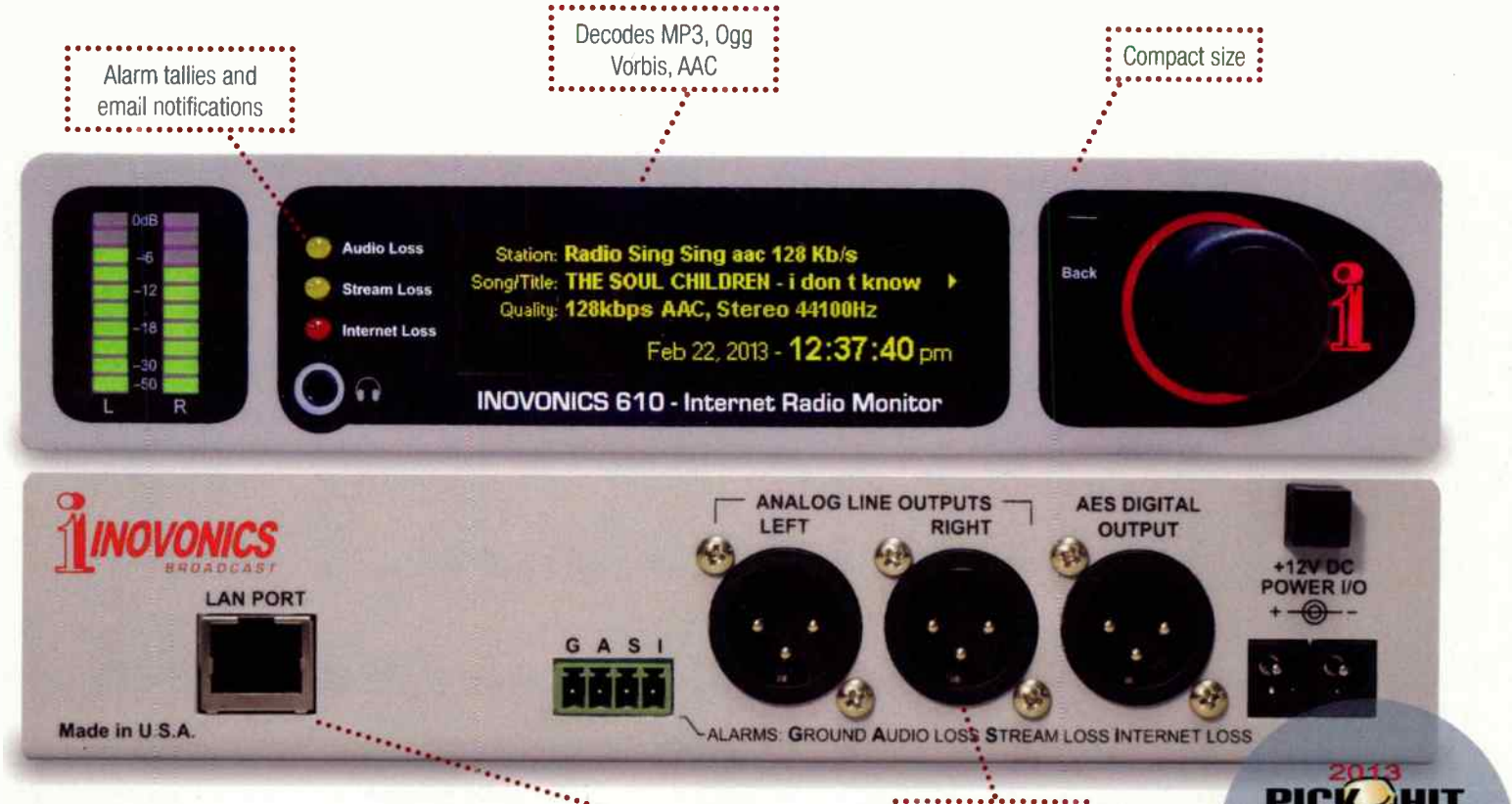

Inovonics 610

by Bill Eisenhamer

2013 PICK HIT Radio

There comes a time when you just have to give up on the cheap products and go for the gusto. We had a good run with our last Internet radio, but we had to reboot it often because of poor design of the power supply. When one radio failed altogether, finding a new radio locally, i.e. not online, became a chore. I did not want to run a dedicated computer for this task, either. Having just returned from the NAB Show, and recently installing an Inovonics INOmini 632, I decided to purchase an Inovonics 610 Internet radio monitor.

What I learned about the device from the 2013 NAB Show: A simple looking device that, hopefully, would be a long-term solution to reliable stream monitoring. Upon receiving the monitor, I was quite pleased with the simple minimalistic design. The front has LED level meters, loss indicators, an OLED display, a back button (to navigate the menu), a jog wheel and a headphone jack. What more do you need? The jog wheel is also a selector button. On the back are balanced analog audio outputs, an AES3 output, alarm outputs, LAN port, and two power jacks. The two power jacks allow devices to be daisy-chained using one wall-wart power supply. The wall-wart power supply comes with a detachable cord so it does not take up multiple outlet spaces.

Physically, two monitors can sit side-by-side in a single rack space, and an optional rack adaptor is available. The rugged metal enclosure is a far cry from the cheap plastic consumer enclosures, and if you are in a high RF environment it will provide some shielding. It is still recommended to take proper precautions in such an environment. Unlike consumer monitors the 610 comes with open-collector outputs for alarm tallies. One can monitor the status for audio loss, stream loss and Internet loss.

UP AND RUNNING

The 610 is simple to install. All configurations can be completed using the front menus on the device itself or via the Web interface. It supports a number of Internet streaming formats: MP3, AAC and Ogg Vorbis. The AES3 audio output is fixed at 48kHz. In many cases this is not an issue, but there could be a situation where the downstream equipment does not have built-in sample rate converters. The balanced analog outputs are XLR connectors providing +4dBu.

Initial configuration of the device via the front menus is intuitive using the jog wheel. The separate back button is a nice touch. The default IP setting is DHCP and will acquire network settings from a DHCP server. It is easy enough to switch to a static address. For installations that do not have a DNS server or the device is connected to an outside dynamic IP address, an option to configure Dynamic DNS is available. Once the IP address of the device is known the rest of the configuration is done via the front menus or the Web interface. Entering the URL for the stream is as easy as entering the address and selecting connect.

The 610 connects to the stream very quickly. Once connected the Now Playing screen will

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display the station name, song/title, the quality of the connection and type, and the date and time. The quality line displays the data rate, the encoding type, e.g. MP3, stereo or mono, and the sample rate of the stream. From the front menu under presets, the now playing station can be saved. Via the Web interface all that needs to be done is enter the URL and click Save as Preset. Up to 10 presets can be stored. I have run Internet loss tests by unplugging the network connection. I have been notified of stream losses. Each time the 610 experienced a loss, it reconnected to the stream. Some of the radios I have used in the past failed to reconnect after an outage.

I used the Web interface to configure the device. Under Alarms and Notifications there are options to choose the audio loss timer and audio threshold, select what conditions to send email notification, and to view and change alarm log settings. An email notification can be sent for audio loss, stream loss and Internet loss. All alarms are logged, and the alarm log can be downloaded for record retention or analysis as a comma-separated value file. Configuring the email preferences is straight-forward, and you can use webmail type services such as Gmail. Time and time zone configuration is a matter of choosing the UTC offset and daylight savings time options. Otherwise, the 610 is embedded to contact a Web based time server, so no clock adjustments are needed. If the device is located behind a firewall, be aware of this. Administration configuration is limited to password protection and saving/uploading hardware profiles. If security is enabled, a password is required to access the front of the 610 and the Web interface. The user cannot be changed nor can you add users. The drawback to a complex password is the time it takes to enter it via the jock wheel, and the now playing information cannot be seen until after the password is entered. In addition, the screen saver timeout is preset and cannot be changed, so if the screen goes dark, the password must be re-entered.

Every device has attributes worth mentioning and even some limitations. I already mentioned Dynamic DNS and email notifications. I have received stream loss email notifications, and having the logs the 610 will be a great troubleshooting tool if we ever have to discuss these things with the streaming provider. Of the limitations, I have already discussed them with Inovonics. Another minor annoyance is the screen saver time-out. This is a fixed time, but that is all it is, a minor annoyance to me. The device does not have SNMP capabilities. Some facilities have the need for SNMP, and when the time comes, a firmware update will be available. The current firmware is version 1.0.0.2.

The 610 is not necessarily inexpensive, but the value is not only in the hardware, but in the support behind the device. Any questions I had were answered by the support staff. The notification features, today, may seem a bit much, but as the industry pursues digital delivery, having a reliable monitor will be a must. Finally the device is designed to move forward via firmware updates that can be done in the field.

The 610 Internet radio monitor is shaping up to be an excellent monitor. As in all early products there are some growing pains, but nothing that prevents the unit from operating well. Any engineer or programmer who wants the ability to really monitor and be notified of an issue will like this monitor. It is more than just another Internet radio; it is a tool that we have lacked until now.

Eisenhamer is the chief engineer of the San Diego cluster for Lincoln Financial Media.

World Radio History

MPX-Direct: Digital Connectivity for FM

by Frank Foti

Prior to the advent of digital exciters for FM radio, integration of an audio processor (with integrated stereo generator) was done via a baseband or multiplexed (MPX) signal connected directly to the exciter's broadband (DC - 53kHz) input. The MPX signal would be routed directly to the modulator. This tried and true method is a present day standard. Any audio processor, be it analog or digital, that contains its own stereo generator offers an analog-based MPX signal on a BNC connector. The connection of this signal, should it be directly out of the stereo generator itself or from the output of a composite STL system, is then connected to the MPX input on the exciter via another BNC connector. Anyone who has installed audio processing will understand this.

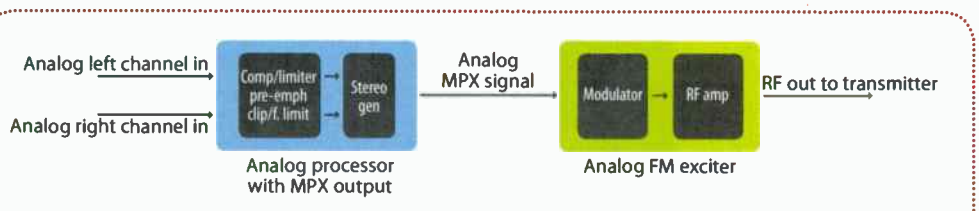

Figure 1. Traditional signal path with an analog processor and composite path.

With the introduction of digital exciters, the only MPX input is analog and it must be passed through an analog-to-digital converter (ADC) before it can be digitally modulated. The sampling rate of the ADC must be relatively high due to the wide bandwidth of the MPX. Consider for a moment the audio spectrum of FM is 99kHz wide. Therefore, any analog signal connected to a digital exciter must be sampled at 200kHz or higher. Once digitized, no other processing is required before modulation.

To date, if an all-digital transmission path is desired, the only interconnect between the audio processor and exciter requires using the AES3 discrete left/right input. This path is quite a bit more complicated than the MPX path because it must condition the audio signal in preparation for stereo generation and herein lies potential for audio degradation. In this configuration, the FM stereo signal must be generated in the exciter.

Experience has proven this method less than ample in modulation efficiency. This is primarily due to the required sample rate converters (SRC) employed in the exciter's input section. The signal that is arriving at the AES3 input of the exciter might be operating at a different sampling rate than the exciter is expecting. If so, a rate converter is employed to make the proper transition. This device can pose problems as the digital filter in the rate converter can generate overshoots to the already tight peak controlled audio signal that is being adjusted.

All audio processors, both analog and digital apply some form of overshoot control to the output filtering section. In most designs, this function is a form of integrated protection clipper working around the final low pass filter to obtain control.

Knowing that the audio bandwidth used in FM stereo is 15kHz, overshoot components will begin with any nonlinear waveform above 5kHz. In this example, this would affect any signal above 5kHz that was clipped.

Should the slope of the up-sampled interpolation filter, in the SRC, appear greater than the slope of the final filter in the audio processor, then output overshoots may result in the sample rate conversion process! Unfortunately, these overshoots are generated after the processing unit. To remove them would require another limiting device. Some exciters provide an additional peak limiter, and the action of this limiter can degrade audio quality.

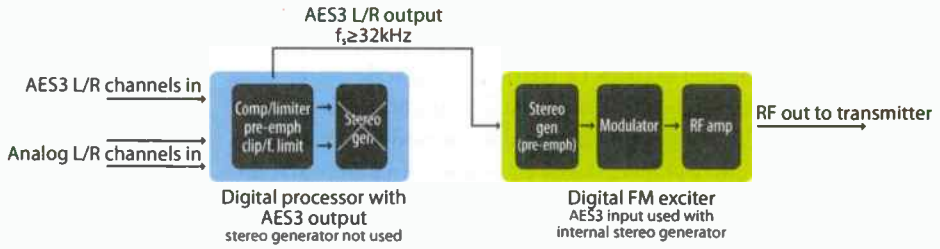

Figure 2. Current technology transports the processed AES3 signal to the transmitter site.

ENTER MPX-DIRECT

The desired goal for the digital interconnect between audio processor and exciter, has been to emulate the older analog method, where the audio processor generates the FM stereo MPX signal, and then connect to a wide spectral input on the exciter...a digital BNC-to-BNC connection so to speak.

MPX-Direct generates the FM stereo MPX signal inside the audio processor, and scales the sampling rate to 192kHz. Through recent firmware developments, the AES3 transom can accommodate a sampling rate at 192kHz, making it possible to transport the MPX signal directly from the audio processor to the input of the exciter: MPX over AES. Now it is possible

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Figure 3. MPX-Direct transports the multiplexed signal via an AES3 stream.

to create a digital version of the older analog method. Figure 3 illustrates the concept.

There are benefits to this configuration. Now it is possible to couple the output of the audio processor directly to the input of the exciter's modulator in a full linear fashion. There are no SRC functions in the path, which can degrade modulation and sonic performance due to overshoots. The absolute peak level at the output of the stereo generator, will translate to the absolute maximum deviation of the FM carrier. Accomplishing this insures the modulator will faithfully mirror the performance of the audio processor. This reduces, and basically eliminates any coloration of the audio due to the exciter's input and modulator sections.

Since the connection between the audio processor and modulator is as close to theoretically perfect as possible, there will be an improvement in sonic bass performance heard on the radio. This has always been a weakness within the analog MPX connection to an exciter, as any unwanted signal components near dc, would negatively affect the performance of the AFC (automatic frequency control) section of the exciter. This usually required the use of a high-pass filter, or dc-servo of some sort. Both of these can degrade the low frequency performance of the modulator, which reduces or smears the aural texture of on-air bass.

Additionally, any specific functions unique to the audio processor/stereo generator are maintained, as they will not be forced to rely on any limitations imposed by the stereo generator in the exciter. By example, the alternative use of SSBSC (single sideband suppressed carrier) in the stereo generator, which has shown to reduce the effect of multipath, can be employed in the audio processor, and this alternative MPX signal will easily connect and operate correctly. Also, the AES3 signal is a standardized method. This now enables a digital MPX connection to be utilized as an industry standard.

Another benefit to this method is it now enables digital distribution of the MPX signal over wide broadcast networks. There are many such infrastructures of this type internationally. Any digital STL system capable of handling 192kHz sampling should be able to carry this signal. To date, MPX-Direct is available for the Omnia.11 audio processing system, and connects to a Nautel VX transmitter that is running version 4.0 software.

Foti is the CEO of the Telos Alliance and founder of Omnia Audio, Cleveland.

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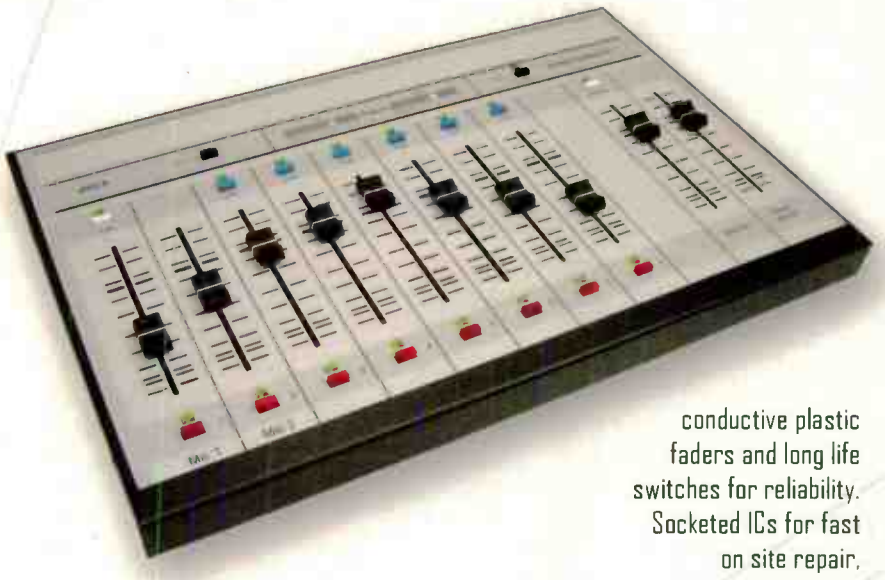

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auralex.com

Lavalier mic | Rode

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rodemic.com

Talkshow system | Broadcast Bionics

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phonebox.com

Wideband true digital wireless system | Avlex

MIPRO ACT-818/828, ACT-80T/ACT-80H: MIPRO ACT-818/828 receivers are available in single-channel (ACT-818) and dual-channel (ACT-828) configurations. Both models are true diversity digital systems with no companding to ensure pristine audio quality. These receivers employ 256-bit encryption that can be enabled/disabled as required, and operate from 480MHz to 698MHz over three bands, each with expanded 64MHz bandwidth. With true digital transmission, these receivers employ 24-bit/44.1kHz audio sampling, a true dynamic range of 115dBA, SmartEQ with capsule emulation and low latency. The MIPRO ACT-80H encrypt-able handheld microphone transmitter features lightweight magnesium alloy housing that is both rugged and comfortable to hold. This microphone has a true condenser cardioid capsule with 12+ hours performance from two AA batteries. In addition to a manual mute on/off, this unit features an auto mute function when lowered by one's side, etc. A bodypack transmitter is also available.

avlex.com

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NEWPRODUCTS

HD Radio diversity delay control | DaySequerra

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daysequerra.com

Headphones | Tascam

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tascam.com

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aphex.com

UPGRADES AND UPDATES

Tieline Technology has released Report-IT Enterprise v2.0.5 for Android devices and 3.2.5 for iOs devices. Both include support for audio and metadata ingest into **Netia** Radio Assist file management systems. (tieline.com, netia.com) ... **Barix** has developed a multicast routing and tunneling firmware that turns its Barionet IP control devices into multisite multicast routers (barix.com) ... **Crown Broadcast** has released version 1.1.6 software for the Crown E-Series transmitters. The free update includes the new Advanced Measurement Interface (AMI). (irec1.com) ... **StreamGuys** has added the high-quality, low-latency codec Ogg Opus to itsmenu. (streamguys.com) ■

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presonus.com

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vidigo.tv

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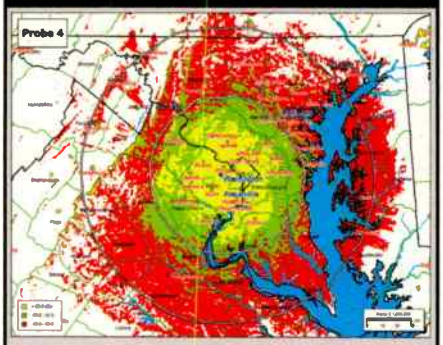

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20 years of *Radio* magazine

by Chriss Scherer, editor

The first issue of *Radio* magazine (originally titled *BE Radio*) was published in January 1994, but its roots go back much farther. In 1959, *Broadcast Engineering* magazine was launched to cover the technology of radio and television. By 1994, it was realized that while the two services are related broadcast efforts, the needs of their specific audiences warranted splitting the content into two publications.

Radio magazine, now part of the NewBay Media group of publications, continues to cover the technology of radio broadcasting. Now in our 20th year, we'll look back at the first year of publication, which had six issues.

Features of the September 1994 issue:

> While testing of digital radio systems were underway, the various systems of the day all used spectrum that was not available in the United States, which pretty much left an in-band system as the only option for terrestrial broadcasters.

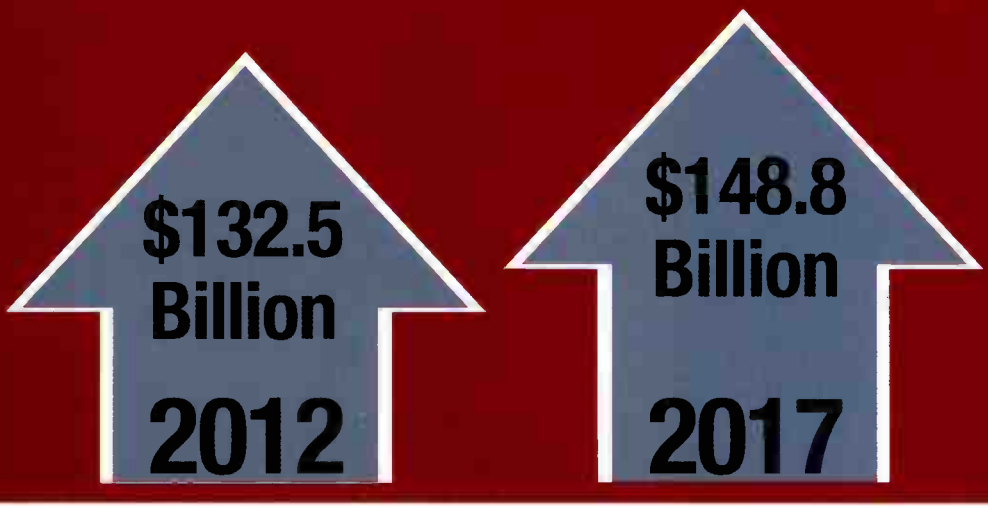
> We examined the current state-of-the-art in audio management systems. That term was used to describe the computer-based systems that would store, record, schedule and play audio on the station. The term automation has still stuck, even though that's really only a small part of what the systems can do today. Some of the products noted in the issue: Arrakis Digilink, Computer Concepts DCS, TM Century Ultimate Digital Studio II, and ITC DigiCenter.

> We outlined the key aspects to consider in choosing an on-air audio consoles. Analog was still the king then, and the PR&E AMX, Wheatstone A-500 and LPB7000 were some of the products mentioned.

> John Battison provided some tips on getting the most from transmitter tubes.

> New products in the issue included the Otari MR-10, the Shure M367, Scott Studios Compu-Cart, Tascam DA-60, Audioarts A-50, Audion Labs VoxPro, and the QEI Quantum series.

BIA/Kelsey: Advertising Revenues to Climb into 2017



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Source: BIA/Kelsey: biakelsey.com

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